Worldwide trends in the prevalence of asthma symptoms: Phase Three of the International Study of Asthma and Allergies in Childhood (ISAAC)

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ABSTRACT

Background: Phase One of the International Study of Asthma and Allergies in Childhood (ISAAC) was designed to allow worldwide asthma symptom prevalence comparisons. In Phase Three we have repeated the Phase One survey in order to assess changes over time.

Methods: The Phase One survey was repeated after an interval of 5-10 years in 106 centres in 56 countries in the 13-14 year age-group (n=304,679), and in 66 centres in 37 countries in the 6-7 year age group (n=193,404).

Results: The average symptom prevalence of current wheeze (in the last 12 months) measured with the written questionnaire changed slightly from 13.2% to 13.7% in the 13-14 year age group (an average increase of 0.06% per year) and from 11.0% to 11.6% in the 6-7 year age group (an average increase of 0.13% per year). There was also little change in the average symptom prevalence of severe asthma, or the symptom prevalence measured with the asthma video questionnaire. However, the time trends in asthma symptom prevalence showed different regional patterns. In Western Europe, current wheeze decreased by –0.07% per year in 13-14 year olds, but increased by 0.20% per year in 6-7 year olds. The corresponding findings for the other regions were: Oceania (-0.39% per year in 13-14 year olds, and –0.21% per year in 6-7 year olds); Latin America (+0.32%, and +0.07% respectively); Northern and Eastern Europe (+0.26%, +0.05%), Africa (+0.16%, +0.10%); North America (+0.12%, +0.32%); Eastern Mediterranean (-0.10%, +0.79%); Asia-Pacific (+0.07%; -0.06%); and the Indian subcontinent (+0.02%, +0.06%). There was a particularly marked reduction in current asthma symptom prevalence in English language countries (-0.51%, -0.09%). Similar patterns were observed for severe asthma (four or more attacks in the previous 12 months). However, the percentage of children reported to have had asthma at some time in their lives increased from 11.2% to 13.8% in the 13-14 year age group (+0.28% per year) and from 9.3% to 10.8% in the 6-7 year age group (+0.18% per year).

Discussion: These findings indicate that international differences in asthma symptom prevalence have reduced, particularly in 13-14 year olds, with decreases in prevalence in English speaking countries and Western Europe and increases in prevalence in regions where prevalence was previously low. Although there was little change in the overall prevalence of current wheeze, the percentage of children reported to have had asthma increased significantly, possibly reflecting greater awareness of this condition and/or changes in diagnostic practice. The asthma symptom prevalence increases in Africa, Latin America and parts of Asia indicate that the global burden of asthma is continuing to rise, but the global prevalence differences are lessening.

INTRODUCTION

The International Study of Asthma and Allergies in Childhood (ISAAC) was founded to maximise the value of epidemiological research into asthma, allergic rhinoconjunctivitis and eczema through facilitating international collaboration [1-4]. Although epidemiological research has the potential to add to our understanding of these conditions, previous studies have lacked standardization in case-definition and methodology, thus limiting the value of spatial and temporal comparisons of the prevalence of these disorders. The ISAAC programme was designed to allow comparisons of the prevalence of these disorders between populations in different countries, and their trends over time [1 2] since these may be particularly informative in suggesting hypotheses about the causes of the observed patterns, and hence about the causes of asthma, rhinitis and eczema.

In Phase One, children in the 13-14 year old age-group were studied in 155 centres in 56 countries (n=463,801), and children in the 6-7 year old age-group were studied in 91 centres in 38 countries (n=257,800) [5-8]. Up to 20-fold variations in the prevalence of "current wheeze" (in the last 12 months) were observed between centres worldwide (range 1.8% to 36.7%), with a 7-fold variation observed between the 10th and 90th percentiles (4.4%, 30.9%). The highest 12-month period prevalences were from centres in the United Kingdom, Australia, New Zealand, and the Republic of Ireland, followed by some centres from North, Central and South America; the lowest prevalences were from centres in Eastern Europe, Albania, Greece, China, Taiwan, Uzbekistan, India, Indonesia and Ethiopia. Phase Two involved more intensive investigation of possible aetiological factors in 9-11 year old children in 30 centres in 22 countries [9].

Phase Three has involved repeating the Phase One survey after 5-10 years to: (i) examine time trends in the prevalence of asthma, allergic rhinoconjunctivitis and eczema in centres and countries which participated in Phase One; (ii) describe the prevalence and severity of asthma, allergic rhinoconjunctivitis and eczema in centres and countries which are of interest but did not participate in Phase One; and (iii) examine hypotheses at an individual level which have been suggested by the findings of Phase One, subsequent ecological analyses and recent advances in knowledge. An overview of the findings for time trends for symptoms of all three conditions in those centres that participated in both Phase One and Phase Three (i.e. objective i above) has been presented in a previous publication [10]. That publication only included the findings for "current wheeze", whereas the current paper uses each of the seven ISAAC questions to describe the detailed findings for time trends in the prevalence of asthma symptoms.

METHODS

We conducted Phase Three following as precisely as possible the Phase One methodology (2,3). Phase Three included two groups of centres: (i) Group A are the centres that previously completed Phase One according to the ISAAC Phase One protocol, including centres for which the Phase One data was submitted too late for inclusion in the first worldwide publications, but was of the required standard; (ii) Group B are the centres from around the world that did not participate in Phase One but participated in Phase Three as new centres. The analysis of time trends presented here is

necessarily confined to the Group A centres, and we will therefore focus on them in describing the methods.

Group A centres were required to conduct Phase Three in the same way as Phase One following, as precisely as possible, the details of the centre methodology documented in the Phase One Centre Report. Each Principal Investigator was sent a final copy of the Phase One Centre Report from the ISAAC International Data Centre (IIDC). They were then required to use the same sampling frame (the exact same set of schools were not aimed for, but some schools were reselected by the random sampling process), age-groups, sample size, method of choosing the children, the same symptom questionnaires (plus an environmental module), the same translations (if applicable), and the same time of year for data collection. Thus, as in Phase One, the written questionnaire and video questionnaires were self-completed in the 13-14 year age-group, whereas the written questionnaire was completed by a parent for children in the 6-7 year age-group.

The Steering Committee required documentation of the procedures for the study from each centre as a prerequisite for inclusion in publications of ISAAC world wide results. Centres completed a Registration Document before starting the study and followed the published ISAAC Phase Three Manual and ISAAC Coding and Data Transfer Manual. The Phase Three data and Centre Report submitted to the ISAAC International Data Centre (IIDC) were checked for coding errors, omissions and inconsistencies and these were corrected with the assistance of the collaborator.

As in Phase One, the 6-7 year and 13-14 year age groups were analysed separately. Symptom prevalences in each centre were calculated by dividing the number of positive responses to each question by the number of completed questionnaires for the written and video questionnaires separately. Thus apparent inconsistencies between responses to the stem and branch questions were accepted and not recoded. For each centre, the annual change in symptom prevalence was calculated by taking the difference between the Phase One and Phase Three prevalences and dividing by the number of years between the two surveys.

The findings for the question on "current wheeze" have previously been published [10], but are also included in the current paper – together with the findings for the other asthma symptom questions – in order that the findings and patterns for current wheeze, severe asthma symptoms, and diagnosed asthma, can be compared and contrasted.

The data are presented in tabular form with the Phase Three prevalence and the annual change in prevalence for each question. For the regional and global summaries, the data for each centre was weighted by the inverse of the variance of the change. The regional analyses were based on the standard ISAAC regions, but we also performed analyses specifically for English language countries (Australia, Canada, Channel Islands, Isle of Man, New Zealand, Republic of Ireland, United Kingdom, USA). The findings were generally very similar in males and females (e.g. the global change in prevalence of "current wheeze" in 13-14 year olds was 0.05% per year in males and 0.03% per year in females, and males and females also showed similar time trends in most regions), so we have presented only the overall findings (both sexes combined). The key findings were also presented as "ranking plots" showing the change in prevalence of a symptom (e.g. current wheeze) for each centre by country, with countries ordered by their average

prevalence (for all centres combined) across Phase One and Phase Three. The average prevalence (rather than the Phase One prevalence) was used to order countries since this is statistically independent from the change in prevalence (between Phase One and Phase Three) whereas the Phase One prevalence is not [11-13]. The ranking plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and assuming no cluster sampling effect.

RESULTS

Participants

The details of the participating centres are listed in a separate Phase Three overview paper [10]. Phase One involved 155 collaborating centres in 56 countries for the 13-14 year age group with a total of 463,801 participating children. The video questionnaire was completed in 99 collaborating centres in 42 countries, with a total of 304,796 children. For the 6-7 year olds there were 91 collaborating centres in 38 countries, with a total of 257,800 participating children. Of the centres that participated in Phase One, 106 centres in 56 countries completed the Phase Three survey and met the requirements for analysis, with a total of 304,679 participating children in the 13-14 year age-group (overall response rate 91% [10]); 54 centres in 32 countries (a total of 167,513 children) also completed the video questionnaires in 13-14 year old children; 66 centres in 37 countries, a total of 193,404 children (response rate 85% [10]) also completed the survey and met the requirements for analysis for the 6-7 year age-group. Four of the centres only did the survey in 6-7 year olds, so in total there were 110 centres (in either age-group) in 58 countries.

13-14 year old group

Written questionnaires

The changes from Phase One for symptoms of asthma (with the Phase Three prevalence rates in parentheses) in 13-14 year olds are summarised by region in Table 1 (the detailed findings by centre and country are summarised in Webtable 1). The average prevalence of "current wheeze" ("Have you had wheezing or whistling in your chest in the last 12 months?) increased only slightly from 13.2% to 13.7% (an average increase of 0.06% per year). There was also little change in the average prevalence of severe asthma. However, the changes in asthma prevalence showed different regional patterns with current wheeze decreasing in those regions such as Oceania (-0.39% per year) that had previously shown the highest rates; there was a particularly marked reduction in the prevalence in English language countries (-0.51% per year). However, prevalence increased in Latin America (+0.32% per year) which had also previously shown relatively high rates. It also increased in regions such as Northern and Eastern Europe (+0.26% per year), Africa (+0.16% per year) and North America (+0.12% per year). There was little change in the Asia-Pacific region (+0.07% per year) and the Indian subcontinent (+0.02% per year), and a small decrease in the Eastern Mediterranean (-0.10% per year) and Western Europe (-0.07% per year).

Table 1: Summary regional and global estimates for changes in the prevalence of self-reported asthma symptoms (written questionnaire) between Phase One and Phase Three: % change in symptom prevalence per year (and Phase Three symptom prevalence %)

Centre	Phase One No	Phase Three No	12 Month Prevalence: Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	Ever had Asthma % change per year (Phase Three prevalence %)	Ever had asthma and current wheeze % change per year (Phase Three prevalence %)
13-14 year olds										
Africa	28,554	28,397	0.16 (13.4)	0.06 (4.0)	0.05 (3.5)	0.02 (5.9)	0.44 (24.7)	0.91 (30.5)	0.07 (11.9)	-0.01 (5.2)
Asia-Pacific	66,224	57,389	0.07 (8.8)	0.00 (2.3)	0.01 (0.7)	-0.02 (2.1)	0.42 (17.0)	0.49 (20.6)	0.39 (12.6)	0.07 (4.0)
Eastern Mediterranean	16,109	19,887	-0.10 (11.6)	-0.04 (2.7)	-0.04 (2.2)	-0.05 (3.9)	-0.11 (15.0)	0.22 (23.4)	0.11 (10.9)	0.00 (3.7)
Indian Sub-continent	22,120	20,767	0.02 (6.4)	-0.09 (1.9)	-0.06 (1.0)	-0.15 (2.6)	-0.05 (6.9)	-0.38 (20.0)	-0.01 (6.1)	-0.03 (2.2)
Latin America	46,209	44,550	0.32 (18.8)	0.02 (3.6)	-0.01 (2.7)	-0.02 (4.6)	0.13 (21.3)	0.83 (35.1)	0.25 (16.1)	0.12 (8.2)
North America	5,863	4,920	0.12 (21.5)	-0.02 (4.9)	0.04 (3.1)	0.11 (7.0)	0.20 (24.9)	0.00 (21.1)	0.71 (22.5)	0.20 (13.2)
Northern and Eastern Europe	36,508	32,608	0.26 (11.6)	0.08 (2.3)	0.01 (0.8)	0.08 (2.2)	0.30 (14.3)	0.41 (14.0)	0.29 (5.9)	0.09 (2.5)
Oceania	15,460	13,317	-0.39 (26.7)	-0.38 (6.2)	-0.05 (2.6)	-0.21 (6.2)	-0.29 (37.5)	-0.01 (28.9)	0.93 (32.4)	0.14 (17.0)
Western Europe	85,969	82,844	-0.07 (15.2)	-0.05 (3.7)	-0.02 (1.6)	-0.02 (3.8)	0.03 (20.3)	0.64 (29.3)	0.33 (16.3)	0.07 (7.7)
GLOBAL TOTAL	**323,016**	**304,679**	**0.06 (13.7)**	**-0.02 (3.2)**	**-0.01 (1.8)**	**-0.01 (3.7)**	**0.15 (19.2)**	**0.51 (25.8)**	**0.28 (13.8)**	**0.06 (6.2)**
6-7 year olds										
Africa	1,696	2,396	0.10 (5.6)	0.02 (2.8)	0.04 (2.3)	0.14 (4.8)	-0.18 (5.4)	-0.18 (8.0)	-0.01 (3.3)	-0.10 (1.1)
Asia-Pacific	40,535	43403	-0.06 (8.9)	-0.09 (1.8)	-0.04 (0.6)	-0.04 (1.2)	-0.10 (4.6)	0.47 (20.6)	0.12 (11.4)	-0.04 (4.9)
Eastern Mediterranean	12,853	13,990	0.79 (11.7)	0.10 (2.3)	0.10 (2.3)	0.04 (1.9)	0.19 (4.9)	0.36 (15.7)	0.28 (9.1)	0.17 (4.6)
Indian Sub-	16,981	18,877	0.06 (	-0.07 (	-0.07 (	-0.09 (	-0.04 (	-0.17	-0.05 (	0.00 (2.6)

Centre	Phase One No	Phase Three No	12 Month Prevalence Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	Ever had Asthma % change per year (Phase Three prevalence %)	Ever had asthma and current wheeze % change per year (Phase Three prevalence %)
continent			6.8)	0.9)	0.6)	1.8)	4.0)	(12.5)	5.2)	
Latin America	21,467	21,112	0.07 (21.4)	0.09 (5.0)	-0.03 (3.6)	-0.05 (4.9)	-0.05 (10.3)	0.63 (34.4)	-0.15 (13.2)	-0.03 (9.0)
North America	5,707	4,014	0.32 (19.1)	0.01 (4.1)	0.04 (3.0)	0.04 (2.9)	0.22 (8.3)	0.34 (16.3)	0.74 (20.0)	0.37 (13.4)
Northern and Eastern Europe	24,196	21,984	0.05 (9.6)	0.04 (2.3)	0.00 (1.2)	0.02 (1.5)	0.06 (4.5)	0.33 (13.0)	0.23 (4.5)	0.13 (2.7)
Oceania	14,233	13,841	-0.21 (21.8)	-0.16 (7.0)	-0.04 (3.0)	-0.12 (3.6)	-0.08 (15.1)	-0.08 (28.4)	0.42 (29.2)	0.01 (16.8)
Western Europe	60,100	53,787	0.20 (9.7)	0.03 (2.1)	-0.01 (1.5)	0.03 (1.7)	0.09 (4.6)	0.65 (20.7)	0.25 (9.1)	0.12 (4.5)
GLOBAL TOTAL	**197,768**	**193,404**	**0.13 (11.6)**	**-0.01 (2.7)**	**-0.02 (1.6)**	**-0.01 (2.1)**	**0.04 (6.0)**	**0.43 (20.4)**	**0.18 (10.8)**	**0.07 (5.7)**

Webtable 1: Changes in the prevalence of self-reported asthma symptoms (written questionnaire) between Phase One and Phase Three in the 13-14 year age-group: % change in symptom prevalence per year (and Phase Three symptom prevalence %)

Figure 1 gives the ranking plot showing the change in prevalence of current wheeze for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three. It shows that in general the countries with the highest prevalence in Phase One (including most of the English language countries) showed decreases in prevalence between Phase One and Phase Three, whereas some of the countries which had previously had low prevalence showed increases. However, there were a number of countries (e.g. India, Albania) which had very low prevalence in Phase One, and little increase in Phase Three.

Figure 2 shows the corresponding ranking plot for severe asthma, as measured by four or more attacks of wheezing in the previous 12 months. It generally shows similar patterns to those for current wheeze, with decreases in prevalence in English language countries, and increases in prevalence in some, but not all, of the countries that had low prevalence in Phase One.

In contrast to the findings for current wheeze, the percentage of children reported to have had asthma at some time in their lives increased from 11.2% to 13.8% in the 13-14 year age group, an annual increase of 0.28% per year (table 1 and figure 3). There were particularly large increases in Oceania (+0.93% per year), Western Europe (+0.33% per year), and North America (+0.71% per year) despite the fact that these regions showed little change (or even a reduction) in symptom prevalence. The average proportion of children with "current wheeze" who were reported to have had asthma at some time in their lives increased only from 43% to 46%, but there were larger increases in Oceania (54% to 64%), Western Europe (45% to 51%) and North America (55% to 61%).

Video questionnaire

Table 2 summarises the findings in 13-14 year olds using the video questionnaire by region (the detailed findings by centre and country are summarised in Webtable 2) and figure 4 gives the corresponding ranking plot. The average prevalence of current wheeze decreased slightly from 8.1% to 7.9%. However, the changes in asthma prevalence showed different regional patterns with current wheeze showing no change in Western Europe, but a marked decrease in Oceania (-0.77% per year). It also showed little change in the Eastern Mediterranean (-0.05% per year), and Latin America (-0.03% per year), Western Europe (0.00% per year) and Northern and Eastern Europe (0.03% per year). There were increases in the Indian subcontinent (+0.31% per year), Africa (+0.34% per year), and Asia-Pacific (+0.12% per year), and a decrease in North America (-0.26% per year). Thus the video questionnaire findings for current wheeze were generally similar to those with the written questionnaire for Africa, Oceania, Asia-Pacific, Western Europe and Eastern Mediterranean. On the other hand, Latin America, and Northern and Eastern Europe showed an increase with the written questionnaire but little change with the video questionnaire, the Indian subcontinent showed little change with the written questionnaire and an increase with the video questionnaire, and North America showed an increase with the written questionnaire but a decrease with the video questionnaire.

Table 2: Summary regional and global changes in the prevalence of self-reported asthma symptoms (video questionnaire) between Phase One and Phase Three (13-14 year olds): % change in symptom prevalence per year (and Phase Three symptom prevalence %)

Centre	Phase One No	Phase Three No	Current Wheeze % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night wheeze % change per year (Phase Three prevalence %)	Night cough % change per year (Phase Three prevalence %)	Severe Wheeze % change per year (Phase Three prevalence %)
Africa	14,465	11,467	0.34 (11.0)	0.23 (14.6)	0.16 (6.2)	0.68 (19.7)	0.29 (7.7)
Asia-Pacific	53,679	51,196	0.12 (6.8)	0.28 (10.7)	0.02 (2.0)	0.29 (10.4)	0.05 (3.5)
Eastern Mediterranean	6,031	8,851	-0.05 (6.3)	0.06 (8.8)	-0.03 (3.1)	0.08 (8.8)	-0.04 (3.2)
Indian Sub-continent	12,562	11,552	0.31 (7.3)	0.14 (4.8)	0.29 (4.9)	0.18 (4.8)	0.01 (3.1)
Latin America	18,003	18,599	-0.03 (11.9)	-0.11 (14.2)	0.01 (4.5)	0.75 (20.6)	0.01 (6.5)
North America	5,673	4,895	-0.26 (11.3)	-0.79 (18.6)	-0.11 (8.3)	0.61 (17.7)	-0.44 (7.2)
Northern and Eastern Europe	13,970	13,167	0.03 (2.7)	0.15 (6.3)	0.02 (1.6)	0.24 (7.5)	0.06 (1.7)
Oceania	15,408	13,205	-0.77 (11.2)	-1.64 (15.9)	-0.73 (5.1)	-0.31 (19.4)	-0.56 (7.4)
Western Europe	33,722	34,581	0.00 (7.3)	-1.24 (13.2)	-0.18 (3.1)	0.23 (16.0)	0.07 (4.4)
GLOBAL TOTAL	**173,513**	**167,513**	**0.01 (7.9)**	**-0.19 (11.6)**	**-0.04 (3.4)**	**0.24 (13.6)**	**0.02 (4.5)**

Webtable 2: Changes in the prevalence of self-reported asthma symptoms (video questionnaire) between Phase One and Phase Three in the 13-14 year age-group: % change in symptom prevalence per year (and Phase Three symptom prevalence %)

6-7 year old group

The Phase Three prevalence rates for symptoms of asthma (with the change from Phase One in parentheses) in 6-7 year olds are summarised by region in table 1 (the detailed findings by centre and country are summarised in Webtable 3). The average prevalence of wheeze in the last 12 months (current wheeze) increased only slightly from 11.1% to 11.6% (an average increase of 0.13% per year). There was also little change in the average prevalence of severe asthma. However, the changes in asthma symptom prevalence showed different regional patterns with current wheeze increasing in Western Europe (+0.20% per year), and decreasing in Oceania (-0.21% per year) both of which had previously shown high rates. Prevalence increased in Latin America (+0.07% per year) which had also previously shown relatively high rates, and in North America (+0.32% per year). It also increased in Eastern Mediterranean (+0.79% per year), and Africa (+0.10% per year) which had previously shown some of the lowest rates, while there was little change in Asia-Pacific (-0.06% per year), Northern and Eastern Europe (+0.05%% per year) or the Indian subcontinent (+0.06% per year). Thus, the patterns in 6-7 year olds were not completely consistent with those in 13-14 year olds. There were increases in both age-groups in Latin America, North America, Northern and Eastern Europe and Africa, and decreases in both age-groups in Oceania. However, there were different patterns in the two age-groups in Western Europe and the Eastern Mediterranean (decreases for 13-14 year olds but increases for 6-7 year olds).

Webtable 3: Changes in the prevalence of parental-reported asthma symptoms (written questionnaire) between Phase One and Phase Three in the 6-7 year age-group: % change in symptom prevalence per year (and Phase Three symptom prevalence %)

Figure 5 gives the ranking plot for 6-7 year olds showing the change in prevalence of current wheeze for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three. As in 13-14 year olds, it shows that in general the countries with the highest prevalence in Phase One (including most of the English language countries) showed decreases in prevalence between Phase One and Phase Three, whereas some of the countries which had previously had low prevalence showed increases.

Figure 6 gives the corresponding ranking plot in 6-7 year olds for severe asthma, as measured by four or more attacks of wheezing in the previous 12 months. It generally shows similar patterns to those for current wheeze, with decreases in prevalence in English language countries, and increases in prevalence in some, but not all, of the countries that had low prevalence in Phase One.

As for the 13-14 year olds, the percentage of 6-7 year old children reported to have had asthma at some time in their lives increased between Phase One and Phase Three (table 2 and figure 7). There were particularly large increases in Oceania (+0.41% per year), Western Europe (+0.24% per year), and North America (+0.67% per year) despite the fact that these regions showed little change (or even a reduction) in symptom prevalence.

DISCUSSION

Phase One of ISAAC was a unique initiative involving genuinely worldwide involvement in research into the patterns and causes of asthma worldwide [3]. It represented by far the most extensive international survey of asthma symptom prevalence ever performed [5]. The only other comparable international survey of asthma is the European Community Respiratory Health Survey (ECRHS) [14] which studied adults (20-44 years) mainly from European centres, and generally yielded similar findings to those of ISAAC [15]. The key findings included the high prevalence of reported asthma symptoms in English language countries, the high symptom prevalence in Latin America, the relatively high prevalences in Western Europe but much lower prevalences in Eastern Europe with a clear Northwest-Southeast gradient, and the relatively low prevalences in Africa and Asia with the exception of the more affluent countries such as Singapore and Japan.

The ISAAC Phase One methodology was simple, the protocol was rigorously applied, and a number of validation studies had indicated that the ISAAC core wheezing questions had acceptable sensitivity and specificity when compared with other indicators of asthma, including physician diagnosis, other questionnaires and physiological measures [10]. Nevertheless, the possibility could not be excluded that some of the patterns observed could be due to issues of translation of terms such as ‘wheezing’, or due to differences in recognition and labelling of symptoms [10]. These issues are of less concern in the current study, since the focus is on time trends, and the same methodology (including the same translations) has been used in the same centres at different times.

Nevertheless, it is possible that recognition and labelling of asthma symptoms may have shown different time trends in different geographical regions, and may account in part for the trends reported here. In this regard, it is of concern that some regions showed different time trends with the written and video questionnaires, although the differences were not consistent: Latin America, and Northern and Eastern Europe showed an increase with the written questionnaire but little change with the video questionnaire, the Indian subcontinent showed little change with

the written questionnaire and an increase with the video questionnaire, and North America showed an increase with the written questionnaire but a decrease with the video questionnaire. Increased use of effective treatment, especially inhaled corticosteroids, is likely to have reduced asthma severity, but is unlikely to eliminate asthma symptoms completely, and is therefore unlikely to explain changes in prevalence [16 17].

When assessing time trends in centres that had previously shown high or low prevalences (figures 1-7) we avoided the possibility of regression to the mean by using the mean prevalence when assessing the change between Phase One and Phase Three [10], whereas a plot of changes relative to the Phase One prevalences would have shown spurious correlations even when no such associations existed [11].

Appropriate quality control measures are a critical component of any multi-centre research collaboration and this is particularly true of ISAAC given the unique global scope of the collaboration and the wide variation in the research experience of the collaborators. The extensive quality control measures adopted for ISAAC Phase Three are described in detail elsewhere [2], but the possibility that inappropriate implementation of the study design may have introduced bias in the results from individual centres should be acknowledged. However it is extremely unlikely that any such bias would affect the broader regional and global patterns presented in this publication.

It should also be stressed that prevalence and time trend data such as this primarily serve for purposes of hypothesis generation rather than hypothesis testing. Furthermore, with more than 100 centres involved, it is to be expected that at least 5 centres would show stastically significant changes by chance alone. Therefore, it is more valuable to focus on the regional and global patterns and trends, rather than on the findings in individual centres.

Bearing these reservations in mind, the findings reported here are of considerable interest.

Firstly, they show that in most high prevalence countries, particularly the English language countries, the rise in the prevalence of asthma symptoms has peaked and may even have begun to decline. This is consistent with the findings of other recent studies in children [18-24] and in adults [25 26]. There are some exceptions to this trend, but of the European and English language countries which showed relatively high prevalence in Phase One, only Germany [27] and Finland have shown significant increases in symptom prevalence in Phase Three. The increases for "North America" are due to increases for Barbados (whose Phase One data was too late for inclusion in the Phase One paper [5]); the one United States centre showed a small decline in symptom prevalence consistent with the findings for other English language countries.

Secondly, a number of countries that had high or intermediate levels of symptom prevalence in Phase One have shown significant increases in prevalence in Phase Three; these include Latin American countries such as Costa Rica, Panama, Mexico, Argentina and Chile, and Eastern European countries such as the Ukraine and Romania. Other countries to show significant increases in symptom prevalence included Barbados, Tunisia, Morocco and Algeria.

Thirdly, with the exception of India, all of the countries with very low symptom prevalence rates in Phase One reported increases in prevalence in Phase Three, though only the increases for Indonesia and China were statistically significant.

Finally, virtually all countries, irrespective of the symptom prevalence level, reported increases in lifetime asthma prevalence between Phase One and Phase Three. In fact, the increases were most marked in those countries with the highest average prevalence between Phase One and Phase Three (figures 3 and 7) despite the fact that many of these countries reported declines in asthma symptom prevalence between Phase One and Phase Three (figures 1 and 4).

So what do these findings mean? Perhaps the most striking finding is the apparent decline in symptom prevalence in English language countries. Just as we do not (yet) know why prevalence has increased since the 1950s, we do not know why it should now be decreasing [16]. The "hygiene hypothesis" has been proposed as one explanation for the increases in symptom prevalence, although it does not appear to entirely account for the time trends since the increases have occurred for both non-atopic (non-eosinophilic) and atopic (eosinophilic) asthma whereas the hygiene hypotheses would only explain (at most) trends for atopic asthma [28]. Furthermore, it does not seem apparent that the English language countries have become "less hygienic" in recent decades, although increases in infant and childhood infections could have occurred due to specific factors such as increased use of childcare facilities [29]. Furthermore, the hygiene hypothesis is unlikely to explain the considerably higher prevalences in many Latin American countries than in Spain and Portugal which are more consistent with changes in environmental exposures other than hygiene [30-32].

Other "established" asthma risk factors do not appear to explain the worldwide asthma prevalence patterns [33-42], or the time trends, particularly the decline in English language countries. It also seems unlikely that the decline in symptom prevalence is due to decreased recognition and labelling of asthma symptoms, given that the prevalence of "asthma ever" has increased. For example, Garcia-Marcos et al [43] argue that asthma is now considered a less stigmatizing disease than it was at the time of Phase One, and the word "asthma" is more readily accepted. This could explain why in some countries symptom prevalence has not increased, or has even declined, but the prevalence of 'asthma ever' has increased. This has particularly occurred in English language countries, and may also in part reflect international differences in health care systems, as well as more specific differences in asthma recognition and diagnosis. It should also be noted that the findings for "asthma ever" are to some extent reassuring with regard to the findings for current asthma symptoms, since they indicate that an increased recognition and diagnosis of asthma has not been accompanied by an increase in reporting of asthma symptoms; such an increase would have been expected if the symptom prevalence patterns were entirely due to differences in recognition and labelling of symptoms.

These findings for English language countries and Western Europe are intriguing, and to some extent reassuring, but they should not be taken to indicate that the global "pandemic" of asthma is easing and that the worst is over. The Phase Three findings show striking increases for Latin American countries to the extent that in future we may be describing asthma as a "Spanish and Portuguese speaking" rather than as an "English speaking" disease. The modest increases for China are of potentially major significance, given the size of China's population and its rapid economic growth. Furthermore there are some intriguing patterns with, for example, decreases in prevalence in India, but modest increases in China, Indonesia, Taiwan and South Korea, and stronger increases in Morocco, Algeria and Tunisia. As with the Phase One findings, it is to be hoped that this new evidence on time trends will lead to further questioning and testing of current theories, and the development of new theories of asthma aetiology. In addition, these findings suggest that although asthma symptom prevalence is no longer increasing in most English language and Western European countries, its global burden may continue to rise.

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APPENDIX

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FIGURES

Figure 1

Ranking plot showing the change per year in prevalence of current wheeze (wheeze in the last 12 months) in 13-14 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

Figure 2

Ranking plot showing the change per year in prevalence of four or more attacks of wheezing in the previous 12 months in 13-14 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

Figure 3

Ranking plot showing the change per year in the lifetime prevalence of asthma ("asthma ever") in 13-14 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

Figure 4

Ranking plot showing the change per year in prevalence of current wheeze (wheeze in the last 12 months) using the video questionnaire in 13-14 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

Figure 5

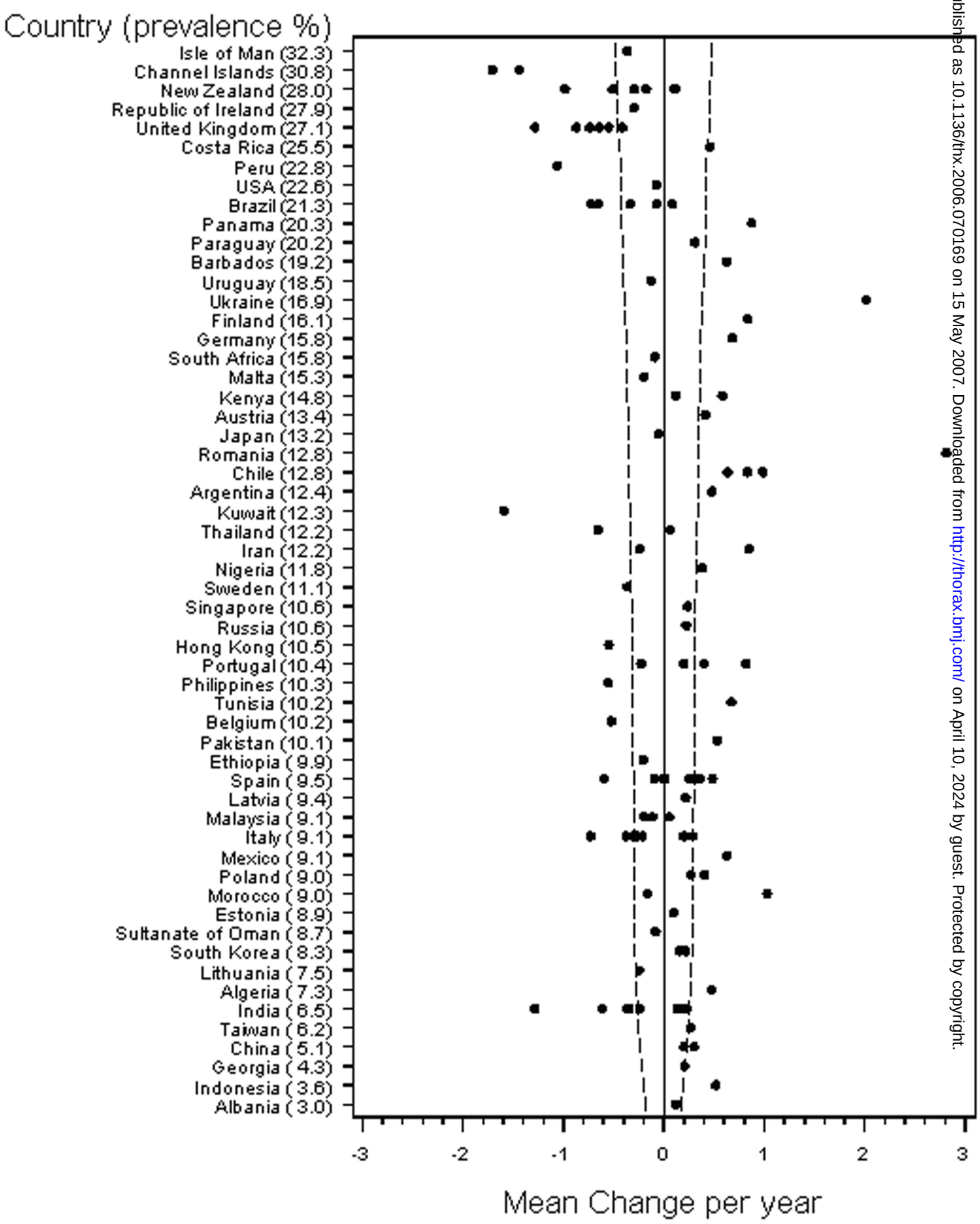
Ranking plot showing the change per year in prevalence of current wheeze (wheeze in the last 12 months) in 6-7 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

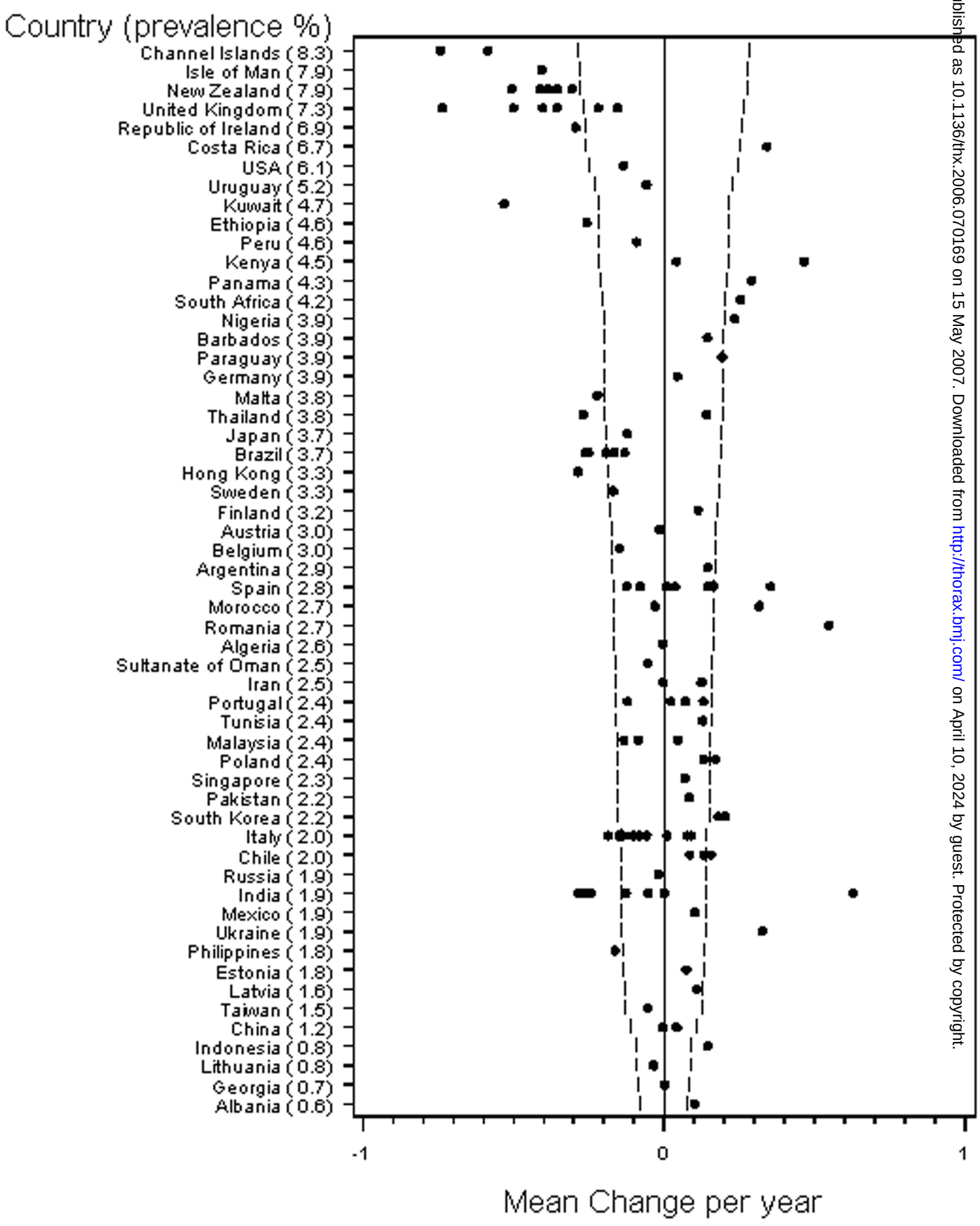
Figure 6

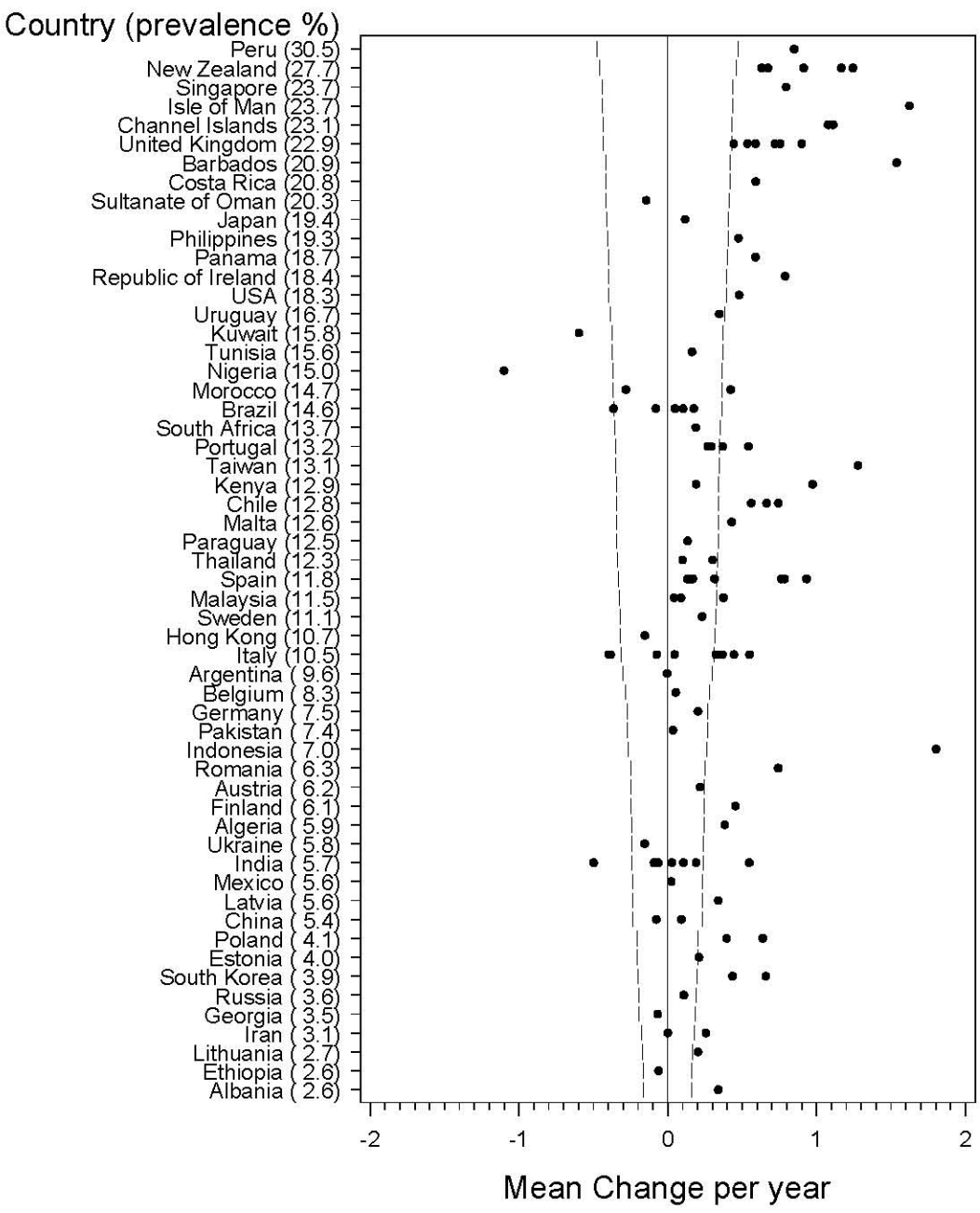
Ranking plot showing the change per year in prevalence of four or more attacks of wheezing in the previous 12 months in 6-7 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

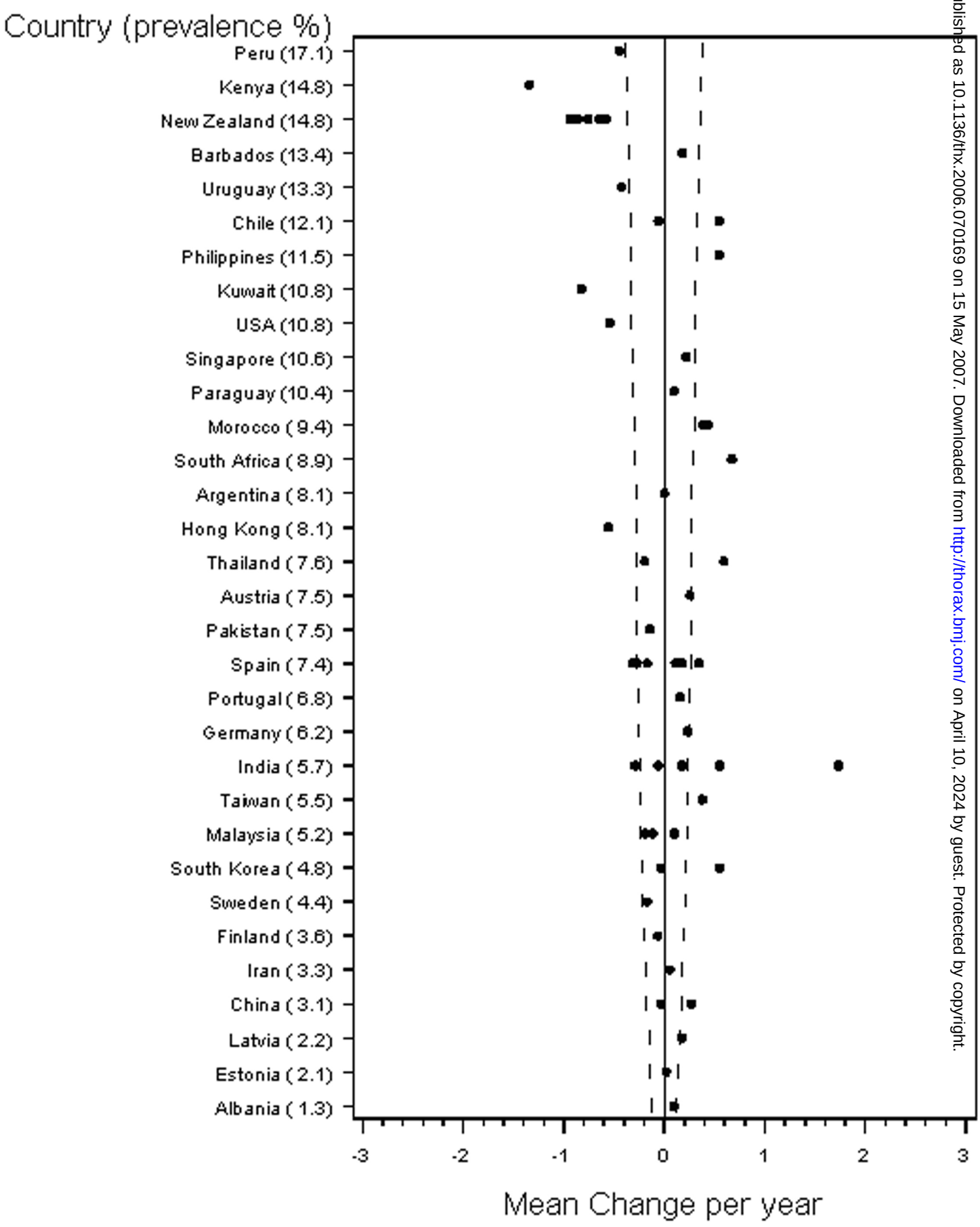
Figure 7

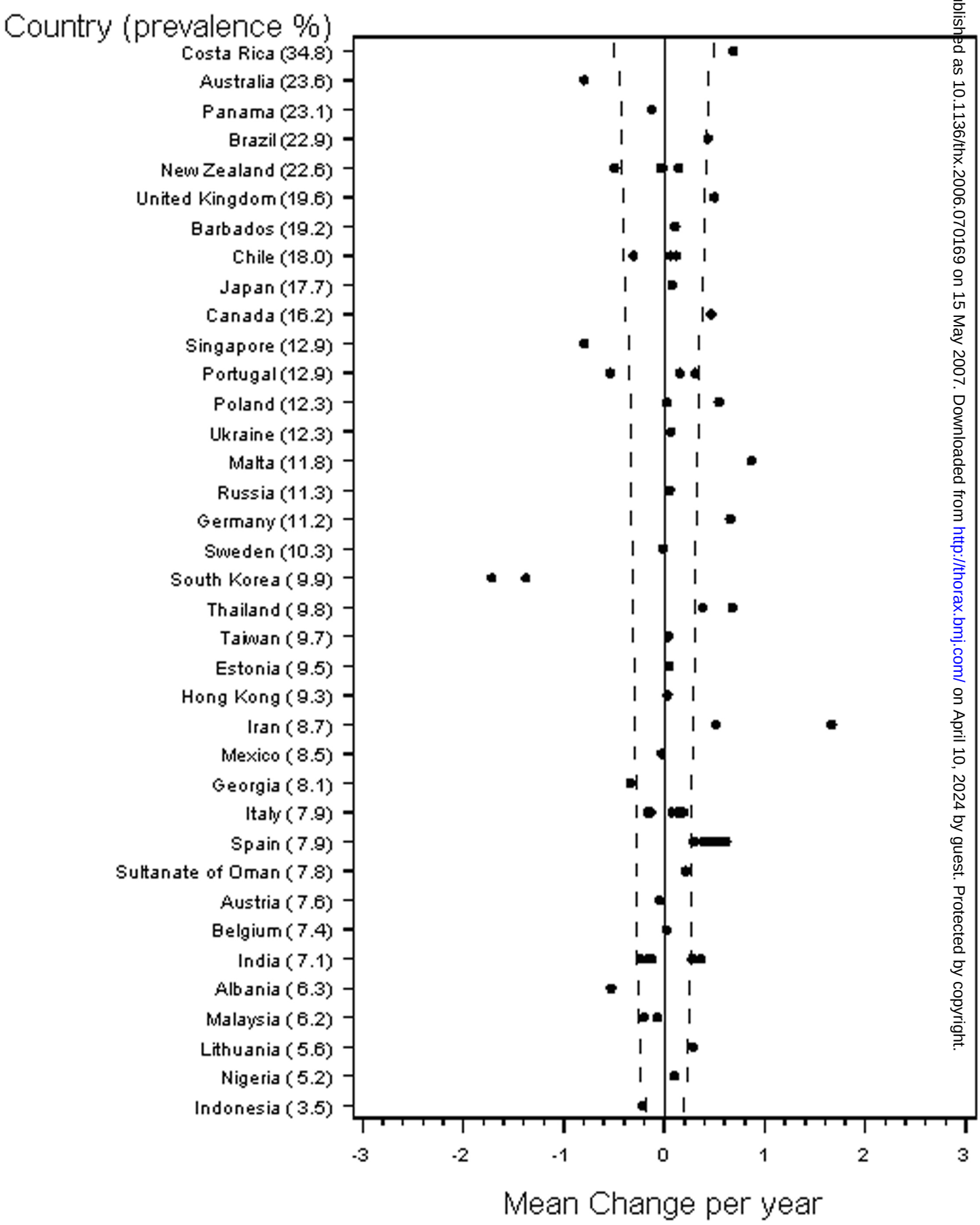
Ranking plot showing the change per year in the lifetime prevalence of asthma ("asthma ever") in 6-7 year old children for each centre by country, with countries ordered by their average prevalence (for all centres combined) across Phase One and Phase Three
[the plot also shows the confidence interval about zero change for a given level of prevalence (i.e. the average prevalence across Phase One and Phase Three) given a sample size of 3,000 and no cluster sampling effect]

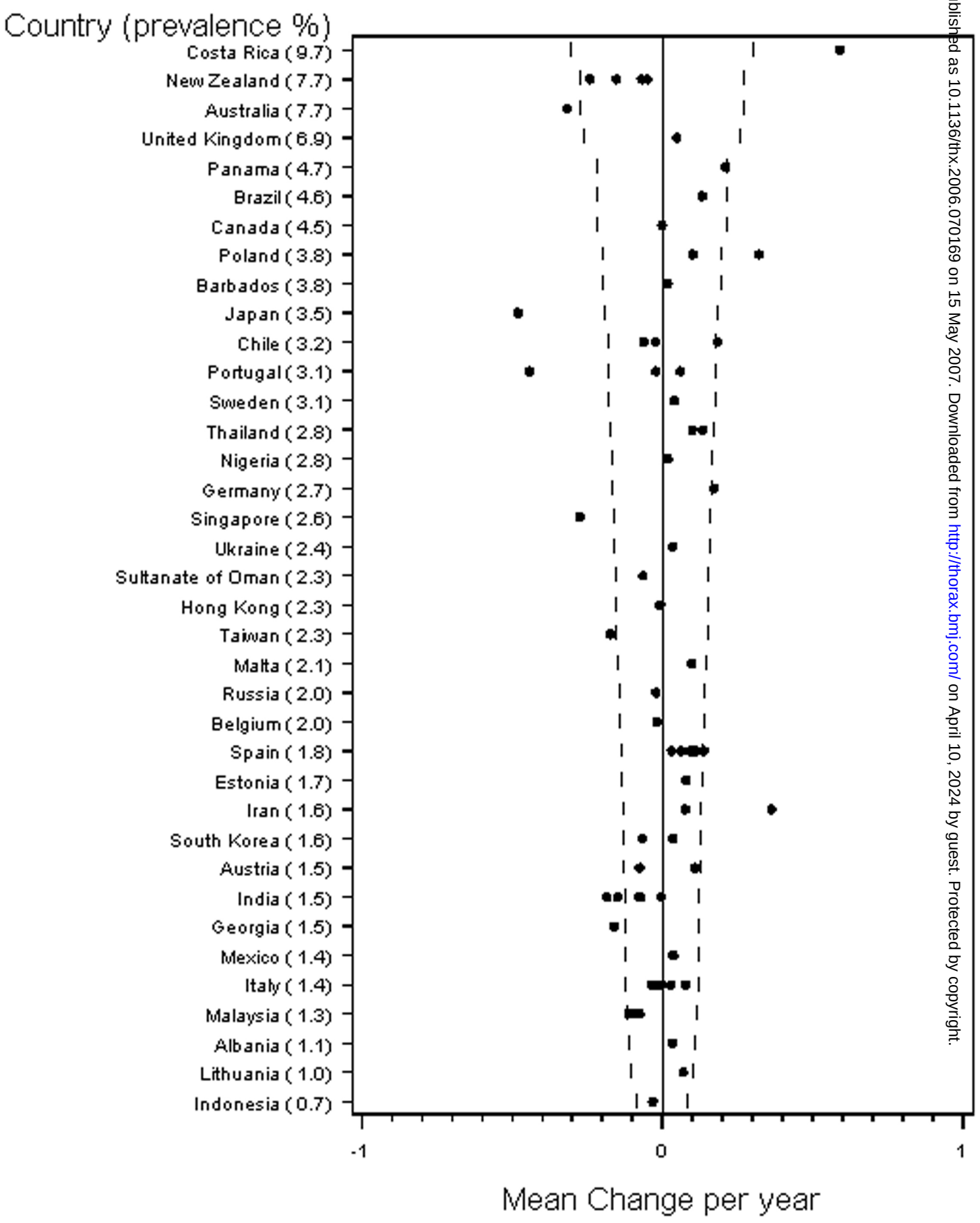


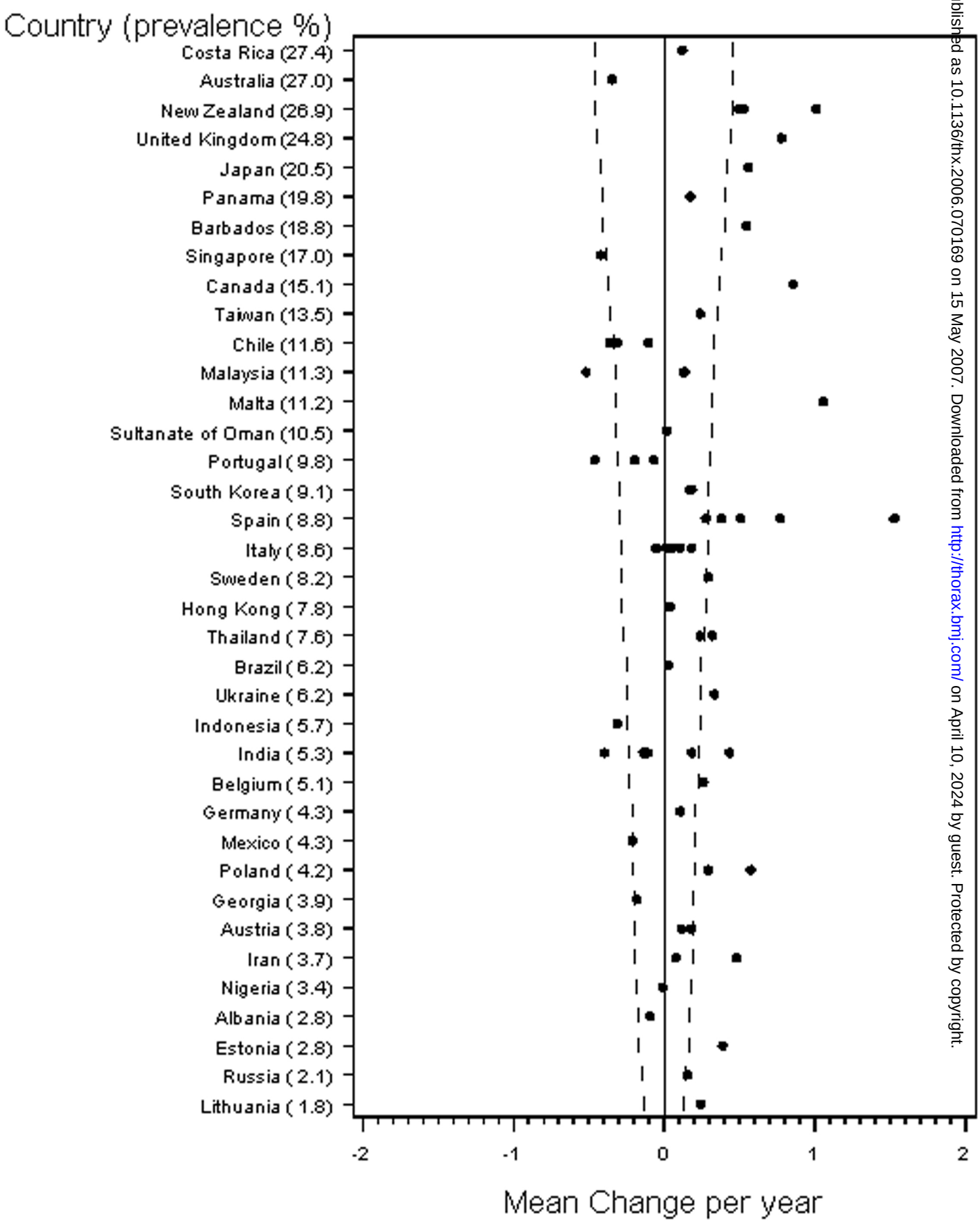












Centre	Phase One		Phase Three		12 Month Prevalence						Ever had Asthma % change per year (Phase Three prevalence %)
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
Africa											
Algeria											
Wilaya of Algiers (West Algier)	1996	2024	2002	4203	0.48 (8.7)	-0.00 (2.6)	0.03 (1.6)	-0.04 (2.1)	1.08 (14.4)	1.44 (18.8)	0.38 (7.1)
Ethiopia											
Addis Ababa	1995	2951	2003	3195	-0.20 (9.1)	-0.26 (3.6)	-0.06 (2.1)	-0.19 (5.8)	-0.10 (26.4)	-0.10 (26.5)	-0.06 (2.3)
Kenya											
Eldoret	1995	3024	2001	3289	0.58 (13.8)	0.47 (5.1)	0.35 (4.0)	0.73 (7.4)	1.76 (27.9)	2.31 (32.2)	0.97 (12.6)
Nairobi	1995	3226	2001	3023	0.12 (18.0)	0.04 (5.5)	-0.13 (5.5)	-0.02 (8.3)	-2.69 (14.2)	0.34 (37.8)	0.19 (16.6)
Morocco											
Casablanca	1995	3183	2001	1777	1.03 (16.0)	0.32 (5.0)	0.15 (3.9)	0.08 (3.9)	1.18 (25.9)	0.84 (24.8)	0.42 (14.6)
Marrakech	1995	2900	2002	1689	-0.16 (4.4)	-0.03 (1.3)	0.03 (1.2)	-0.15 (1.2)	-0.09 (20.5)	0.08 (19.1)	-0.28 (15.1)
Nigeria											
Ibadan	1995	3057	2001	3142	0.38 (13.0)	0.23 (4.6)	0.07 (4.1)	0.06 (7.9)	-1.54 (34.2)	-0.67 (27.7)	-1.10 (11.7)
South Africa											
Cape Town	1995	5169	2002	5037	0.60 (20.3)	0.25 (5.0)	0.20 (5.0)	0.38 (7.8)	1.59 (32.6)	1.86 (36.6)	0.19 (14.4)
Tunisia											
Sousse	1996	3020	2001	3042	0.67 (11.9)	0.13 (2.7)	0.27 (2.8)	0.26 (5.4)	0.69 (23.1)	3.45 (43.8)	0.16 (16.0)
Region Total		**28,554**		**28,397**	**0.16 (13.4)**	**0.06 (4.0)**	**0.05 (3.5)**	**0.02 (5.9)**	**0.44 (24.7)**	**0.91 (30.5)**	**0.07 (11.9)**
Asia-Pacific											
China											
Beijing	1994	4166	2001	3530	0.30 (7.2)	-0.00 (1.5)	0.01 (0.3)	0.01 (1.0)	0.06 (25.6)	0.51 (19.3)	-0.08 (6.3)
Guangzhou	1994	3855	2001	3514	0.20 (4.8)	0.04 (1.0)	-0.01 (0.2)	0.04 (0.8)	0.85 (23.4)	0.04 (19.2)	0.09 (4.6)
Hong Kong											
Hong Kong	1995	4666	2002	3321	-0.55 (8.6)	-0.29 (2.3)	-0.04 (0.2)	-0.15 (1.4)	-1.32 (19.9)	-0.66 (23.1)	-0.15 (10.1)
Indonesia											
Bandung	1996	2249	2002	2826	0.52 (5.2)	0.15 (1.3)	0.05 (1.0)	-0.03 (0.7)	1.30 (10.0)	2.96 (21.7)	1.80 (12.4)
Japan											
Fukuoka	1994	2827	2002	2520	-0.05 (13.0)	-0.12 (3.2)	-0.03 (0.4)	-0.14 (1.0)	-0.47 (23.6)	0.03 (14.2)	0.12 (19.9)
Malaysia											
Alor Setar	1995	3298	2002	2941	0.05 (9.3)	0.05 (2.4)	-0.01 (0.3)	-0.10 (1.1)	0.16 (17.5)	-0.37 (25.7)	0.09 (10.8)
Klang Valley	1995	6069	2001	3025	-0.11 (11.6)	-0.13 (3.0)	-0.01 (0.9)	-0.08 (1.8)	-0.20 (14.6)	0.91 (30.8)	0.37 (16.1)
Kota Bharu	1995	3075	2001	2989	-0.20 (5.8)	-0.09 (1.2)	0.05 (0.7)	0.00 (1.3)	0.28 (11.7)	0.42 (24.4)	0.04 (9.0)
Philippines											
Metro Manilla	1994	3207	2001	3658	-0.55 (8.4)	-0.16 (1.2)	-0.15 (0.9)	-0.15 (3.0)	-0.46 (18.2)	-0.82 (28.6)	0.47 (20.9)
Singapore											
Singapore	1994	4205	2001	4217	0.24 (11.4)	0.07 (2.6)	0.03 (1.5)	-0.01 (2.3)	0.19 (14.6)	1.26 (20.1)	0.79 (26.5)
South Korea											
Provincial Korea	1995	6975	2000	7375	0.21 (8.5)	0.20 (2.5)	0.06 (0.4)	0.17 (3.6)	0.41 (13.9)	0.92 (12.9)	0.66 (5.5)
Seoul	1995	2990	2000	2888	0.16 (9.1)	0.18 (2.9)	0.00 (0.3)	0.22 (3.7)	0.03 (13.7)	0.88 (13.6)	0.44 (5.0)

Centre	Phase One		Phase Three		12 Month Prevalence						Ever had Asthma % change per year (Phase Three prevalence %)
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
Taiwan											
Taipei	1995	11003	2001	6378	0.26 (7.0)	-0.05 (1.4)	0.02 (0.5)	0.03 (1.0)	1.82 (19.4)	0.29 (12.5)	1.28 (17.0)
Thailand											
Bangkok	1995	3712	2001	4669	0.06 (13.9)	0.14 (5.0)	0.11 (1.9)	0.10 (4.5)	0.40 (18.0)	0.44 (31.0)	0.30 (15.9)
Chiang Mai	1995	3927	2001	3538	-0.65 (8.7)	-0.27 (2.2)	-0.05 (0.7)	-0.09 (2.6)	-0.23 (12.1)	-0.96 (22.8)	0.10 (9.9)
Region Total		**66,224**		**57,389**	**0.07 (8.8)**	**0.00 (2.3)**	**0.01 (0.7)**	**-0.02 (2.1)**	**0.42 (17.0)**	**0.49 (20.6)**	**0.39 (12.6)**
Eastern Mediterranean											
Iran											
Rasht	1995	3181	2002	3004	0.85 (15.6)	0.12 (3.2)	0.21 (3.2)	0.32 (4.5)	0.56 (13.0)	0.65 (17.7)	0.26 (4.5)
Tehran	1995	2691	2001	3119	-0.24 (10.9)	-0.00 (2.2)	-0.06 (1.6)	-0.00 (3.0)	0.26 (15.3)	0.64 (18.5)	0.00 (2.6)
Kuwait											
Kuwait	1995	1051	2001	2882	-1.59 (7.6)	-0.53 (3.1)	-0.54 (2.5)	-1.08 (4.2)	-1.99 (12.9)	0.24 (32.1)	-0.60 (14.0)
Malta											
Malta	1995	4183	2002	4136	-0.20 (14.6)	-0.22 (3.1)	-0.12 (1.6)	-0.13 (2.7)	-0.32 (18.4)	-0.08 (31.3)	0.43 (14.1)
Pakistan											
Karachi	1995	1829	2001	2999	0.53 (11.7)	0.08 (2.5)	-0.01 (1.5)	0.48 (6.7)	-0.89 (9.8)	0.31 (19.4)	0.03 (7.5)
Sultanate of Oman											
Al-Khod	1995	3174	2001	3747	-0.08 (8.4)	-0.05 (2.3)	0.03 (3.1)	-0.19 (2.8)	-0.08 (18.7)	-0.13 (20.1)	-0.15 (19.9)
Region Total		**16,109**		**19,887**	**-0.10 (11.6)**	**-0.04 (2.7)**	**-0.04 (2.2)**	**-0.05 (3.9)**	**-0.11 (15.0)**	**0.22 (23.4)**	**0.11 (10.9)**
Indian Sub-Continent											
India											
Borivali	1995	3878	2003	1004	-0.24 (1.5)	-0.05 (0.2)	-0.04 (0.1)	-0.12 (0.7)	-0.34 (2.6)	0.19 (11.8)	-0.08 (5.3)
Chandigarh	1995	3138	2001	3122	0.23 (5.5)	-0.13 (0.8)	-0.03 (0.5)	-0.07 (2.3)	-0.45 (5.3)	3.11 (26.7)	0.10 (4.0)
Jodhpur	1995	3079	2002	2181	-0.37 (3.5)	-0.28 (1.3)	-0.11 (1.2)	-0.19 (2.3)	-0.16 (6.3)	-0.26 (9.7)	-0.07 (1.3)
Kottayam	1994	1080	2003	2341	-0.62 (5.3)	-0.24 (1.3)	-0.11 (0.7)	-0.35 (1.6)	-1.33 (4.1)	1.39 (31.1)	-0.09 (5.6)
Chennai (Madras) (3)	1995	2047	2002	3685	-0.35 (15.4)	0.63 (6.1)	0.06 (2.2)	-1.06 (6.1)	-0.88 (11.7)	-0.46 (29.0)	-0.50 (8.9)
Mumbai (18) (Bombay)	1995	3177	2002	2982	0.13 (4.6)	-0.00 (1.0)	-0.03 (0.6)	0.07 (1.8)	0.28 (9.4)	1.53 (25.7)	0.55 (9.1)
New Delhi (7)	1995	3025	2001	3469	-1.28 (5.3)	-0.27 (1.4)	-0.14 (1.1)	-0.31 (2.9)	-2.29 (4.7)	-3.24 (6.3)	0.19 (6.5)
Pune	1994	2696	2001	1983	0.14 (2.8)		-0.10 (0.0)	-0.17 (0.1)	0.35 (6.5)	0.15 (10.5)	0.03 (5.1)
Region Total		**22,120**		**20,767**	**0.02 (6.4)**	**-0.09 (1.9)**	**-0.06 (1.0)**	**-0.15 (2.6)**	**-0.05 (6.9)**	**-0.38 (20.0)**	**-0.01 (6.1)**
Latin America											
Argentina											
Córdoba	1997	3042	2002	3445	0.48 (13.6)	0.14 (3.2)	-0.04 (1.4)	-0.03 (3.0)	0.40 (18.8)	-2.77 (28.5)	-0.00 (9.6)
Brazil											
Curitiba	1995	3004	2001	3628	0.09 (18.9)	-0.13 (2.7)	-0.13 (1.9)	-0.26 (3.1)	-0.12 (19.1)	0.76 (34.7)	0.10 (9.2)
Porto Alegre	1994	3195	2003	3007	-0.72 (18.2)	-0.16 (3.1)	-0.17 (3.0)	-0.10 (4.8)	-0.74 (22.4)	-0.47 (35.0)	-0.08 (21.2)

Centre	Phase One		Phase Three		12 Month Prevalence						Ever had Asthma % change per year (Phase Three prevalence %)
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
Recife	1994	3086	2002	2865	-0.07 (19.1)	-0.25 (1.7)	-0.08 (3.9)	-0.09 (4.1)	0.32 (23.0)	0.81 (37.3)	-0.37 (18.0)
Salvador	1995	3162	2002	3020	-0.33 (24.6)	-0.19 (4.6)	0.09 (3.6)	0.07 (5.9)	0.99 (34.6)	0.68 (34.3)	0.17 (13.7)
São Paulo	1995	3007	2002	3161	-0.65 (18.7)	-0.26 (2.5)	-0.10 (2.8)	0.02 (2.9)	-0.50 (17.0)	0.04 (33.3)	0.05 (10.4)
Chile											
Punta Arenas	1994	3050	2001	3044	0.83 (13.6)	0.13 (2.2)	0.03 (1.1)	0.19 (2.8)	1.71 (19.2)	1.59 (28.8)	0.66 (13.0)
South Santiago	1995	3050	2001	3026	0.98 (17.0)	0.16 (2.2)	0.04 (2.4)	0.09 (5.5)	-0.78 (20.7)	1.28 (40.4)	0.74 (16.0)
Valdivia	1994	3231	2001	3105	0.63 (16.0)	0.09 (2.7)	0.05 (1.6)	0.12 (3.1)	1.34 (27.4)	3.33 (39.5)	0.56 (15.8)
Costa Rica											
Costa Rica	1994	3200	2002	2436	0.46 (27.3)	0.34 (8.0)	-0.10 (2.7)	0.29 (12.4)	-0.56 (19.7)	-0.59 (26.4)	0.59 (23.2)
Mexico											
Cuernavaca	1994	3102	2002	1431	0.63 (11.6)	0.10 (2.3)	-0.09 (0.9)	-0.10 (1.6)	1.63 (17.0)	0.87 (20.5)	0.02 (5.7)
Panama											
David	1995	2885	2001	3183	0.88 (22.9)	0.29 (5.2)	0.40 (4.4)	-0.49 (3.8)	-0.55 (11.3)	3.11 (40.3)	0.59 (20.5)
Paraguay											
Asunción	1997	2966	2002	3000	0.31 (20.9)	0.19 (4.4)	0.31 (4.6)	0.54 (7.9)	1.35 (22.1)	3.42 (48.4)	0.13 (12.8)
Peru											
Lima	1995	3157	2001	3022	-1.06 (19.6)	-0.09 (4.3)	-0.14 (2.5)	-0.33 (4.9)	-1.09 (29.4)	0.71 (37.9)	0.85 (33.1)
Uruguay											
Montevideo	1994	3072	2002	3177	-0.13 (17.9)	-0.06 (4.9)	0.08 (3.3)	-0.12 (4.2)	-0.13 (17.4)	0.50 (32.1)	0.35 (18.1)
Region Total		**46,209**		**44,550**	**0.32 (18.8)**	**0.02 (3.6)**	**-0.01 (2.7)**	**-0.02 (4.6)**	**0.13 (21.3)**	**0.83 (35.1)**	**0.25 (16.1)**
North America											
Barbados											
Barbados	1996	3533	2001	2498	0.62 (20.8)	0.14 (4.3)	0.04 (3.5)	0.27 (6.6)	0.54 (21.5)	-0.16 (13.9)	1.54 (24.7)
USA											
Seattle	1995	2330	2003	2422	-0.07 (22.3)	-0.13 (5.6)	0.04 (2.7)	0.00 (7.4)	0.04 (28.4)	0.12 (28.6)	0.48 (20.2)
Region Total		**5,863**		**4,920**	**0.12 (21.5)**	**-0.02 (4.9)**	**0.04 (3.1)**	**0.11 (7.0)**	**0.20 (24.9)**	**0.00 (21.1)**	**0.71 (22.5)**
Northern and Eastern Europe											
Albania											
Tiranë	1995	2957	2001	2983	0.12 (3.4)	0.10 (0.9)	-0.01 (0.2)	-0.05 (0.5)	0.45 (7.2)	0.81 (10.5)	0.34 (3.6)
Estonia											
Tallinn	1994	3506	2001	3603	0.09 (9.3)	0.07 (2.1)	-0.03 (0.5)	-0.02 (1.2)	-0.03 (9.0)	-0.42 (11.7)	0.21 (4.8)
Finland											
Kuopio County	1994	2876	2001	3051	0.84 (19.0)	0.11 (3.6)	-0.03 (0.4)	0.08 (2.6)	0.47 (20.9)	0.06 (15.0)	0.45 (7.7)
Georgia											
Kutaisi	1996	3297	2003	2650	0.21 (5.1)	0.00 (0.7)	0.05 (0.9)	0.13 (1.6)	-0.44 (5.1)	0.04 (9.3)	-0.07 (3.3)
Latvia											
Riga	1994	3004	2004	1283	0.22 (10.5)	0.11 (2.2)	0.03 (0.9)	0.06 (1.9)	0.38 (12.3)	0.66 (18.9)	0.34 (7.2)
Lithuania											
Kaunas	1995	1600	2001	2723	-0.24 (6.7)	-0.03 (0.7)	-0.03 (0.3)	0.01 (1.0)	0.33 (14.0)	0.25 (6.9)	0.20 (3.3)

Centre	Phase One		Phase Three		12 Month Prevalence						Ever had Asthma % change per year (Phase Three prevalence %)
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
Poland											
Krakow	1995	2786	2002	2545	0.27 (9.4)	0.17 (3.1)	0.04 (1.2)	0.14 (2.8)	0.81 (15.5)	1.09 (23.7)	0.64 (6.8)
Poznan	1994	3625	2002	1875	0.41 (11.2)	0.13 (2.8)	0.09 (1.7)	0.23 (3.4)	0.65 (13.5)	0.86 (19.5)	0.39 (5.2)
Romania											
Cluj	1994	3396	2001	3019	2.81 (22.7)	0.55 (4.6)	0.20 (1.8)	0.83 (6.5)	2.66 (25.5)	1.29 (13.4)	0.74 (8.9)
Russia											
Novosibirsk	1996	3654	2002	3769	0.22 (11.2)	-0.02 1.9)	0.04 1.0)	0.16 1.8)	-0.42 (12.9)	0.48 (14.2)	0.11 3.9)
Sweden											
Linköping	1994	2496	2002	2679	-0.36 9.7)	-0.17 2.6)	-0.08 0.3)	-0.06 1.4)	-0.45 (14.6)	0.14 (11.6)	0.23 (12.0)
Ukraine											
Kharkiv	1998	3311	2002	2428	2.01 (20.9)	0.33 2.5)	0.08 1.1)	0.08 2.3)	1.85 (20.6)	1.80 (19.3)	-0.16 5.5)
Region Total		**36,508**		**32,608**	**0.26 (11.6)**	**0.08 2.3)**	**0.01 0.8)**	**0.08 2.2)**	**0.30 (14.3)**	**0.41 (14.0)**	**0.29 5.9)**
Oceania											
New Zealand											
Auckland	1993	3206	2001	2870	-0.51 (22.5)	-0.38 4.9)	0.02 2.9)	-0.31 5.6)	-0.45 (32.4)	0.14 (30.8)	0.63 (27.9)
Bay of Plenty	1993	2813	2002	1976	-0.98 (20.6)	-0.51 4.4)	-0.11 2.3)	-0.33 4.1)	-0.86 (31.6)	-0.49 (26.9)	0.67 (28.3)
Christchurch	1993	3186	2003	3116	-0.17 (27.9)	-0.31 6.7)	-0.07 2.2)	-0.13 6.2)	-0.25 (37.8)	-0.06 (26.8)	1.17 (37.6)
Nelson	1993	1838	2003	2305	-0.29 (28.0)	-0.35 6.6)	-0.09 1.7)	-0.19 6.3)	-0.17 (41.6)	0.13 (27.6)	0.91 (29.4)
Wellington	1993	4417	2001	3050	0.11 (32.6)	-0.41 7.8)	0.08 3.7)	-0.03 8.1)	0.17 (42.5)	0.15 (31.5)	1.24 (36.3)
Region Total		**15,460**		**13,317**	**-0.39 (26.7)**	**-0.38 6.2)**	**-0.05 2.6)**	**-0.21 6.2)**	**-0.29 (37.5)**	**-0.01 (28.9)**	**0.93 (32.4)**
Western Europe											
Austria											
Urfahr-Umgebung	1995	1515	2003	1439	0.41 (15.1)	-0.02 2.9)	0.01 0.9)	0.05 5.4)	1.02 (27.2)	0.74 (19.2)	0.22 7.0)
Belgium											
Antwerp	1995	1515	2002	3250	-0.52 8.3)	-0.15 2.5)	-0.14 0.5)	-0.18 1.3)	-0.58 9.1)	-0.58 (17.1)	0.05 8.5)
Channel Islands											
Guernsey	1996	1170	2001	1248	-1.70 (26.5)	-0.58 6.7)	-0.10 3.5)	-0.14 7.9)	1.48 (39.1)	-2.21 (33.8)	1.11 (26.9)
Jersey	1996	1135	2002	7738	-1.44 (26.5)	-0.74 6.2)	0.41 5.2)	-0.30 6.7)	0.60 (34.3)	-2.24 (31.7)	1.08 (25.2)
Germany											
Münster	1994	4000	1999	4132	0.68 (17.5)	0.04 4.0)	0.13 1.9)	0.35 7.9)	0.92 (25.8)	0.60 (23.2)	0.20 8.0)
Isle of Man											
Isle of Man	1995	1467	2001	1716	-0.36 (31.2)	-0.41 6.7)	0.00 3.4)	-0.19 7.3)	1.73 (41.1)	-1.00 (35.5)	1.62 (28.6)
Italy											
Cosenza	1994	1068	2002	9258	-0.38 4.1)	-0.14 0.3)	0.00 0.0)	-0.18 0.9)	-1.09 6.1)	0.69 (27.9)	-0.38 5.0)
Emilia-Romagna	1994	3961	2002	1347	-0.29 8.1)	-0.08 1.9)	-0.06 0.1)	0.02 2.2)	-0.16 (15.8)	1.89 (36.6)	-0.07 9.6)
Empoli	1994	1046	2002	1229	-0.73 7.6)	-0.19 0.8)	-0.09 0.1)	-0.16 1.2)	-0.56 (13.1)	1.45 (40.2)	-0.40 8.9)
Firenze	1994	1171	2002	1383	-0.22 8.7)	-0.06 2.1)	-0.11 0.1)	-0.06 2.1)	-0.07 (15.2)	2.52 (41.5)	0.32 (12.1)
Milano	1995	3377	2002	1411	-0.21	0.01	-0.05	0.13	-0.31	1.24	0.33

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	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
	4	3	2	0	8.9)	2.3)	0.3)	3.5)	(15.5)	(37.2)	(13.3)
	199	332	200	132	0.20	0.08 (	-0.01 (	0.09 (	0.12	1.10	0.44
Roma	4	3	2	5	(11.4)	2.6)	0.3)	3.2)	(15.3)	(31.8)	(14.9)
	199	118	200	108	-0.30	-0.15 (	-0.11 (	-0.10 (	-0.50	1.41	0.05
Siena	4	1	2	2	(10.5)	1.8)	0.3)	2.1)	(16.8)	(37.7)	(11.4)
	199	124	200	118	0.29	0.09 (	-0.01 (	0.26 (	-0.34	1.74	0.55
Torino	4	2	2	0	(10.9)	3.0)	0.6)	5.0)	(16.0)	(37.2)	(13.8)
	199	442	200	131	-0.26 (	-0.10 (	-0.05 (	-0.11 (	-0.27 (	0.23	0.37
Trento	5	6	2	1	4.1)	0.6)	0.0)	0.5)	7.6)	(19.1)	(10.1)
Portugal											
	199	353	200	316	-0.23 (	-0.12 (	-0.05 (	-0.01 (	0.66	2.05	0.29
Funchal	5	1	2	1	9.0)	1.9)	1.5)	2.7)	(21.2)	(34.1)	(15.2)
	199	303	200	302	0.40	0.07 (	0.08 (	0.13 (	1.20	1.99	0.37
Lisbon	3	0	2	4	(14.6)	3.5)	2.1)	3.5)	(24.8)	(35.4)	(15.6)
	199	105	200	110	0.20 (	0.02 (	0.05 (	0.02 (	0.42	1.67	0.27
Portimao	4	8	2	9	9.7)	2.2)	1.8)	2.1)	(18.2)	(31.4)	(12.4)
	199	313	200	333	0.82	0.13 (	0.08 (	0.18 (	1.50	2.83	0.54
Porto	5	1	2	6	(13.1)	2.6)	1.5)	2.8)	(21.0)	(32.9)	(15.1)
Rep. of Ireland											
	199	314	200	308	-0.30	-0.29 (	-0.03 (	-0.11 (	-0.48	0.46	0.79
Rep. of Ireland	5	7	3	9	(26.7)	5.7)	2.4)	5.1)	(21.4)	(37.6)	(21.5)
Spain											
	199	303	200	306	-0.59 (	-0.12 (	-0.06 (	-0.12 (	-0.55	-0.02	0.13
Barcelona	3	1	2	6	9.0)	2.3)	0.8)	1.6)	(13.4)	(20.4)	(12.3)
	199	321	200	340	0.26	0.01 (	-0.09 (	0.07 (	0.35	-0.72	0.79
Bilbao	4	1	1	1	(13.7)	4.3)	0.8)	3.5)	(22.2)	(20.5)	(21.8)
	199	301	200	399	0.01	-0.08 (	-0.08 (	-0.11 (	0.02	0.78	0.14
Cartagena	3	7	2	8	(10.7)	2.7)	1.1)	1.9)	(15.1)	(27.4)	(11.8)
	199	309	200	402	-0.00 (	0.01 (	0.02 (	0.02 (	-0.15	-0.11	0.15 (
Castellón	4	4	2	4	7.1)	1.8)	0.6)	1.3)	(11.6)	(21.4)	9.0)
	199	322	200	265	0.49	0.35 (	0.05 (	0.24 (	1.42	-0.23	0.93
Madrid	7	1	2	2	(10.1)	3.9)	1.5)	2.7)	(16.9)	(17.3)	(14.3)
	199	304	200	293	0.36 (	0.15 (	0.03 (	0.05 (	-0.13	0.75	0.31
Pamplona	4	0	1	2	8.0)	2.8)	0.7)	1.4)	(11.3)	(22.9)	(10.9)
	199	317	200	313	-0.09	0.04 (	0.00 (	-0.06 (	-0.09	-0.25	0.17
Valencia	4	4	2	2	(10.3)	2.9)	1.1)	2.3)	(16.4)	(19.3)	(13.5)
	199	317	200	294	0.25 (	0.16 (	0.04 (	0.04 (	0.21	0.62	0.76
Valladolid	4	7	2	4	8.2)	2.8)	0.8)	1.8)	(14.8)	(27.9)	(12.4)
United Kingdom											
	199	222	200	235	-0.55	-0.22 (	-0.08 (	-0.28 (	-0.40	-0.41	0.90
North Thames	5	0	2	6	(26.6)	5.9)	2.7)	5.8)	(23.1)	(44.3)	(24.5)
	199	444	200	466	-1.28	-0.74 (	-0.14 (	-0.48 (	-1.34	-0.56	0.44
Scotland	5	4	2	2	(27.8)	6.4)	3.7)	6.6)	(22.1)	(38.5)	(24.5)
	199	229	200	243	-0.74	-0.50 (	-0.03 (	-0.13 (	-0.87	-0.11	0.72
South Thames	5	7	2	2	(26.2)	6.2)	3.2)	7.9)	(20.7)	(44.7)	(25.5)
	199	209	200	219	-0.65	-0.15 (	-0.07 (	-0.27 (	-1.11	-0.33	0.59
Sunderland	5	2	1	3	(16.1)	5.2)	2.0)	3.4)	(17.6)	(19.1)	(25.8)
	199	211	200	508	-0.41	-0.36 (	-0.05 (	-0.16 (	-0.47	0.20	0.54
Surrey/Sussex	2	4	2	2	(22.7)	5.1)	1.8)	5.4)	(33.9)	(28.6)	(24.3)
	199	235	200	250	-0.87	-0.40 (	-0.00 (	-0.39 (	1.20	-0.56	0.76
Wales	5	1	2	1	(27.5)	6.2)	3.7)	6.3)	(38.1)	(39.6)	(27.1)
					-0.07	**-0.05 (**	**-0.02 (**	**-0.02 (**	**0.03**	**0.64**	**0.33**
Region Total		**85,969**		**82,844**	**(15.2)**	**3.7)**	**1.6)**	**3.8)**	**(20.3)**	**(29.3)**	**(16.3)**
					0.06	**-0.02 (**	**-0.01 (**	**-0.01 (**	**0.15**	**0.51**	**0.28 (**
GLOBAL TOTAL		**323,016**		**304,679**	**(13.7)**	**3.2)**	**1.8)**	**3.7)**	**(19.2)**	**(25.8)**	**13.8)**

Centre	Phase One		Phase Three		Current Wheeze % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night wheeze % change per year (Phase Three prevalence %)	Night cough % change per year (Phase Three prevalence %)	Severe Wheeze % change per year (Phase Three prevalence %)
	Year	N	Year	N					
Africa									
Kenya									
Nairobi	1995	3224	2001	3023	-1.34 (10.8)	-1.25 (16.9)	-0.65 (7.8)	-1.31 (23.4)	-1.00 (7.1)
Morocco									
Casablanca	1995	3182	2001	1771	0.39 (12.9)	0.65 (16.9)	0.29 (7.2)	0.53 (17.6)	0.45 (11.0)
Marrakech	1995	2899	2002	1687	0.43 (8.7)	0.37 (10.3)	0.32 (4.7)	0.87 (16.7)	0.53 (7.5)
South Africa									
Cape Town	1995	5160	2002	4986	0.67 (11.2)	0.34 (13.9)	0.21 (5.3)	1.09 (19.2)	0.28 (7.0)
Region Total		**14,465**		**11,467**	**0.34 (11.0)**	**0.23 (14.6)**	**0.16 (6.2)**	**0.68 (19.7)**	**0.29 (7.7)**
Asia-Pacific									
China									
Beijing	1994	4164	2001	3523	-0.03 (3.1)	0.22 (6.2)	0.03 (0.9)	-0.08 (6.3)	0.04 (1.6)
Guangzhou	1994	3854	2001	3514	0.27 (3.8)	0.62 (11.3)	0.01 (0.8)	-0.00 (5.4)	0.06 (1.6)
Hong Kong									
Hong Kong	1995	4660	2002	3321	-0.56 (6.2)	-1.27 (6.4)	-0.30 (1.7)	-0.40 (21.8)	-0.19 (5.6)
Malaysia									
Alor Setar	1995	3295	2002	2916	-0.12 (4.5)	0.06 (9.1)	-0.04 (1.8)	0.08 (9.2)	0.13 (3.7)
Klang Valley	1995	5956	2001	3025	0.10 (7.5)	1.11 (16.3)	0.08 (3.2)	0.62 (12.8)	0.11 (4.4)
Kota Bharu	1995	3001	2001	2989	-0.19 (2.8)	0.29 (8.8)	-0.00 (1.7)	0.51 (8.3)	0.14 (3.0)
Philippines									
Metro Manilla	1994	3205	2001	3658	0.54 (13.4)	0.58 (16.6)	0.04 (4.1)	0.58 (18.6)	0.20 (6.3)
Singapore									
Singapore	1994	4188	2001	3631	0.22 (11.4)	0.68 (12.9)	0.08 (3.7)	0.84 (14.9)	0.40 (7.8)
South Korea									
Provincial Korea	1995	6957	2000	7224	0.55 (5.8)	1.20 (12.0)	0.17 (1.3)	0.73 (6.9)	0.20 (2.6)
Seoul	1995	2957	2000	2870	-0.03 (5.0)	0.35 (10.0)	0.11 (1.2)	0.11 (6.4)	0.03 (2.8)
Taiwan									
Taipei	1995	3814	2001	6378	0.38 (6.7)	0.52 (8.9)	0.04 (1.9)	0.31 (5.3)	-0.01 (2.7)
Thailand									
Bangkok	1995	3704	2001	4648	0.59 (11.5)	0.26 (14.2)	0.00 (2.7)	0.45 (17.1)	-0.17 (3.5)
Chiang Mai	1995	3924	2001	3499	-0.19 (4.8)	-0.57 (4.2)	0.00 (1.7)	-0.41 (7.7)	-0.36 (0.9)
Region Total		**53,679**		**51,196**	**0.12 (6.8)**	**0.28 (10.7)**	**0.02 (2.0)**	**0.29 (10.4)**	**0.05 (3.5)**
Eastern Mediterranean									
Iran									
Rasht	1995	3174	2002	2991	0.06 (3.5)	0.15 (7.2)	-0.02 (0.9)	-0.07 (5.5)	0.07 (2.5)
Kuwait									
Kuwait	1995	1028	2001	2882	-0.83 (8.4)	-0.18 (13.6)	-0.78 (4.8)	1.02 (15.9)	-0.67 (5.1)
Pakistan									
Karachi	1995	1829	2001	2978	-0.15 (7.1)	-0.07 (5.9)	0.08 (3.5)	-0.13 (5.3)	-0.42 (1.9)
Region Total		**6,031**		**8,851**	**-0.05 (6.3)**	**0.06 (8.8)**	**-0.03 (3.1)**	**0.08 (8.8)**	**-0.04 (3.2)**
Indian subcontinent									
India									
Chandigarh	1995	3086	2001	2317	-0.06 (2.5)	-0.19 (3.8)	0.26 (4.1)	0.15 (3.9)	0.00 (1.9)
Jodhpur	1995	3037	2002	1717	0.17 (3.8)	-0.35 (4.2)	0.12 (2.5)	-0.29 (2.7)	-0.05 (1.6)
Chennai (Madras) (3)	1994	1049	2003	2098	1.74 (21.4)	-0.39 (4.9)	0.71 (10.4)	0.47 (9.7)	0.17 (6.0)
New Delhi (7)	1995	2817	2001	3469	-0.29 (5.3)	-0.79 (4.4)	-0.50 (4.5)	-0.62 (4.2)	-0.57 (2.8)
Pune	1994	2573	2001	1951	0.55 (4.5)	0.80 (7.0)	0.31 (2.8)	0.41 (3.8)	0.32 (3.1)
Region Total		**12,562**		**11,552**	**0.31 (7.3)**	**0.14 (4.8)**	**0.29 (4.9)**	**0.18 (4.8)**	**0.01 (3.1)**
Latin America									
Argentina									
Córdoba	1997	2948	2002	3438	0.00 (8.1)	-0.39 (7.3)	-0.05 (2.5)	0.67 (16.7)	-0.05 (5.5)
Chile									
Punta Arenas	1994	2821	2001	3043	0.54 (13.3)	0.81 (17.1)	0.19 (3.9)	1.42 (24.7)	0.27 (6.0)
South Santiago	1995	3049	2001	3016	-0.06 (12.7)	-0.45 (14.2)	-0.03 (4.2)	1.20 (23.4)	0.16 (5.5)
Paraguay									
Asunción	1997	2966	2002	3000	0.10 (10.6)	-0.51 (12.0)	-0.01 (5.2)	1.06 (18.1)	0.04 (6.3)
Peru									
Lima	1995	3150	2001	2927	-0.45 (15.8)	-0.18 (20.3)	0.09 (6.9)	0.36 (18.9)	0.01 (8.3)
Uruguay									
Montevideo	1994	3069	2002	3175	-0.42 (11.6)	-0.30 (15.1)	-0.15 (4.7)	0.38 (22.3)	-0.42 (7.6)
Region Total		**18,003**		**18,599**	**-0.03 (11.9)**	**-0.11 (14.2)**	**0.01 (4.5)**	**0.75 (20.6)**	**0.01 (6.5)**

Centre	Phase One		Phase Three		Current Wheeze % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night wheeze % change per year (Phase Three prevalence %)	Night cough % change per year (Phase Three prevalence %)	Severe Wheeze % change per year (Phase Three prevalence %)
	Year	N	Year	N					
North America									
Barbados									
Barbados	1996	3533	2001	2498	0.18 (13.9)	0.20 (22.0)	0.35 (12.9)	-0.17 (15.9)	-0.38 (7.4)
USA									
Seattle	1995	2140	2003	2397	-0.54 (8.7)	-0.92 (15.1)	-0.14 (3.5)	0.75 (19.5)	-0.45 (7.0)
Region Total		**5,673**		**4,895**	**-0.26 (11.3)**	**-0.79 (18.6)**	**-0.11 (8.3)**	**0.61 (17.7)**	**-0.44 (7.2)**
Northern and Eastern Europe									
Albania									
Tiranë	1995	2362	2001	2924	0.09 (1.6)	0.50 (4.3)	0.46 (3.1)	0.29 (3.3)	0.17 (1.6)
Estonia									
Tallinn	1994	3400	2001	3258	0.02 (2.2)	0.18 (6.8)	0.03 (1.4)	0.14 (7.1)	0.08 (1.5)
Finland									
Kuopio County	1994	2875	2001	3049	-0.06 (3.3)	-0.07 (7.1)	0.00 (0.9)	-0.06 (10.7)	-0.09 (1.9)
Latvia									
Riga	1994	2847	2004	1276	0.18 (3.1)	0.10 (4.2)	0.04 (1.1)	0.34 (6.7)	0.10 (1.6)
Sweden									
Linköping	1994	2486	2002	2660	-0.17 (3.7)	-0.40 (8.3)	0.01 (1.0)	0.23 (9.3)	-0.06 (2.0)
Region Total		**13,970**		**13,167**	**0.03 (2.7)**	**0.15 (6.3)**	**0.02 (1.6)**	**0.24 (7.5)**	**0.06 (1.7)**
Oceania									
New Zealand									
Auckland	1993	3201	2001	2869	-0.64 (11.2)	-1.56 (15.9)	-0.79 (5.1)	-0.09 (20.0)	-0.63 (6.3)
Bay of Plenty	1993	2810	2002	1902	-0.57 (13.4)	-1.66 (13.5)	-0.53 (6.7)	-0.88 (17.2)	-0.50 (8.3)
Christchurch	1993	3167	2003	3094	-0.86 (8.8)	-1.60 (16.2)	-0.67 (4.6)	-0.46 (17.9)	-0.61 (7.1)
Nelson	1993	1826	2003	2295	-0.76 (11.5)	-1.64 (15.9)	-0.65 (3.9)	-0.49 (18.4)	-0.23 (9.4)
Wellington	1993	4404	2001	3045	-0.93 (12.1)	-1.75 (17.1)	-0.86 (5.4)	-0.08 (22.5)	-1.01 (6.8)
Region Total		**15,408**		**13,205**	**-0.77 (11.2)**	**-1.64 (15.9)**	**-0.73 (5.1)**	**-0.31 (19.4)**	**-0.56 (7.4)**
Western Europe									
Austria									
Urfahr-Umgebung	1995	1502	2003	1424	0.26 (8.6)	0.00 (15.6)	0.02 (3.8)	0.24 (10.1)	0.21 (4.6)
Germany									
Münster	1994	3996	1999	4130	0.23 (6.8)	0.25 (17.7)	0.19 (4.7)	0.75 (14.4)	0.12 (4.7)
Portugal									
Funchal	1995	3406	2002	2961	0.15 (7.3)	0.28 (16.3)	0.17 (4.4)	0.93 (16.6)	-0.06 (4.6)
Spain									
Barcelona	1993	2984	2002	3062	-0.17 (5.9)	-1.43 (9.0)	-0.28 (2.2)	0.81 (23.6)	-0.01 (4.0)
Bilbao	1994	3166	2001	3401	0.16 (10.9)	-1.65 (16.1)	-0.15 (5.0)	-0.69 (11.9)	0.20 (6.6)
Cartagena	1993	3013	2002	3991	-0.27 (5.3)	-1.11 (12.9)	-0.23 (2.1)	0.01 (12.9)	-0.13 (2.5)
Castellón	1994	3089	2002	4021	0.11 (6.7)	-1.29 (8.6)	-0.24 (2.0)	-0.24 (16.8)	0.07 (3.2)
Madrid	1997	3221	2002	2651	0.34 (7.8)	-1.39 (10.7)	-0.11 (2.4)	-0.42 (10.1)	0.43 (4.5)
Pamplona	1994	3040	2001	2922	0.11 (7.7)	-1.54 (13.8)	-0.16 (2.7)	0.32 (18.0)	0.16 (4.5)
Valencia	1994	3135	2002	3078	-0.32 (7.1)	-3.11 (10.6)	-0.31 (2.6)	-0.23 (16.1)	-0.03 (4.0)
Valladolid	1994	3170	2002	2940	0.18 (7.7)	-1.83 (14.3)	-0.26 (1.8)	0.78 (23.3)	0.30 (5.7)
Region Total		**33,722**		**34,581**	**0.00 (7.3)**	**-1.24 (13.2)**	**-0.18 (3.1)**	**0.23 (16.0)**	**0.07 (4.4)**
GLOBAL TOTAL		**173,513**		**167,513**	**0.01 (7.9)**	**-0.19 (11.6)**	**-0.04 (3.4)**	**0.24 (13.6)**	**0.02 (4.5)**

Centre	Phase One		Phase Three		12 Month Prevalence						
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	Ever had Asthma % change per year (Phase Three prevalence %)
Africa											
Nigeria											
Ibadan	1995	169	2002	239	0.10 (5.6)	0.02 (2.8)	0.04 (2.3)	0.14 (4.8)	-0.18 (5.4)	-0.18 (8.0)	-0.01 (3.3)
Region Total		**1,696**		**2,396**	**0.10 (5.6)**	**0.02 (2.8)**	**0.04 (2.3)**	**0.14 (4.8)**	**-0.18 (5.4)**	**-0.18 (8.0)**	**-0.01 (3.3)**
Asia-Pacific											
Hong Kong											
Hong Kong	1995	3618	2001	4448	0.03 (9.4)	-0.01 (2.2)	0.01 (0.4)	-0.00 (1.1)	0.14 (7.7)	0.73 (26.0)	0.04 (7.9)
Indonesia											
Bandung	1996	1390	2002	2503	-0.21 (2.8)	-0.03 (0.6)	-0.06 (0.4)	-0.03 (0.6)	-0.10 (2.5)	2.02 (21.2)	-0.31 (4.8)
Japan											
Fukuoka	1994	2896	2002	2958	0.10 (18.2)	-0.48 (1.6)	-0.01 (1.1)	-0.02 (1.6)	-0.01 (5.2)	0.45 (13.1)	0.59 (23.0)
Malaysia											
Alor Setar	1995	2978	2002	3786	-0.07 (5.7)	-0.09 (1.0)	-0.07 (0.3)	-0.07 (0.9)	-0.25 (2.9)	0.46 (19.0)	-0.52 (9.8)
Klang Valley	1995	3109	2001	3044	-0.07 (7.4)	-0.11 (1.4)	-0.04 (0.4)	-0.01 (1.3)	-0.10 (4.2)	0.58 (21.4)	0.13 (11.9)
Kota Bharu	1995	3819	2001	3110	-0.21 (4.3)	-0.08 (0.6)	-0.05 (0.1)	-0.02 (0.9)	-0.05 (3.7)	-0.55 (17.7)	0.14 (11.2)
Singapore											
Singapore	1994	2353	2001	5389	-0.80 (10.2)	-0.28 (1.6)	-0.13 (0.9)	-0.15 (0.9)	-0.52 (4.5)	0.53 (18.7)	-0.42 (15.5)
South Korea											
Provincial Korea	1995	5527	2000	4258	-1.38 (5.6)	-0.07 (1.5)	-0.03 (0.4)	-0.12 (1.4)	-0.12 (3.9)	0.03 (17.6)	0.17 (9.1)
Seoul	1995	2582	2000	1760	-1.71 (6.5)	0.04 (1.6)	-0.07 (0.2)	-0.22 (0.9)	0.05 (4.4)	0.51 (19.8)	0.18 (9.9)
Taiwan											
Taipei	1994	4806	2001	4832	0.04 (9.8)	-0.17 (1.7)	-0.06 (0.4)	-0.08 (0.7)	-0.16 (4.8)	0.59 (21.1)	0.24 (14.4)
Thailand											
Bangkok	1995	3629	2001	4209	0.68 (15.0)	0.13 (4.3)	0.07 (1.3)	0.16 (2.6)	0.10 (5.7)	1.36 (31.0)	0.24 (10.7)
Chiang Mai	1995	3828	2001	3106	0.38 (7.8)	0.10 (2.1)	0.00 (0.7)	0.12 (1.6)	0.06 (3.2)	0.39 (16.5)	0.32 (6.1)
Region Total		**40,535**		**43403**	**-0.06 (8.9)**	**-0.09 (1.8)**	**-0.04 (0.6)**	**-0.04 (1.2)**	**-0.10 (4.6)**	**0.47 (20.6)**	**0.12 (11.4)**
Eastern Mediterranean											
Iran											
Rasht	1995	3013	2001	3057	1.67 (15.3)	0.36 (3.2)	0.17 (2.0)	0.22 (2.4)	0.41 (4.3)	0.69 (9.9)	0.48 (7.0)
Tehran	1995	2456	2001	3008	0.51 (8.6)	0.08 (1.4)	0.14 (1.6)	0.11 (1.5)	0.09 (2.3)	0.20 (7.2)	0.08 (2.1)
Malta											
Malta	1994	3493	2001	3795	0.86 (14.9)	0.10 (2.4)	0.09 (2.1)	-0.01 (1.1)	0.26 (5.9)	0.76 (24.4)	1.06 (14.9)
Oman											
Al-Khod	1995	3891	2001	4130	0.21 (8.4)	-0.06 (2.2)	-0.03 (3.3)	-0.12 (2.5)	-0.09 (6.4)	-0.27 (18.0)	0.02 (10.6)
Region Total		**12,853**		**13,990**	**0.79 (11.7)**	**0.10 (2.3)**	**0.10 (2.3)**	**0.04 (1.9)**	**0.19 (4.9)**	**0.36 (15.7)**	**0.28 (9.1)**
Indian Sub-Continent											
India											
Mumbai (Bombay)	(16) 1994	1104	2003	2114	-0.12 (2.4)	-0.08 (0.6)	-0.09 (0.1)	-0.10 (0.5)	-0.14 (1.6)	-0.39 (10.1)	-0.12 (3.0)
Mumbai	(18) 1995	2154	2002	2614	-0.23	-0.18	-0.18	0.04	-0.06	-0.80	-0.40

Centre	Phase One		Phase Three		12 Month Prevalence						
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	Ever had Asthma % change per year (Phase Three prevalence %)
(Bombay)	5	6	2	9	(23.0)	3.4)	2.6)	7.8)	(12.9)	(21.4)	(11.6)
	199	396	200	286	-0.15 (	-0.15 (	-0.12 (	-0.17 (	-0.06 (	-0.15	-0.11 (
Jodhpur	5	7	3	5	2.5)	0.1)	0.0)	0.2)	2.5)	(11.4)	2.9)
	199	356	200	486	0.36 (	-0.00 (	-0.03 (	0.02 (	0.09 (	0.73	0.18 (
Kottayam	4	8	2	2	4.7)	0.6)	0.4)	0.9)	2.5)	(14.1)	3.8)
	199	293	200	370	-0.12 (	-0.07 (	-0.02 (	0.07 (	-0.14 (	-1.08 (	0.43 (
New Delhi (7)	5	8	2	6	6.0)	0.9)	0.6)	2.1)	3.0)	7.0)	6.8)
	199	324	200	271	0.28 (		-0.13 (	-0.22 (	0.09 (	0.38	-0.14 (
Pune	5	8	1	1	4.0)		0.0)	0.0)	3.1)	(11.8)	3.4)
					0.06 (	**-0.07 (**	**-0.07 (**	**-0.09 (**	**-0.04 (**	**-0.17**	**-0.05 (**
Region Total		**16,981**		**18,877**	**6.8)**	**0.9)**	**0.6)**	**1.8)**	**4.0)**	**(12.5)**	**5.2)**
Latin America											
Brazil											
	199	300	200	304	0.44	0.13 (	0.42 (	0.35 (	-0.04 (	0.33	0.03 (
São Paulo	5	5	2	7	(24.4)	5.1)	6.7)	4.8)	5.2)	(36.5)	6.3)
Chile											
	199	306	200	305	0.06	0.18 (	0.00 (	-0.01 (	-0.12 (	0.68	-0.36 (
Punta Arenas	4	0	1	2	(17.5)	3.3)	2.5)	2.5)	9.2)	(34.2)	7.9)
	199	318	200	307	-0.31	-0.06 (	-0.08 (	-0.17 (	0.11	1.49	-0.31 (
South Santiago	4	2	1	5	(14.7)	2.2)	3.2)	2.4)	(10.0)	(34.5)	8.4)
	199	313	200	318	0.12	-0.02 (	-0.21 (	-0.01 (	-0.10	1.71	-0.11
Valdivia	4	8	1	3	(21.4)	4.4)	3.2)	3.3)	(14.5)	(36.6)	(15.7)
Costa Rica											
	199	294	200	323	0.69	0.59	-0.18 (	0.44	0.12	-0.16	0.12
Costa Rica	4	2	2	4	(37.6)	(12.1)	3.5)	(14.9)	(17.1)	(37.0)	(27.9)
Mexico											
	199	309	200	257	-0.03 (	0.04 (	-0.04 (	-0.21 (	-0.10 (	-0.11	-0.21 (
Cuernavaca	4	7	2	9	8.4)	1.6)	1.3)	1.1)	3.2)	(19.0)	3.5)
Panama											
	199	304	200	294	-0.13	0.21 (	0.19 (	-0.38 (	-0.14	1.91	0.17
David	5	3	1	2	(22.7)	5.4)	4.5)	4.0)	(11.5)	(40.8)	(20.3)
					0.07	**0.09 (**	**-0.03 (**	**-0.05 (**	**-0.05**	**0.63**	**-0.15**
Region Total		**21,467**		**21,112**	**(21.4)**	**5.0)**	**3.6)**	**4.9)**	**(10.3)**	**(34.4)**	**(13.2)**
North America											
Barbados											
	199	328	200	275	0.11	0.02 (	0.03 (	-0.01 (	0.23 (	0.23	0.54
Barbados	5	9	1	9	(19.5)	3.9)	3.4)	2.7)	7.5)	(11.9)	(20.5)
Canada											
	199	241	200	125	0.47	-0.00 (	0.05 (	0.07 (	0.20 (	0.51	0.86
Saskatoon	4	8	3	5	(18.2)	4.5)	2.2)	3.3)	9.9)	(26.1)	(19.0)
		5,70		**4,0**	**0.32**	**0.01 (**	**0.04 (**	**0.04 (**	**0.22 (**	**0.34**	**0.74**
Region Total		**7**		**14**	**(19.1)**	**4.1)**	**3.0)**	**2.9)**	**8.3)**	**(16.3)**	**(20.0)**
Northern and Eastern Europe											
Albania											
	199	298	200	289	-0.53 (	0.03 (	-0.08 (	-0.22 (	-0.37 (	-0.28 (	-0.09 (
Tiranë	5	1	0	6	5.0)	1.2)	0.9)	1.3)	3.0)	7.9)	2.6)
Estonia											
	199	307	200	238	0.05 (	0.08 (	-0.01 (	0.01 (	0.05 (	0.26	0.39 (
Tallinn	4	0	1	5	9.6)	2.0)	0.7)	0.8)	2.0)	(13.5)	4.1)
Georgia											
	199	335	200	266	-0.34 (	-0.16 (	-0.07 (	0.14 (	-0.34 (	-0.06 (	-0.18 (
Kutaisi	6	6	3	6	6.9)	0.9)	0.8)	2.5)	2.1)	8.3)	3.3)
Lithuania											
	199	187	200	277	0.28 (	0.07 (	-0.03 (	-0.02 (	0.21 (	0.80 (	0.24 (
Kaunas	5	8	2	2	6.6)	1.2)	0.4)	0.6)	3.2)	8.8)	2.6)
Poland											
	199	226	200	249	0.02	0.10 (	0.01 (	0.04 (	0.44 (	0.07	0.29 (
Krakow	5	4	1	7	(14.5)	4.4)	2.2)	2.7)	7.5)	(25.6)	5.8)
	199	271	200	199	0.54	0.32 (	0.21 (	0.09 (	0.39 (	1.34	0.57 (
Poznan	4	0	2	9	(12.5)	4.9)	2.7)	2.5)	6.1)	(23.7)	5.9)

Centre	Phase One		Phase Three		12 Month Prevalence						
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	Ever had Asthma % change per year (Phase Three prevalence %)
Russia											
Novosibirsk	1996	3637	2002	2730	0.05 (11.4)	-0.02 (1.9)	-0.03 (1.5)	0.02 (1.0)	-0.36 (3.5)	-0.34 (8.1)	0.16 (2.5)
Sweden											
Linköping	1994	1329	2002	2089	-0.01 (10.2)	0.04 (3.3)	-0.00 (1.1)	-0.00 (1.0)	-0.09 (5.3)	-0.11 (11.9)	0.29 (9.3)
Ukraine											
Kharkiv	1998	2971	2002	1950	0.07 (12.5)	0.03 (2.5)	-0.02 (1.3)	0.07 (1.7)	1.46 (10.4)	0.45 (13.7)	0.33 (6.8)
Region Total		**24,196**		**21,984**	**0.05 (9.6)**	**0.04 (2.3)**	**0.00 (1.2)**	**0.02 (1.5)**	**0.06 (4.5)**	**0.33 (13.0)**	**0.23 (4.5)**
Oceania											
Australia											
Melbourne	1993	2840	2002	2968	-0.80 (20.0)	-0.32 (6.2)	-0.03 (2.3)	-0.10 (3.2)	-0.42 (12.0)	-0.43 (28.3)	-0.35 (25.5)
New Zealand											
Auckland	1993	3526	2002	3541	-0.02 (22.4)	-0.05 (7.4)	0.01 (3.8)	-0.17 (3.8)	0.07 (15.4)	0.20 (29.3)	0.50 (28.3)
Bay of Plenty	1993	2681	2002	2150	-0.04 (23.7)	-0.15 (6.8)	0.03 (3.8)	-0.04 (4.4)	0.14 (17.1)	0.01 (29.0)	0.50 (30.2)
Christchurch	1993	3318	2002	3315	-0.49 (22.3)	-0.24 (7.8)	-0.13 (2.6)	-0.14 (3.6)	-0.24 (16.8)	-0.29 (29.2)	0.53 (33.6)
Nelson	1993	1868	2002	1867	0.15 (20.2)	-0.07 (6.4)	0.01 (2.4)	-0.15 (3.1)	0.11 (14.2)	0.33 (24.4)	1.01 (27.7)
Region Total		**14,233**		**13,841**	**-0.21 (21.8)**	**-0.16 (7.0)**	**-0.04 (3.0)**	**-0.12 (3.6)**	**-0.08 (15.1)**	**-0.08 (28.4)**	**0.42 (29.2)**
Western Europe											
Austria											
Kärnten	1995	5264	2002	4847	-0.05 (7.5)	-0.08 (1.2)	-0.00 (0.9)	-0.05 (1.1)	-0.06 (4.1)	0.25 (13.1)	0.11 (4.1)
Urfahr-Umgebung	1995	2129	2002	2029	-0.05 (7.3)	0.11 (2.0)	0.07 (1.1)	0.03 (1.3)	0.03 (4.7)	0.08 (11.0)	0.18 (4.6)
Belgium											
Antwerp	1995	6533	2002	5645	0.02 (7.5)	-0.02 (1.9)	-0.04 (1.0)	-0.03 (1.0)	0.00 (3.6)	0.43 (17.8)	0.26 (6.0)
Germany											
Münster	1994	3739	1999	3830	0.65 (12.8)	0.17 (3.1)	-0.05 (1.8)	0.07 (2.5)	0.15 (6.8)	0.51 (16.1)	0.11 (4.6)
Italy											
Emilia-Romagna	1994	4472	2002	2265	0.19 (8.9)	0.03 (1.6)	-0.08 (0.1)	0.02 (1.3)	0.06 (2.0)	0.96 (23.8)	0.18 (8.3)
Empoli	1994	1434	2002	1152	0.13 (9.7)	0.08 (1.4)	-0.04 (0.2)	0.10 (1.6)	0.10 (1.8)	0.79 (25.5)	-0.05 (7.4)
Firenze	1994	1138	2002	1036	-0.17 (8.6)	-0.04 (1.6)	-0.13 (0.0)	-0.01 (1.3)	-0.13 (1.5)	0.91 (27.0)	-0.05 (8.4)
Milano	1994	3616	2002	2249	0.08 (7.6)	-0.02 (1.3)	-0.06 (0.2)	0.00 (1.3)	0.02 (2.4)	0.81 (29.2)	0.05 (9.6)
Roma	1994	4027	2002	2224	0.16 (8.4)	-0.00 (1.4)	-0.05 (0.2)	0.03 (1.3)	0.07 (2.3)	0.86 (25.0)	0.11 (11.2)
Torino	1994	1429	2002	2361	-0.13 (5.4)	-0.02 (1.1)	-0.06 (0.0)	0.01 (1.5)	0.02 (1.6)	1.05 (26.1)	0.02 (7.8)
Portugal											
Funchal	1995	1797	2002	1819	-0.54 (11.0)	-0.44 (2.1)	-0.13 (4.1)	-0.55 (3.3)	-0.63 (7.0)	-0.29 (32.9)	-0.46 (14.2)
Lisbon	1995	2143	2002	2477	0.15 (14.2)	-0.02 (3.4)	0.07 (3.4)	-0.02 (2.9)	0.06 (7.1)	0.91 (32.7)	-0.07 (7.8)
Portimao	1994	1189	2001	1069	0.31 (13.2)	0.06 (2.5)	0.26 (3.6)	-0.15 (2.1)	0.13 (5.5)	1.06 (29.4)	-0.19 (4.9)
Spain											
Bilbao	1994	3019	2001	3157	0.61 (12.4)	0.10 (2.8)	0.06 (1.4)	0.04 (1.6)	0.27 (6.7)	0.69 (20.7)	1.53 (20.8)

Centre	Phase One		Phase Three		12 Month Prevalence						Ever had Asthma % change per year (Phase Three prevalence %)
	Year	N	Year	N	Wheeze % change per year (Phase Three prevalence %)	≥4 Attacks % change per year (Phase Three prevalence %)	Wheeze disturbs Sleep % change per year (Phase Three prevalence %)	Severe wheeze limiting speech % change per year (Phase Three prevalence %)	Exercise Wheeze % change per year (Phase Three prevalence %)	Night Cough % change per year (Phase Three prevalence %)	
Cartagena	1993	3335	2002	2948	0.30 (11.1)	0.11 (2.6)	0.08 (2.2)	0.03 (1.8)	0.22 (5.1)	0.52 (20.8)	0.51 (10.8)
Castellón	1994	3594	2002	3915	0.45 (8.3)	0.06 (1.5)	0.08 (1.4)	0.08 (1.4)	0.18 (3.5)	0.77 (14.6)	0.38 (7.3)
Madrid	1997	2442	2002	2347	0.55 (9.4)	0.10 (2.2)	0.10 (1.8)	0.22 (2.3)	0.34 (5.4)	0.94 (21.6)	0.38 (9.9)
Pamplona	1994	2996	2001	3176	0.51 (7.1)	0.14 (1.6)	0.08 (0.9)	0.10 (1.1)	0.38 (4.2)	1.17 (17.9)	0.77 (9.7)
Valencia	1994	3940	2002	3398	0.39 (9.3)	0.03 (1.8)	0.09 (1.1)	0.11 (1.9)	0.09 (3.6)	0.69 (17.1)	0.28 (8.4)
United Kingdom											
Sunderland	1996	1864	2001	1843	0.50 (20.9)	0.05 (7.0)	0.12 (6.2)	0.14 (4.0)	0.23 (14.6)	-0.19 (27.1)	0.78 (26.7)
Region Total		**60,100**		**53,787**	**0.20 (9.7)**	**0.03 (2.1)**	**-0.01 (1.5)**	**0.03 (1.7)**	**0.09 (4.6)**	**0.65 (20.7)**	**0.25 (9.1)**
GLOBAL TOTAL		**197,768**		**193,404**	**0.13 (11.6)**	**-0.01 (2.7)**	**-0.02 (1.6)**	**-0.01 (2.1)**	**0.04 (6.0)**	**0.43 (20.4)**	**0.18 (10.8)**