

Defining Chronic Cough: A Systematic Review of the Epidemiological Literature

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Purpose: Recent evidence suggests a global burden of chronic cough in general populations. However, the definitions vary greatly among epidemiological studies, and none have been validated for clinical relevance. We aimed to examine previous epidemiological definitions in detail and explore the operational characteristics. **Methods:** A systematic review was conducted for epidemiological surveys that reported the prevalence of chronic cough in general adult populations during the years 1980 to 2013. A literature search was performed on Pubmed and Embase without language restriction. Epidemiological definitions for chronic cough were classified according to their components, such as cutoff duration. Meta-analyses were performed for the male-to-female ratio of chronic cough prevalence to explore operational characteristics of epidemiological definitions. **Results:** A total of 70 studies were included in the systematic review. The most common epidemiological definition was identified as 'cough ≥ 3 months' duration without specification of phlegm ($n=50$); however, it conflicted with the cutoff duration in current clinical guidelines (cough ≥ 8 weeks). Meta-analyses were performed for the male-to-female ratio of chronic cough among 28 studies that reported sex-specific prevalence using the most common definition. The pooled male-to-female odds ratio was 1.26 (95% confidence interval 0.92-1.73) with significant heterogeneity ($I^2=96\%$, $P<0.001$), which was in contrast to clinical observations of female predominance from specialist clinics. Subgroup analyses did not reverse the ratio or reduce the heterogeneity. **Conclusions:** This study identified major issues in defining chronic cough in future epidemiological studies. The conflict between epidemiological and clinical diagnostic criteria needs to be resolved. The unexpected difference in the gender predominance between the community and clinics warrants further studies. Clinical validation of the existing definition is required.

Key Words: Cough; epidemiology; definition

INTRODUCTION

Cough is an essential mechanism for protecting airways, but is also one of the most common symptoms that lead patients to seek medical attention.¹ In particular, chronic cough has a high global health burden, affecting about 10% of general adult populations.² Chronic cough is a significant health issue due to its substantial impact on quality of life,³ and it causes many clinical challenges.^{4,5}

In the past, chronic cough was understood to be a consequence of several diseases affecting airway sensory nerve terminals, such as rhinitis, gastroesophageal acid reflux, and eo-

sinophilic airway diseases.^{4,5} However, many patients with these diseases do not report cough,^{6,7} suggesting that chronic cough,

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although associated, may be a separate condition. Moreover, diagnostic and therapeutic failures have been reported in a substantial proportion of patients with the classic causes of chronic cough (12%-44%).⁸ Therefore, cough hypersensitivity syndrome, a new paradigm has recently been formulated to understand chronic cough as a clinical syndrome with a common intrinsic pathophysiology (cough hypersensitivity).⁹⁻¹²

This recent paradigm shift in understanding chronic cough warrants further epidemiological characterization. However, in our recent meta-analyses of prevalence studies, substantial methodological heterogeneity was found among the existing epidemiological definitions.² Moreover, to the best of our knowledge, none of these definitions have been validated for clinical relevance. To further advance understanding of this disease, a consensus definition needs to be developed. Using a systematic literature review, this study examined previous epidemiological definitions utilized in general population surveys reporting the prevalence of chronic cough and explored the operational characteristics of the most common definition. We hope to open a field of discussion toward consensus development for the definition of chronic cough in further epidemiological studies.

MATERIALS AND METHODS

Data sources and searches

A systematic search was conducted of the Pubmed and Em-

base databases for the literature that measured the prevalence of chronic cough in community-based adult populations, as previously described.² The search terms were “cough AND (epidemiology OR epidemiologic OR epidemiological OR prevalence OR incidence)” for articles published in peer-reviewed journals between January 1980 and December 2013. Additional searches were performed in Google Scholar (<http://scholar.google.com>) and via cross-referenced articles. Language was not restricted. In cases where full-text links were not available, we contacted the corresponding authors by email for the full text. The systematic review process followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Fig. 1).¹³

Study selection

Studies were initially included if they met the following criteria: (1) cross-sectional or longitudinal studies conducted in community-based or unselected adult populations and (2) reported prevalence of chronic cough. Various definitions of chronic cough were accepted due to the lack of a validated definition. However, here we ultimately included studies only if their diagnostic terms were chronic cough, or other conceptually equivalent terms, such as long-term, longstanding, or persistent cough. We excluded studies with bronchitis, or cough but without including any conceptual terms for chronicity in their diagnostic labels. Other exclusion criteria were as follows: (1) no relevant analyses, (2) convenience sample studies without detailed

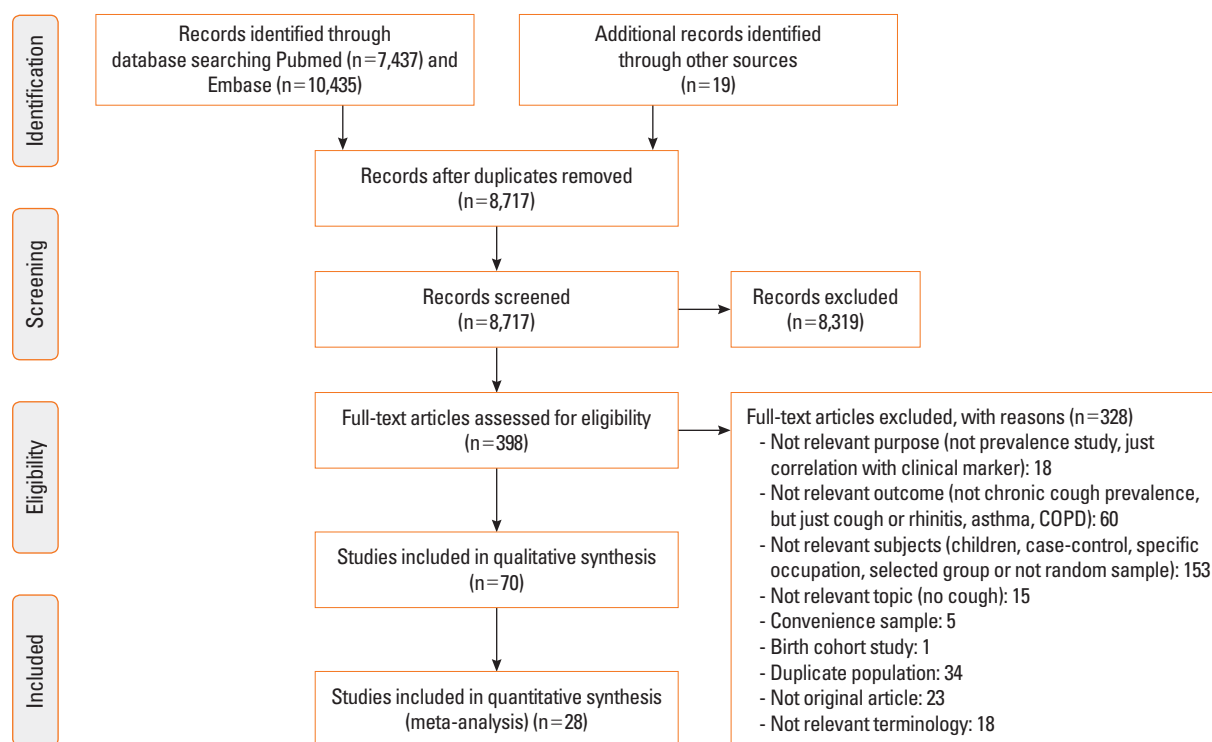


Fig. 1. PRISMA for study selection.

information on demographic characteristics, (3) birth cohort studies confined to specific ages, (4) studies confined to specific occupations, (5) studies using duplicate samples, or (6) non-original papers (reviews and case reports). In determining eligibility, discrepancies were resolved through consensus conference.

Data extraction and quality assessment

For all of the included articles, we extracted and confirmed the data. The extracted outcomes included study design, study region, study year, participant characteristics, smoking rate, and definition and prevalence of chronic cough. Sex-specific prevalence of chronic cough was also extracted in as many cases as possible, including email contact of the corresponding authors. In addition, according to text excerpts of research purposes described in original papers, individual studies were classified as studies with chronic cough as the primary outcome or not.

Quality was assessed by 2 reviewers using a quality scoring system in a quality effects model.¹⁴ Briefly, the scores were calculated by summing 6 measurements: (1) definition of the study population, (2) use of reported diagnostic criteria, (3) method of case ascertainment, (4) administration of measurement protocol, (5) characteristics of catchment area, and (6) prevalence measure. Discrepancies in scoring were resolved by consensus conference.

Data analyses

Definitions were classified according to the diagnostic terms and questions as utilized in original papers. Definitions were also examined by their components, such as cutoff duration, phlegm, or prevalence measure. Time trends in the definitions were also examined by each decade (1980-1990, 1991-2000, and 2001-2013). These evaluations were repeated for a subgroup of studies that had chronic cough as the primary outcome.

Operational characteristics of the most common definition were examined in relation to sex ratio, as female predominance was a representative finding among patients visiting cough clinics in several countries.¹⁵ A quality effects model was primarily used to calculate a pooled male-to-female odds ratio (OR) and 95% confidence interval (95% CI) of chronic cough prevalence. Heterogeneity was assessed using the I^2 test, with a cutoff of 50%¹⁶ and the chi-squared test with a P value <0.10 . We adapted the quality effects model due to a considerable heterogeneity in our previous meta-analyses of prevalence,² probably due to a combination of true variance of the prevalence and variability produced by the methodological differences used to measure the outcome.¹⁴ The quality effects model gives greater weight to studies of high quality than those of low quality, as it uses the quality scores assigned to individual studies; however, the random effects model assigns more weight to smaller studies in cases of heterogeneity.¹⁷ Therefore, we determined that the quality effects model was a more appropriate statistical method

to obtain a pooled ratio. However, we also presented the pooled estimates by the random effects model for comparison.

Subgroup analyses were performed to explain the heterogeneity, according to study year (before vs after 2000), region, age group (non-elderly vs elderly), and study quality (quality score ≤ 9 vs ≥ 10). Evidence of publication bias was assessed by applying the Peters test to funnel plots of the natural log of OR.¹⁸ Quality effects meta-analyses were performed using MetaXL software version 2.0 (<http://www.epigear.com>), and all other statistical analyses were conducted using Stata software package release 12.0 (Stata Corp., College Station, TX, USA).

RESULTS

Baseline description

A total of 70 articles met the inclusion criteria¹⁹⁻⁸⁸ (Fig. 1). Nineteen articles⁸⁹⁻¹⁰⁷ that had been included in previous meta-analyses for prevalence² were excluded here because their diagnostic terms were determined not to specifically intend chronic cough (such as 'chronic bronchitis', 'frequent cough', or just 'cough' in their terms). The characteristics of the 70 articles included and the 19 article excluded are summarized in Appendix Tables S1 and S2, respectively. The quality scores of the included studies are described in Appendix Table S3.

Cutoff duration for defining chronic cough

Several diagnostic terms were identified from the 70 studies included, such as chronic cough ($n=56$), chronic cough with phlegm ($n=4$), long-standing cough ($n=5$), long-term cough ($n=2$), and persistent cough ($n=3$) (Appendix Table S4). By cutoff duration, cough ≥ 3 months was by far the most common criterion ($n=55$), and cough ≥ 8 weeks was the second ($n=3$) most common. Eleven studies did not specify a cutoff duration for defining chronic cough (Table 1).

Based on the research purpose of individual articles (Appendix Table S3), 13 studies were classified as having chronic cough as the primary outcome. Cough ≥ 3 months was again the most common cutoff criterion ($n=7$), and cough ≥ 8 weeks was the second ($n=3$) most common. One study used cough ≥ 3 weeks, and the remaining 2 studies did not use a cutoff duration for cough (Table 1).

Time trends in the utilization of cutoff duration for defining chronic cough were examined (Fig. 2). Over the last 3 decades, the overall number of epidemiological studies for chronic cough had continuously increased, but cough ≥ 3 months remained the most frequently used criterion. Other cutoff criteria, such as 8 or 3 weeks, have only been found in recent studies published during 2001-2013. In a subgroup analysis of 13 studies with chronic cough as the primary outcome, cough ≥ 3 months remained the most common criterion, but the proportion of cough ≥ 8 weeks was higher than in the analysis of all studies (Fig. 2).

Table 1. Component of chronic cough definitions utilized in epidemiological studies

Component	All studies (n=70)	Studies with chronic cough as primary outcome (n=13)
Duration		
≥3 months	19,21,23,24,27,28,30,32,33,36-47,49,50,52-55,60-65,67-81,83-88	19,23,24,30,53,73,81
≥8 weeks or 2 months	31,34,35	31,34,35
≥3 weeks	25	25
No specific description	22,26,29,48,51,56-59,66,82	22,29
Combined phlegm		
Yes (productive cough)	24,26,47,50,61	24
No (dry cough)	74	
No specific description	19,23,25,27-46,48,49,51-60,62-73,75-88	19,22,23,25,29-31,34,35,53,73,81
Prevalence measure		
12-month prevalence	20,21,23,24,26-33,36-55,58,60-65,67-71,73-88	23,24,29-31,53,73,81
Point prevalence	19,22,25,34,35,72	19,22,25,34,35
No specific description	56,57,59,66	

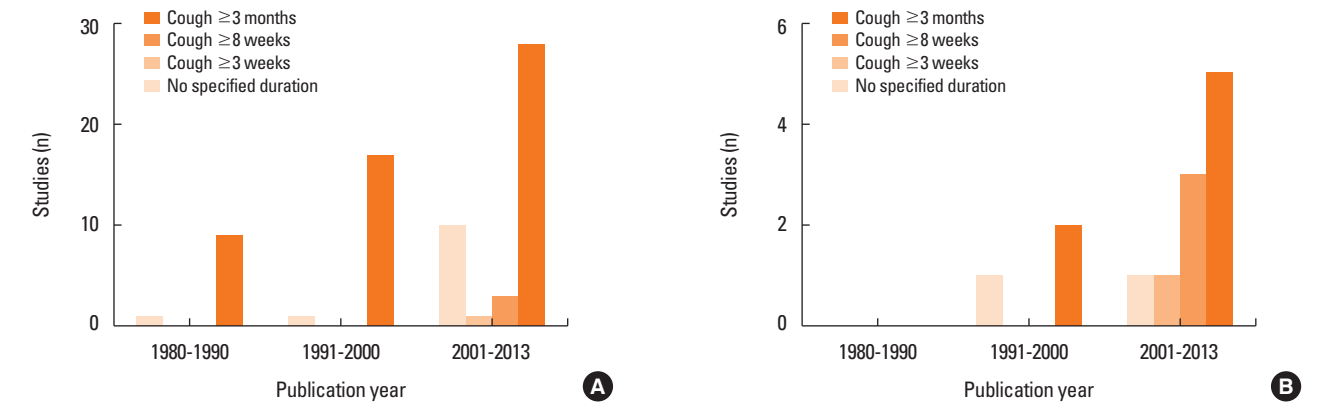


Fig. 2. Time trends in the utilization of definitions in epidemiological studies. (A) Time trends among all articles which reported the prevalence of chronic cough (n=70). (B) Time trends among a subgroup of articles which reported the prevalence of chronic cough as the primary outcome (n=13).

Other components for defining chronic cough

Most studies did not differentiate by the presence of phlegm in their reporting the prevalence of chronic cough (n=64). This preponderance was similarly observed in a subgroup analysis of 13 studies with chronic cough as the primary outcome (Table 1). Of 6 studies that utilized a phlegm component, none quantified or specified the diagnostic criteria for phlegm in detail. Based on the ways of measuring prevalence, the majority of studies (n=60) were classified as using period prevalence (12-month prevalence), whereas 6 studies used point prevalence (Table 1). The proportion of using point prevalence was higher in the subgroup of studies that analyzed chronic cough as the primary outcome (5 of 13).

Chronic cough by gender

Next, we examined the operational characteristics of the most common definition (n=50, cough ≥3 months [12-month prevalence] with no specification on phlegm, *i.e.*, using a question,

“Do you usually cough on most days for 3 consecutive months or more during the year?”) in relation to a male-to-female ratio of chronic cough prevalence because female predominance is a common finding among patients visiting cough clinics in several countries.¹⁵ This meta-analysis included 28 studies (56%) that specified sex-specific prevalence.^{19,20,23,27,28,32,33,36,37,42,44-46,52,53,55,60,64,67,68,70,72,73,76,77,79,81,88} Sex-specific pooled prevalence was 9.6% (95% CI 6.0-14.1%, $I^2=99\%$, $P<0.001$) in males, and 8.6% (95% CI 5.2-12.8%, $I^2=99\%$, $P<0.001$) in females by the quality effects model. The pooled male-to-female ratio of chronic cough prevalence was OR 1.26 (95% CI 0.92-1.73) (Fig. 3) with a significant level of heterogeneity ($I^2=96\%$, $P<0.001$) but no significant funnel plot asymmetry (Peters test, $P=0.592$). Male preponderance was also observed by random effects model analyses (OR 1.45, 95% CI 1.20-1.75; Appendix Fig. S1).

The current smoking rate was correlated with chronic cough prevalence at population levels ($r=0.378$, $P=0.009$), and was markedly higher among males than females ($40.8 \pm 13.3\%$ vs

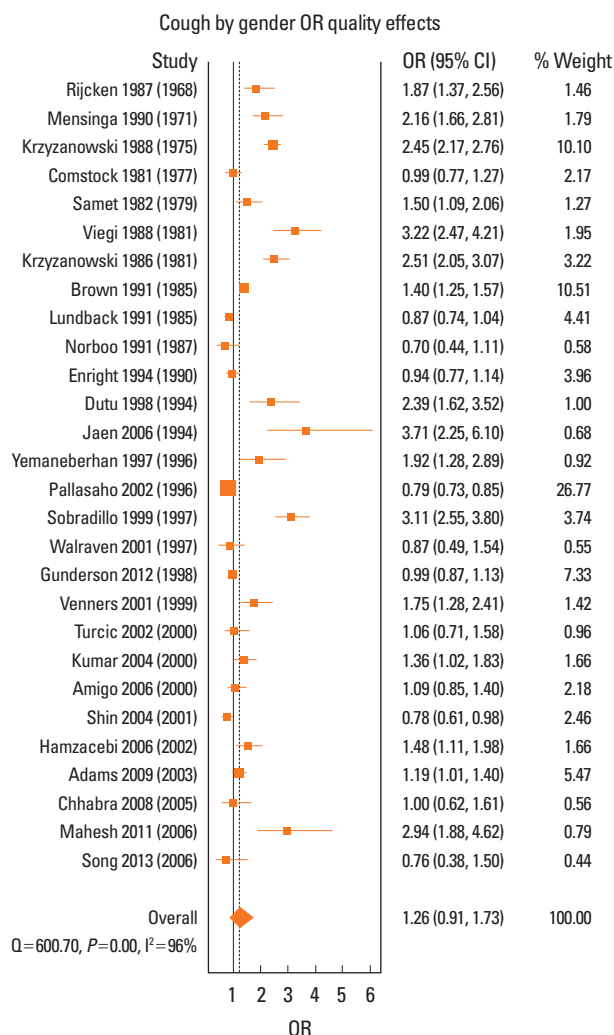


Fig. 3. Forest plots for male-to-female ratio in 28 epidemiological studies using a 'cough ≥ 3 months' definition and quality effects model. Study name indicates the first author and publication year, and they were ordered according to the study year (the number within the parenthesis). OR, odds ratio; 95% CI, 95% confidence interval.

13.7 $\pm$ 17.7%, $P < 0.001$). Thus, smoking was presumed to be a confounder in the association between gender and chronic cough prevalence. However, meta-regression analyses for sex-smoking-cough interactions were not performed here, as only 15 studies reported a sex-specific rate of current smoking.

We performed subgroup analyses as follows, to explore confounders affecting the gender/cough association. In subgroup analyses by study year, the male-to-female ratio was slightly lower in recent studies conducted after 2000, compared to studies before 2000 (Table 2); however, significant heterogeneity still remained among recent studies after 2000 ($I^2 = 76\%$, $P < 0.001$). In subgroup analyses by age group, elderly-specific studies^{33,73,76} had a lower heterogeneity than non-elderly studies^{20,23,36,42,44,45,52,55,64,67,70,72,79}; however, the number of elderly-specific studies was small ($n = 3$). Subgroup analyses by study qual-

ity score or region also did not significantly reduce heterogeneity (Table 2).

DISCUSSION

In previous analyses, we found a global pooled prevalence of chronic cough of 9.6% with a wide geographical distribution.² Here, we examined previous epidemiological definitions and their differences, and explored the operational characteristics of the most common definition in relation to the male-to-female ratio.

The high frequency of using 3 months as the cutoff for chronic cough in epidemiological studies may be attributed to the use of major standardized questionnaires in respiratory epidemiology. The British Medical Research Council (BMRC) questionnaire was the first one, particularly developed for the epidemiology of chronic bronchitis in the 1960s.¹⁰⁸ A reference paper stated that to define "chronic," *quantitative terms must be introduced into the definition, and at present this must be done more or less arbitrarily, and that the phrase "chronic or recurrent" has usually been accepted as implying that expectoration has occurred on most days during at least three consecutive months for more than 2 successive years.*¹⁰⁸ This cutoff duration for "chronic" remained in use in later major protocols of the European Community for Coal and Steel (ECSC)-87 and the American Thoracic Society with the Division of Lung Diseases (ATS-DLD)-78.¹⁰⁹ The ECSC-87 and ATS-DLD-78 questionnaires had modified the BMRC questionnaire by asking for a seasonal association of cough, from in the winter to no specification of season, but not the cutoff duration for chronicity in cough and phlegm. The use of 3 months' cutoff duration has been maintained in recent large-scale population surveys in Europe, including the European Community Respiratory Health Survey (ECRHS) since the 1990s.¹¹⁰

It may be advantageous to utilize these major questionnaires in further population surveys for chronic cough, as they have been extensively validated and have presented little risk for bias from the mode of administration. However, a major dilemma is that the questionnaires were not developed or validated for chronic cough specifically. Moreover, the criterion of 3 months' duration conflicts with the criterion of 8 weeks' duration used in major clinical guidelines for chronic cough in adults.^{4,5} However, because neither of them was evidence-based, but rather arose from expert opinions, neither can be viewed as "correct." Before the publication of current clinical guidelines, a ≥ 3 weeks' duration had often been utilized in clinical studies of chronic or persistent cough,¹¹¹⁻¹¹³ as common colds were considered to usually resolve within 3 weeks; however, a later consensus was made as 8 weeks¹¹⁴ because post-infectious cough often persists longer than 3 weeks. Meanwhile, in a recent international qualitative study, significant variation was still observed in the definition of chronic cough used in clinical prac-

Table 2. Sub-group analyses for sex associations of chronic cough

Classification	Parameter	Number of studies	Number of subjects	Quality effects OR (95% CI)	Random effects OR (95% CI)	I^2	P value for I^2
Among studies using 'cough ≥ 3 months' definition							
All		28	135,327	1.26 (0.92-1.73)	1.45 (1.20-1.75)	96%	<0.001
Study year	1980-1999	19	107,160	1.28 (0.85-1.91)	1.58 (1.23-2.02)	97%	<0.001
	2000-2013	9	28,167	1.17 (0.91-1.50)	1.20 (0.97-1.48)	76%	<0.001
Region	Africa	2	18,265	1.47 (0.66-3.28)	1.33 (0.61-2.88)	80%	0.027
	America	4	9,811	1.05 (0.87-1.27)	1.08 (0.90-1.30)	54%	0.091
	Asia	7	24,366	1.16 (0.76-1.79)	1.18 (0.81-1.71)	86%	<0.001
	Europe	14	78,825	1.31 (0.82-2.08)	1.77 (1.31-2.38)	98%	<0.001
	Oceania	1	4,060	NA	NA		
Age group	Elderly-specific (≥ 60 -70 years)	3	6,619	0.94 (0.79-1.11)	0.95 (0.80-1.12)	0%	0.700
	Non-elderly-specific (< 60 -70 years)	13	84,658	1.27 (0.80-2.00)	1.64 (1.21-2.23)	98%	<0.001
	Others (all ages)	12	44,050	1.35 (1.07-1.71)	1.40 (1.15-1.70)	76%	<0.001
Quality score	≤ 9	22	77,492	1.34 (1.03-1.75)	1.45 (1.18-1.77)	91%	<0.001
	≥ 10 (max: 11)	6	57,835	1.20 (0.68-2.12)	1.45 (0.93-2.27)	99%	<0.001

OR, odds ratio; 95% CI, 95% confidence interval; NA, not applicable.

tice, even among specialist clinicians.¹¹⁵ We suggest that the discrepancy on cutoff duration needs to be resolved by prospective studies on the natural course of self-limiting cough and the characteristics of the minority of patients who go on to prolong chronic cough.

As another component, phlegm may need to be discussed. Productive cough could suggest a likelihood of cough associated with infection or smoking. However, it is difficult to quantify or characterize phlegm objectively in large-scale population surveys. Moreover, among chronic cough patients, the history of excessive sputum production did not indicate different natures of cough.¹¹³ In our unpublished data, the population-level correlations between current smoking and chronic cough prevalence did not significantly differ between chronic cough subjects with and without phlegm. Collectively, the informative value of classifying chronic cough as dry or productive may be questioned in epidemiological surveys.

Our meta-analysis found a slightly higher proportion of males than females, and a high level of heterogeneity in the sex ratio, among chronic cough subjects in the community. These findings were unexpected, as a homogeneous demographic profile was observed among chronic cough patients visiting specialist clinics, where two-thirds of patients were females.¹⁵ The female-predominant profiles of chronic cough patients are considered plausible, as females have enhanced cough responses to tussigen inhalation compared to males, irrespective of being cough patients or healthy controls.¹¹⁶⁻¹²⁰

With regard to this discrepancy between community and clinics, socioeconomic or individual factors need to be prospectively investigated first. These may include disease characteristics, health-seeking behaviours, or other non-medical factors.

Smoking may be one of these factors; smoking is more prevalent among males than among females (males $40.8\% \pm 13.3\%$ vs females $13.7\% \pm 17.7\%$ in the present data) and is correlated with chronic cough prevalence, but smokers are less likely to seek medical care for their health problems.¹²¹ Moreover, smoker's cough may be resolved by smoking cessation alone,¹¹⁴ also possibly leading to less medical attendance among them. Meanwhile, females have more frequent complications from cough, such as incontinence.¹²²

The discrepancy in sex-specific associations of chronic cough between community and clinics also leads to the speculation that the current duration-based definition does not easily differentiate clinically relevant cough from a protective cough response. As suggested by the cough-smoking correlations,^{2,34,37,53,55,75,78} chronic cough among smokers may be a protective response against irritant inhalation. However, chronic cough patients are frequently never smokers^{122,123} and have troublesome cough in response to various trivial triggers, such as cold air, singing/talking, or fatigue/stress,¹²³⁻¹²⁵ which represents a hypersensitive cough response. Thus, if we aim to identify subjects with chronic cough that is clinically relevant, we may need to add some components to detect this hypersensitivity. Conventional tussigen inhalation cough reflex tests have limited utility, as there is a significant overlap between chronic cough patients and normal controls.¹¹ It would be ideal to have an objective cough reflex test to define cough hypersensitivity for use in epidemiological surveys.

This study has several limitations. First, our meta-analysis of gender ratio included relatively few studies ($n=28$; 56%) and thus could not confirm the gender associations of chronic cough prevalence in the community populations. We attempted to

contact the corresponding authors by email, but could add sex-specific data in only a few cases. Second, the reasons for the heterogeneity in the pooled gender ratio were not clearly explained by our subgroup analyses. The heterogeneity may arise from the variability in the study designs, protocols, or demographic characteristics of included studies and participants. Among demographic factors, in particular, we suppose age and smoking could influence the gender ratio of chronic cough; however, the lack of available information did not allow us to perform meta-regression tests for smoking, or further subgroup analyses by age groups in detail.

Despite these limitations, this study has strength in that it is the first systematic review on the epidemiological definitions of chronic cough. We had no language restriction in retrieving the relevant publication from major databases, enabling the inclusion of non-English literature and the comprehensive review of existing definitions. Our meta-analysis had explorative nature for the reasons described above, but could identify the unexpected but clear heterogeneity and discrepancy in the gender preponderance between the community and clinics.

In conclusion, this study identified major issues for further epidemiological studies of chronic cough. First, cough ≥ 3 months' duration was the most common definition, but it conflicts with the criterion of current clinical guidelines (cough ≥ 8 weeks). Moreover, both criteria were determined by expert opinions rather than clinical evidence. Thus, we may need to develop objective evidence for defining chronicity in cough. Second, we found unexpected discrepancies in the demographic profiles of chronic cough subjects between the community and clinics. This discrepancy needs to be comprehensively explained in further prospective studies, but also may raise a question about the appropriateness of using a duration-based definition for identifying clinically relevant chronic cough.

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Appendix Table S1. Characteristics of 70 studies which reported the prevalence of chronic, longstanding, or persistent cough in general adult populations

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Comstock, 1981 [28]	US	1977	Random sample, residents of Washington County, Maryland	Chronic cough ("Do you usually cough like this on most days for 3 consecutive months or more during the year?")	≥ 20 years	Total 4,035	Total 23.8% Males 23.8% Females 24.0%
Lebowitz, 1982 [49]	US	1970	Random sample, the Tucson study	Chronic cough (cough on most days for at least 3 months of the year)	≥ 15 years	Males 1,976	19.5%
Samet, 1982 [68]	US	1979	Random sample with stratification by sex and ethnicity from the 1978 R. L. Polk Directory for Bernalillo County	Chronic cough (cough on most days for 3 consecutive months or more during the year)	all ages	Females 2,059	Total 10.5% Males 12.5% Females 8.7%
Schenker, 1982 [69]	US	1978	Random sample from telephone directories	Chronic cough (usual cough on most days for 3 consecutive months or more)	17-74 years	5,670	8.9%
Krzyzanowski, 1986 [45]	Poland	1968	Random sample, the longitudinal Cracow study (1968-1981)	Chronic cough (symptoms almost every day lasting at least 3 consecutive months a year for at least 2 years)	19-70 years	Total 2,887 Males 1,263 Females 1,624	Total 16.3% Males 23.4% Females 10.8%
Korn, 1987 [43]	US	1974	Random sample, the 6-Cities cohort	Chronic cough (usually coughs as much as 4 to 6 times per day, 4 or more days per week, for 3 months a year, for at least 3 years)	25-74 years	8,515	14.5%
Rijcken, 1987 [67]	Netherlands	1967-1969	Random sample, the Vlagtwedde/Vlaardingen 1967/1969 study	Chronic cough (cough on most days or nights for as long as 3 consecutive months each year during winter)	15-65 years	Total 1,607 Males 905 Females 702	Total 12.4% Males 15.8% Females 9.1%
Krzyzanowski, 1988 [44]	France	1975	Random sample, the French PAARC study, seven cities throughout France	Chronic cough (cough almost every day for 3 consecutive months every year)	25-59 years	Total 16,464 Males 8,692 Females 7,772	Total 8.8% Males 11.9% Females 5.2%
Viegi, 1988 [79]	Italy	1980-1982	Multistage stratified geographic cluster sample	Chronic cough (cough for as much as 3 months of the year for at least 2 years)	8-64 years	Total 3,289 Males 1,580 Females 1,709	Total 9.0% Males 13.7% Females 4.7%
Mensinga, 1990 [55]	Netherlands	1970-1972	Random sample, the Vlagtwedde/Vlaardingen 1970/1972 study	Chronic cough (cough on most days or nights for as long as 3 consecutive months each year during winter)	17-49 years	Total 2,805 Males 1,426 Females 1,379	Total 10.0% Males 13.3% Females 6.6%
Bakke, 1991 [21]	Norway	1985	Random sample, the Hordaland County cohort	Chronic cough ("Do you have cough for 3 months or more altogether during a year?")	15-70 years	4,469	13.1%
Brown, 1991 [23]	Scotland	1984-1987	Population sample from the Scottish Heart Health Study, Scotland mainland	Chronic cough (cough first thing in the morning and/or at any time during the day or night for as much as 3 months each year)	40-59 years	Total 10,359 Males 4,114 Females 5,220	Total 14.1% Males 16.4% Females 12.3%
Davydova, 1991 [30]	Russia	Not provided	Male sample (not specified)	Longterm cough (> 3 months per 2 years)	40-59 years	1,768	13.2%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Lundback, 1991 [52]	Sweden	1985	Postal survey, Norrbotten areas, northern Sweden	Longstanding cough ("Do you usually cough on most days for 3 consecutive months or more during the year?")	35-66 years	Total 5,698 Males 2,906 Females 2,792	Total 10.1% Males 9.5% Females 10.7%
Norboo, 1991 [60]	India	1987-1988	Contact all habitants of a Himalayan village	Chronic cough (either morning cough in winter, or daytime/night-time cough in winter or both were reported, and on most days for as much as 3 months each year)	≥ 20 years	Total 320 Males 154 Females 166	Total 34.7% Males 30.1% Females 38.0%
Tollerud, 1991 [75]	US	1984-1987	Random sample, the Normative Aging Study	Chronic cough (cough most days for 3 consecutive months or more during the year)	41-86 years	1,071	12.4%
Viegi, 1991 [78]	Italy	1980-1982 in Po Delta, and 1985-1988 in Pisa	Random sample	Chronic cough (cough for as much as 3 months of the year for at least 2 years)	8-64 years	6,206	10.3%
Cullinan, 1992 [29]	UK	1988-1989	General practice register sample	Chronic or persistent cough (Cough every day or on half the days of the year)	5-54 years	Total 9,077 Males 4,192 Females 4,885	Total 12.2% Males 14.1% Females 10.6%
Peat, 1992 [65]	Australia	1981 and 1990	Random sample, the Busseton study	Chronic cough (cough on the most mornings for at least 3 months of the year)	18-55 years	553	10.7% in 1981 13.1% in 1990
Xu, 1992 [85]	China	1986	Random sample, the Beijing Respiratory Health Study	Chronic cough (cough for 3 or more months of the year)	40-69 years	3,606	17.5%
Enright, 1994 [33]	US	1989-1990	Random sample, the Cardiovascular Health Study, four communities in US	Chronic cough (cough > 3 months)	≥ 65 years	Total 5,201 Males 2,219 Females 2,982	Total 9.2% Males 8.7% Females 9.2%
Lai, 1995 [47]	Hong Kong	1991-1992	Age-stratified random sample from a register of Hong Kong residents	Chronic cough with phlegm (cough up phlegm 3 consecutive months for 2 years)	≥ 70 years	Total 2,032 Males 997 Females 1,029	Total 10.0% Males 13.6% Females 6.4%
Matsuda, 1997 [54]	Vietnam	1995	Random sample	Chronic cough (cough for 3 or more months of the year)	mostly 20-50 years	368	6.0%
Yemaneberhan, 1997 [88]	Ethiopia	1996	Random sample, one urban and three rural areas	Chronic cough (cough for 3 months of the year)	all ages	Total 12,876 Males 9,844 Females 9,677	Total 1.5% Males 1.7% Females 0.9%
Dutu, 1998 [32]	Romania	1994	Random sample from Mihăești, Vâlcea (a rural population)	Chronic cough (<i>tusei cornice</i> in Romanian, cough that comes at most of the days or night for at least 3 consecutive months for the last 2 years)	≥ 18 years	Total 1,001 Males 439 Females 562	Total 12.3% Males 17.5% Females 8.2%
Nriagu, 1999 [62]	South Africa	not specified	Random sample	Chronic cough (chronic cough for at least 3 months during last 12 months)	not specified	1,060	33%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Sobradillo, 1999 [72]	Spain	1997	Random sample, the IBERPOC study, seven areas of Spain	Chronic cough (<i>tos habitual</i> in Spanish; cough for the last 3 months and usual cough in the morning)	40-69 years	Total 4,035 Males 1,976 Females 2,059	Total 13.5% Males 19.9% Females 7.4%
Zemp, 1999 [86]	Switzerland	1991	Random sample, the SAPALDIA study	Chronic cough ("Do you usually cough during the day, or night, on most days for as much as 3 months each year?" and answer of ≥ 2 to the question "For how many years have you coughed like this?")	18-60 years	9,651	5.2%
Cheng, 2001 [26]	Taiwan	1994	Two-stage random sample of paid employees	Chronic cough and phlegm (experience chronic cough with phlegm over the past 12 months)	25-65 years	Total 15,345 Males 9,746 Females 5,599	Total 10.9% Males 12.0% Females 9.1%
Lindström, 2001 [50]	Sweden and Finland	1995	Random sample, a part of the FinEsS study	Chronic productive cough ("Do you bring up phlegm when coughing on most days during periods of at least 3 months during at least 2 successive years?")	20-69 years	Total 13,737 Males 6,852 Females 6,885	Total 9.1% Males 9.6% Females 8.7%
Montnemery, 2001 [58]	Sweden	1992	Random sample, the OLIN study	Long-standing cough ("Have you had longstanding cough during the last years?")	20-59 years	8,469	12.5%
Venners, 2001 [77]	China	1999	Random sample, Beijing and Anqing	Chronic cough ("Do you always cough in the morning for 3 or more months during the winter?")	≥ 18 years	Total 3,709 Males 1,743 Females 1,996	Total 4.5% Males 5.7% Females 3.4%
Walraven, 2001 [81]	Gambia	1996-1997	Stratified cluster sample survey in random samples of one urban and one rural area	Chronic cough (cough for 3 months of the year)	≥ 15 years	Total 5,389 Males 2,228 Females 3,161	Total 1.0% Males 0.9% Females 1.0%
Huchon, 2002 [40]	France	2000	Small-scale model using 5 sample criteria; geographical area of residence, the type of habitat, the age of the index person, the profession and socioeconomic status, and the number of persons living in the household	Chronic cough ("Do you usually cough when you get up?", which occurs for ≥ 3 months a year for ≥ 2 consecutive years)	≥ 25 years	14,706	4.8%
Pallasaho, 2002 [64]	Sweden, Finland, and Estonia	1996	Random sample, the FinEsS study, Stockholm (Sweden), Helsinki (Finland), and Tallinn (Estonia)	Longstanding cough ("Do you usually cough on most days for 3 consecutive months or more during the year?")	20-64 years	Total 18,741 Males 8,160 Females 10,581	Total 20.3% Males 18.2% Females 22.0%
Turcic, 2002 [76]	Croatia	2000	Residents at senior home at Zagreb municipality	Chronic cough (cough lasting 3 months per year or more)	60-94 years	Total 622 Males 147 Females 475	Total 30.4% Males 31.3% Females 30.1%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Zhang, 2002 [87]	China	1999-2000	Random sample	Chronic cough ("Do you usually have cough first thing in the morning or during the day?" and "Do you cough like this for as much as 3 months each year?")	≥ 15 years	22,528	1.9%
Cerveri, 2003 [24]	Italy	1998-2000	Random sample, the ISAYA study	Chronic cough and phlegm ("Have you had cough and phlegm on most days for as much as 3 months per year and for at least 2 successive years?")	20-44 years	Total 18,645 Males 9,192 Females 9,453	Total 11.9% Males 11.8% Females 12.0%
Omenaas, 2003 [63]	Norway	1991	Random sample, the ECRHS phase I study	Chronic cough (Do you have cough for 3 months or more altogether during a year)	20-44 years	3224	9%
Kumar, 2004 [46]	India	1999-2001	Random cluster sample, one urban and one rural town in Punjab State	Chronic cough (cough day/night for > 3 months)	> 15 years	Total 3,603 Males 2,013 Females 1,590	Total 5.7% Males 6.4% Females 4.8%
Shin, 2004 [70]	Korea	2001	Random sample, the Korean Health and Genome study, Ansan and Ansung	Chronic cough ("Have you had cough on most days for as much as 3 months per year and for at least 2 successive years?")	40-69 years	Total 8,140 Males 3,806 Females 4,334	Total 3.7% Males 3.2% Females 4.1%
Wang, 2004 [82]	China	not specified	Region-stratified random sample	Chronic cough (cough more than once a week on average in the past year)	18-70 years	2,532	12.8%
Iversen, 2005 [41]	Scotland	2001-2002	Random sample	Chronic or persistent cough (cough for at least 3 months of the year)	mean 52 years	2,596	19.1%
Skorge, 2005 [71]	Norway	1996	Random sample, the Hordaland Study	Chronic cough ("Do you have a cough for 3 months or more altogether during a year?")	26-82 years	2,401	12.6%
Amigo, 2006 [20]	Chile	2000	Random sample, a semirural area in Limache	Persistent cough in the last 12 months ("Do you usually cough during the day, or at night, in the winter?" and "Do you cough like this on most days for as much as 3 months each year?")	22-28 years	Total 1,232 Males 559 Females 673	Total 27.5% Males 28.4% Females 26.7%
Chen, 2006 [25]	China	2004	Cluster randomized sample from college students	Chronic cough (cough presenting as a sole or predominant symptom lasting for > 3 weeks without abnormal X ray)	mean age 21.2 years	Total 1,087 Males 648 Females 439	Total 3.3% Males 3.4% Females 3.2%
Ford, 2006 [34]	UK	2003	Random sample from 36 general practice databases, the H. pylori screening and treatment program	Chronic cough (coughing bouts more frequent than weekly in the previous 2 months)	40-49 years	Total 3,883 Males 1,704 Females 2,179	Total 12.0% Males 11.4% Females 13.2%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Hamzaçebi, 2006 [37]	Turkey	2002	Random sample, inhabitants of Samsun	Chronic cough ("Have you had on most days for as much as 3 months per year and for at least 2 successive years?")	15-85 years	Total 1,916 Males 810 Females 1,106	Total 10.6% Males 12.9% Females 9.0%
Jaén, 2006 [42]	Spain	1993-1994	Random sample, an urban area of Catalonia	Chronic cough (cough most of the days at least 3 months a year during 2 consecutive years)	20-70 years	Total 576 Males 280 Females 296	Total 16.1% Males 24.6% Females 8.1%
Nordenstedt, 2006 [61]	Norway	1995-1997	1995-1997 Random sample, Nord-Trøndelag Health Survey (HUNT)-2	Chronic cough (daily productive cough for more than 3 months during the past 2 years)	19-101 years	58,596	14.8%
Purty, 2006 [66]	India	2002	Simple random sample	Chronic cough (not specified)	≥ 60 years	320	11.3%
Chhabra, 2008 [27]	India	2005	All the residents of the upper middle class	Chronic cough (cough on most days for 3 consecutive months or more during the year for the past 2 years or more)	> 18 years	Total 3,465 Males 1,756 Females 1,709	Total 2.0% Males 2.0% Females 2.0%
Mossakowska, 2008 [59]	Poland	2002	Direct contact, the Polish Centenarians Program	Chronic cough (not specified)	≥ 100 years	Total 301 Males 43 Females 258	Total 13.0% Males 25.6% Females 10.9%
Wilson, 2008 [84]	China	2002	Random sample	Persistent cough (cough, with or without a cold, 4 days a week, for 3 months of the year for ≥ 1 year)	mean age 47.7 years	31,704	2.3%
Adams, 2009 [19]	Australia	2002-2004	Random sample, the North West Adelaide Health Study	Chronic cough (cough reported on most/every day in the past 3 months)	≥ 18 years	Total 3,960 Males 1,988 Females 2,072	Total 18.2% Males 18.5% Females 16.0%
Lötvall, 2009 [51]	Sweden	2008	Random postal survey, the West Sweden Asthma Study	Longstanding cough ("Have you had a persisting cough during the last year?")	16-76 years	Total 18,087 Males 8,190 Females 9,897	Total 11.4% Males 10.2% Females 12.4%
Hersoug, 2010 [39]	Denmark	2006-2008	Random sample, the Health2006 study	Chronic cough ("Have you had coughing most days or nights?" and "Have you coughed this way for a minimum of 3 months in a year and for at least 2 successive years?")	18-69 years	3,471	15.6%
Songür, 2010 [74]	Turkey	2007	Recruitment by fliers	Chronic dry cough (cough occurring on most days for at least 3 months, lasting for more than 2 consecutive years)	44-61 years	1,082	7.3%
Voll-Aanerud, 2010 [80]	Europe	1998-2002	Random sample, the ECRHS phase II study	Random sample, the ECRHS phase II study	28-56 years	6,009	6.8%
Desalu, 2011 [31]	Nigeria	2009	Random sample	Chronic cough (cough > 8 weeks in the previous 12 months)	mean age 33.9 years	Total 472 Males 238 Females 234	Total 1.1% Males 0% Females 2.1%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Hazenkamp-von Arx, 2011 [38]	Switzerland	2005	Random sample	Chronic cough (cough occurring on most days for at least 3 months, lasting for more than 2 consecutive years)	15-70 years	1,581	5.8%
Lam, 2011 [48]	Vietnam	2007-2008	Random sample	Longstanding cough ("Have you had longstanding cough during the last years?")	21-70 years	Total 5,782 Males 2,854 Females 2,928	Total 15.9% Males 15.8% Females 15.9%
Mahesh, 2011 [53]	India	2006-2009	2006-2009 Random sample, Mysore district	Chronic cough ("Do you cough on most days for as much as 3 months each year?")	≥ 30 years	Total 4,333 Males 2,322 Females 2,011	Total 2.5% Males 3.6% Females 1.2%
Milenkovic, 2011 [56]	Serbia	2003	Random sample	Longstanding cough ("Have you had problems with prolonged cough over recent years?")	20-80 years	Total 5,079 Males 2,466 Females 2,613	Total 32.2% Males 28.9% Females 35.1%
Wang, 2011 [83]	China	2008	Random cluster sample	Persistent cough ("Do you usually have a cough?" and "Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?" and "Do you usually cough like this on most days for 3 consecutive months or more during the year?")	mainly 30-39 years	7,614	1.5%
Bende, 2012 [22]	Sweden	2001	Random sample, the Skövde survey	Chronic cough ("Are you bothered by cough daily or frequently?")	≥ 20 years	Total 1,387 Males 667 Females 719	Total 6.3% Males 4.8% Females 7.6%
Fujimura, 2012 [35]	Japan	2011	Randomly selected email addresses	Chronic cough ("At present, do you have cough?" and "How long have the symptoms lasted?"; 8 weeks or longer)	≥ 16 years	Total 1,000 Males 6,460 Females 4,045	Total 2.2% Males 2.6% Females 1.5%
Gundersen, 2012 [36]	Norway	1997-1999	1997-1999 Invitations to all the habitants, the Hordaland Health Study	Chronic cough ("Have you had daily cough as long as a period of 3 months in both last years?")	40-45 years	Total 9,740 Males 4,595 Females 5,255	Total 9.9% Males 9.8% Females 9.9%
Mirabelli, 2012 [57]	US	1987-1989	Random sample, the ARIC study	Chronic cough ("Do you usually cough as much as four to six times a day, four or more days out of the week?")	45-64 years	Total 15,273 Males 6,833 Females 8,440	Total 9.7% Males 10.4% Females 9.1%
Song, 2013 [73]	Korea	2005-2006	Random sample, the KLoSHA study	Chronic persistent cough ("Do you usually cough as much as four to six times a day, four or more days a week?", and "Do you usually cough like this on most days for 3 consecutive months or more during the year?")	≥ 65 years	Total 796 Males 352 Females 444	Total 4.6% Males 4.0% Females 5.2%

Appendix Table S2. Characteristics of 19 studies excluded due to definition issues

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Dutu, 1980 [95]	Romania	1970-1980	Inhabitants of Bucarest district which undertook regular medical examination of respiratory and cardiovascular functions over the last 10 years	Chronic bronchitis (cough for 3 consecutive months per year during the cold season in at least the last 10 years)	60-85 years	Total 751 Males 374 Females 377	Total 16.0% Males 21.9% Females 11.9%
Wicht, 1981 [107]	South Africa	Not provided	Random sequential sample based on Belville's voters list, being a representative sample of the white adult population of Belville	"Do you usually cough like this on most days for 3 consecutive months or more during the year?"	≥ 18 years	Total 504 Males 271 Females 234	Total 8.1% Males 12.2% Females 3.4%
Pertuze, 1986 [104]	Chile	1979	Census sample of a subpopulation in Rancagua province	Chronic bronchitis (cough and phlegm for 3 months of the year for 2 successive years)	> 14 years (mean 35.7)	Total 549 Males 224 Females 325	Total 21.9% Males 22.3% Females 21.5%
Burr, 1987 [90]	UK	not specified	Random sample	Cough (cough on most days for as much as 3 months each year)	65-74 years	513	27.3%
Littlejohns, 1989 [103]	UK	not specified	General practice register sample	Chronic bronchitis (cough and phlegm for 3 months of the year for 2 successive years)	40-70 years	Total 1,444 Males 635 Females 809	Total 11.3% Males 16.7% Females 7.2%
Grievink, 1998 [100]	Netherlands	1994-1995	Random sample, the MORGEN study	Cough ("Do you cough when getting up during winter time on most days for at least 3 months a year?")	20-59 years	6,555	6.8%
Cetinkaya, 2000 [91]	Turkey	1996	Random sample	Chronic bronchitis (presence of cough and phlegm on most days during at least three months per year for at least two previous years)	20-83 years	Total 1,023 Males 461 Females 562	Total 13.5% Males 17.8% Females 10.0%
von Hertzen, 2000 [105]	Finland	1978-1980	Two-stage stratified cluster sample, the Mini-Finland Health Survey	Chronic bronchitis (cough with phlegm production on most days for at least 3 months a year during at least 2 consecutive years)	≥ 30 years	Total 7,217 Males 3,322 Females 3,895	Total 10.5% Males 15.7% Females 6.1%
Coultas, 2001 [92]	US	1988-1994	Probability sampling, the NHANES III study	Cough ("Have you had a cough most days for 3 or more consecutive months per year?")	≥ 45 years	5,743	10.8%
Golshan, 2002 [99]	Iran	2000	Random sample	Chronic bronchitis (history of chronic productive cough for at least three months a year in the last two years)	1-81 years	561	3.4%
Jakeways, 2003 [101]	UK	1991	Random sample	Cough ≥ 3 months ("Do you usually cough during the day, or at night, during the winter", and "do you usually cough like this for as much as 3 months of the year?")	18-70 years	2,633	9.3%

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Appendix Table S2. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Ehrlich, 2004 [96]	South Africa	1998	Random sample, the South African Demographic and Health Survey	Chronic bronchitis (usual cough with phlegm every day for at least 3 months a year for at least 2 successive years)	≥ 15 years	Total 13,826 Males 5,649 Females 8,073	Total 2.7% Males 2.5% Females 2.9%
Frostad, 2006 [98]	Norway	1972	Random sample	Cold-induced long-lasting cough and phlegm ("During the last 2 years, have you had a cough and/or phlegm in connection with a cold for more than 3 weeks?")	15-70 years	Total 17,678 Males 8,147 Females 9,531	Total 21.6% Males 20.9% Females 22.1%
Ko, 2006 [102]	Hong Kong	2003-2004	Age-stratified random sample from a register of Hong Kong residents	Cough up phlegm 3 consecutive months for 2 years	≥ 70 years	1,524	10.5%
Desalu, 2010 [94]	Nigeria	2005-2006	Random sample	Dry cough [1] answering "yes" to the question "Do you usually cough, either during the day or at night?" and 2) answering "no" or "not sure" to the question "Do you usually cough up phlegm from your chest, either during the day, at night or first thing in the morning?" and then answering "no" to the question "Do you cough up phlegm like this on most days for as much as three months each year?"]	20-44 years	498	9.6%
Freitas, 2011 [97]	Brasil	2009	Cluster sample from in 3 administrative regions in Distrito Federal	Cough ≥ 3 weeks (at least 3 weeks with productive cough as of the date of the interview)	≥ 15 years	629	5.4%
de Oca, 2012 [93]	South America	2002	Two-stage cluster sample, the PLATINO study	Chronic bronchitis (cough and phlegm on most days > 3 months for 2 years)	≥ 40 years	5,571	3.2%
Accordini, 2013 [89]	Italy	2007-2010	Random sample, the GEIRD study	Chronic bronchitis (cough and sputum on most days for a minimum of 3 months a year and for at least 2 successive years)	20-44 years	Total 18,873 Males 5,006 Females 5,488	Total 12.6% Males 12.6% Females 12.7%
Wheaton, 2013 [106]	US	2007-2010	Stratified, multistage probability sample, the NHANES 2007-2010 study	Frequent cough (usually cough on most days for 3 consecutive months or more during the year)	40-79 years	Total 5,139 Males 2,572 Females 2,567	Total 10.4% Males 10.5% Females 10.3%

Appendix Table S3. Summary of research purpose and assessed quality of 70 included studies*

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Comstock, 1981 [28]	To evaluate the effects of exposure at home to tobacco smoke by other household members and to fumes from the use of gas as a cooking fuel on respiratory symptoms and ventilatory functions	1	1	2	3	1	1	9
Lebowitz, 1982 [49]	To investigate the relationship of risk factors and respiratory symptoms in a white community population	1	1	2	3	1	1	9
Samet, 1982 [68]	To characterize the epidemiologic feature of respiratory diseases among Hispanics	0	1	2	3	1	1	9
Schenker, 1982 [69]	To analyze the relationships between cigarette tar content, smoking habits, and respiratory symptoms in women	1	1	2	3	1	1	9
Krzyzanowski, 1986 [45]	To study the relation of mortality to ventilatory functions and respiratory symptoms during a 13-year follow up period	1	1	2	3	1	1	9
Korn, 1987 [43]	To examine the relationships between occupational exposure to dust/gases/fumes and chronic respiratory symptoms	1	1	2	3	2	1	10
Rijcken, 1987 [67]	To study the relationship of airway responsiveness to respiratory symptom prevalence	1	1	2	3	1	1	9
Viegi, 1988 [79]	To analyze the relationships of respiratory symptoms with sex, age, smoking habit and socioeconomic status in an unpolluted area of Northern Italy	1	1	2	3	1	1	9
Krzyzanowski, 1988 [44]	To assess the effect moderate occupational exposure to dust, gases or chemical fumes on the prevalence of respiratory symptoms and ventilatory function	1	1	2	3	2	1	10
Mensinga, 1990 [55]	To study the relationships of the prevalence of respiratory symptoms with skin test reactivity or blood eosinophilia	1	1	2	3	1	1	9
Bakke, 1991 [21]	To examine the relationship of occupational airborne exposure to respiratory symptoms and asthma	1	1	2	3	1	1	9
Brown, 1991 [23]	To examine the relationships of chronic cough and chronic phlegm with smoking history	1	1	2	3	1	1	10
Davydova, 1991 [30]	To elucidate the role of short-term and long-term cough in prediction and diagnosis of chronic bronchitis	1	0	2	0	1	0	4
Lundback, 1991 [52]	To assess the prevalence of respiratory symptoms and their relationship to demographic data in adults living in Norrbotten, northern Sweden	1	1	2	3	1	1	9
Norboo, 1991 [60]	To investigate the prevalence of respiratory illness, and to study the relationships with the level of domestic pollution in a Himalayan village	0	1	2	3	0	1	7
Tollerud, 1991 [75]	To investigate the relationships of atopy markers to the prevalence of respiratory symptoms in middle-aged or older men	1	1	2	3	0	1	8
Viegi, 1991 [78]	To report prevalence rates of respiratory symptoms, diseases, and risk factors in two Italian general population samples exposed to different levels of air pollution	1	1	2	3	2	1	10
Cullinan, 1992 [29]	To measure the prevalence of persistent cough and sputum in south east England	1	0	2	3	1	1	8
Peat, 1992 [65]	To estimate whether the prevalence of asthma in adults increased over a nine year interval	1	1	2	3	1	1	9
Xu, 1992 [85]	To investigate the association of occupational dust/gas/fume exposures with chronic respiratory symptoms and pulmonary functions in Beijing	1	1	2	3	1	1	9
Enright, 1994 [33]	To examine the prevalence and the correlates of major respiratory symptoms and lung diseases in the elderly	1	1	2	3	2	1	10
Lai, 1995 [47]	To investigate the prevalence of respiratory symptoms and diseases in the elderly	1	0	2	3	1	1	8
Matsuda, 1997 [54]	To investigate the relationship between occupational exposure to dust/chemicals and chronic respiratory symptoms in Vietnam	1	1	2	3	0	1	8

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Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Yemaneberhan, 1997 [88]	To investigate the role of environmental factors leading to the differences in the prevalence of wheeze and asthma between urban and rural areas	1	1	2	3	1	1	9
Dutu, 1998 [32]	To determine the prevalence of respiratory symptoms of asthma and chronic bronchitis	1	1	2	3	1	1	9
Nriagu, 1999 [62]	To determine the prevalence of asthma and respiratory symptoms among the childhood and adult population in a heavily-polluted urban area of Durban, South Africa	0	1	2	3	0	1	7
Sobradillo, 1999 [72]	To estimate the prevalence of chronic respiratory symptoms and chronic airflow limitation in 7 areas of Spain	1	1	2	3	2	1	10
Zemp, 1999 [86]	To investigate the association between long-term ambient pollution exposure and respiratory symptoms	1	1	2	3	2	1	10
Cheng, 2001 [26]	To examine the prevalence of job stress, and their associations with health complaints in Taiwan	0	0	2	3	0	1	6
Lindstrom, 2001 [50]	To study the influence of different smoking categories on prevalence of respiratory symptoms and chronic bronchitis in Northern Sweden and Northern Finland	1	0	2	3	1	1	8
Montnemery, 2001 [58]	To test whether living environment, occupation and social position are risk factors for asthma and chronic bronchitis/emphysema	1	0	2	3	1	1	8
Venners, 2001 [77]	To evaluate established environmental determinants of respiratory health, chronic indoor exposures to SO ₂ and PM ₁₀ and respiratory health status in three areas of China: a large city, a small city, and a rural agricultural region	1	1	2	3	1	1	9
Walraven, 2001 [81]	To compare the prevalence of asthma, smoking and chronic cough in rural and urban Gambia	1	1	2	3	1	1	9
Huchon, 2002 [40]	To determine the prevalence of chronic bronchitis in the French adult population, to identify the role of known risk factors for chronic bronchitis, and to assess rates of chronic bronchitis diagnosis and lung function evaluation in patients with chronic bronchitis	0	1	2	3	2	1	9
Pallasaho, 2002 [64]	To assess whether differences exist in prevalence of asthma, chronic bronchitis, and respiratory symptoms between three Baltic capitals, and to examine risk factor profiles for respiratory conditions	1	1	2	3	2	1	10
Turcic, 2002 [76]	To study the prevalence of respiratory symptoms and diseases in older subjects, and its relationships to residence place, occupation and smoking history	0	1	1	3	0	1	6
Zhang, 2002 [87]	To determine the effects of occupational and environmental exposure on respiratory symptoms in adults in rural Beijing	0	1	2	3	1	1	8
Cerveri, 2003 [24]	To assess the prevalence of chronic cough and phlegm and to evaluate clinical characteristics and risk factors in young adults	1	0	2	3	2	1	9
Omenaas, 2003 [63]	To investigate whether dietary vitamin C intake is related to self-reported respiratory symptoms in young adults of a community	1	1	2	3	1	1	9
Kumar, 2004 [46]	To study the association of outdoor air pollution with chronic respiratory morbidity in Punjab, India	1	1	2	3	1	1	9
Shin, 2004 [70]	To examine the prevalence of undiagnosed airflow obstruction and its relation with respiratory symptoms in middle-age adults in Korea	1	1	2	3	1	1	9
Wang, 2004 [82]	To understand the epidemiology of symptomatic gastroesophageal reflux and to explore their risk factors	0	0	2	3	1	1	7
Iversen, 2005 [41]	To investigate the epidemiology of chronic respiratory diseases in Scotland, and to explore the relationship between quality of life and geographic location in those reporting disease	1	1	2	3	2	1	10
Skorge, 2005 [71]	To investigate the impact of indoor exposures on respiratory symptoms	1	1	2	3	1	1	9

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Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Amigo, 2006 [20]	To assess the associations between smoking and respiratory symptoms, lung function and bronchial hyperresponsiveness in young adults in Chile	1	1	2	3	1	1	9
Chen, 2006 [25]	To study the prevalence of cough and its risk factors in young college students in Guangzhou	1	0	2	3	0	1	7
Ford, 2006 [34]	To explore the relationship between cough and various risk factors including gastrointestinal diseases	1	0	2	3	1	2	9
Hamzacebi, 2006 [37]	To determine the prevalence of asthma and asthmatic symptoms and the relationships with age, gender and smoking behavior in Turkish adults living in Samsun	1	1	2	3	1	1	9
Jaén, 2006 [42]	To assess the association between lifetime occupational exposures and airflow obstruction	1	1	2	3	1	1	9
Nordenstedt, 2006 [61]	To investigate the relation between respiratory and reflux symptoms	1	1	2	3	1	1	9
Purty, 2006 [66]	To assess present morbidity pattern of rural elderly persons in India	1	0	2	3	0	0	6
Chhabra, 2008 [27]	To study the prevalence of respiratory morbidity and its associated factors in urban Delhi	0	1	2	3	0	1	7
Mossakowska, 2008 [59]	To assess the prevalence of asthma, allergy, and respiratory symptoms in the Polish centenarians	1	0	2	3	0	1	7
Wilson, 2008 [84]	To assess the prevalence of respiratory symptoms in relation to personal, occupational, and environmental risk factors in a heavy-industry area in China	1	1	2	3	1	1	9
Adams, 2009 [19]	To determine the prevalence of chronic cough that is not associated with diagnosed respiratory conditions, and to examine the impact on physical and mental health problems	1	1	2	3	1	2	10
Lötvall, 2009 [51]	To investigate the changes in asthma prevalence over the last 18 years	1	0	2	3	1	1	8
Hersoug, 2010 [39]	To investigate the associations between indoor particulate matter exposure and lower airway symptoms	1	1	2	3	1	1	9
Songur, 2010 [74]	To investigate the influence of reproductive factors on chronic respiratory symptoms and pulmonary function in premenopausal and postmenopausal women	0	1	2	3	0	1	7
Voll-Aanerud, 2010 [80]	To describe the association of respiratory symptoms with health-related quality of life	1	1	2	3	2	1	10
Desalu, 2011 [31]	To determine the prevalence of cough in an urban adult community population in Nigeria	1	1	2	3	1	1	9
Freitas, 2011 [97]	To estimate the prevalence of respiratory symptoms in 3 administrative regions in Distrito Federal, Brazil	1	1	2	3	1	2	10
Hazenkamp-von Arx, 2011 [38]	To investigate the impact of traffic exhaust on respiratory symptoms among adults living along a Swiss alpine highway corridor	1	1	2	3	1	1	9
Lam, 2011 [48]	To assess the prevalence of respiratory symptoms and their relation with demographic data among adults in rural and urban Vietnam	1	0	2	3	1	1	8
Mahesh, 2011 [53]	To estimate the prevalence of chronic cough and phlegm and to study their associated factors in Mysore district, India	1	1	2	3	1	1	9
Milenkovic, 2011 [56]	To estimate the prevalence of respiratory symptoms among adults in Belgrade, Serbia	1	0	2	3	1	1	8
Mirabelli, 2012 [57]	To examine associations between respiratory symptoms and occupation	1	0	2	3	1	1	8
Wang, 2011 [83]	To investigate the long-term effects of air pollution on prevalence of respiratory symptoms in adults in Beijing	0	1	2	3	1	1	8
Bende, 2012 [22]	Is chronic cough related to upper airway symptoms or other explanatory variables?	1	0	2	3	1	2	9
Fujimura, 2012 [35]	To investigate the incidence of cough in the general population in Japan	0	0	2	3	0	2	7

(Continued to the next page)

Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Gundersen, 2012 [36]	To evaluate the prevalence of respiratory symptoms among adults residing in low outdoor air pollution areas	1	1	2	3	1	1	9
Song, 2013 [73]	To investigate the epidemiology of cough in the elderly, particularly in relation with their comorbidity	1	1	2	3	1	1	9

*Quality scoring and index were calculated using the following criteria¹⁴; Q1. Were the target population and the observation period well defined? Yes=1, No=0; Q2. Diagnostic criteria, Use of diagnostic system reported (DSM, ICD, RDC)=1, Own system/symptoms described/no system/not specified=0; Q3. Method of case ascertainment, Community survey/multiple institutions=2, Inpatient/inpatients and outpatients/case registers=1, Not specified=0; Q4. Administration of measurement protocol, Administered interview=3, Systematic casenote review=2, Chart diagnosis/case records=1, Not specified=0; Q5. Catchment Area, Broadly representative (national or multi-site survey)=2, Small area/not representative (single community, single university)=1, Convenience sampling/ other (primary care sample/treatment group)=0; Q6. Prevalence measure, Point prevalence (e.g. one month)=2, 12-month prevalence=1, Lifetime prevalence=0.

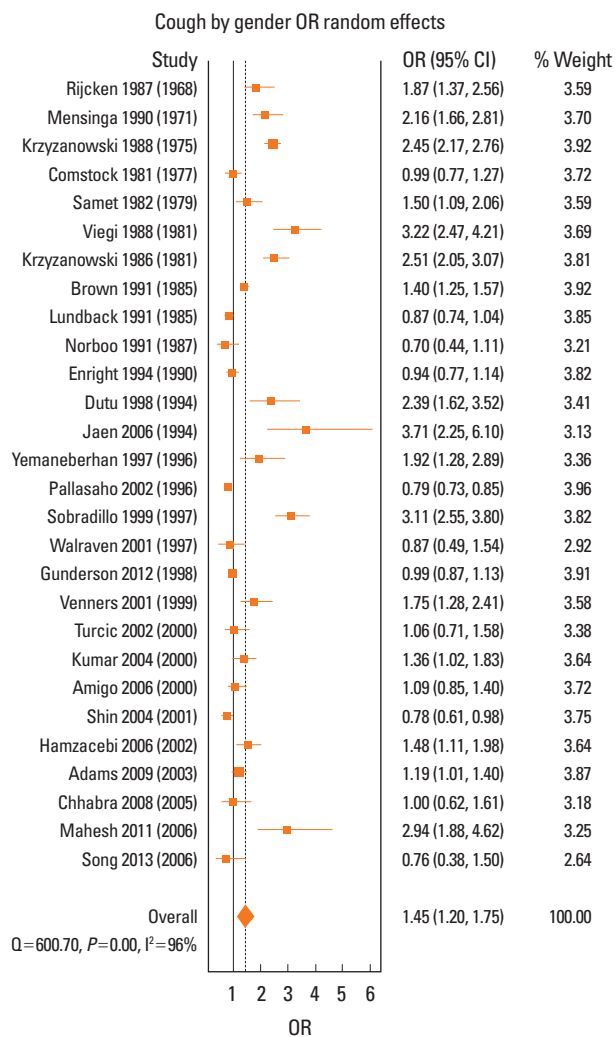
Appendix Table S4. Classification of definitions according to terminology and question among 70 epidemiological studies for chronic cough

Terminology	Cut-off duration	Text excerpts regarding the definition in specific publications (reference)
Chronic cough	Cough ≥ 3 months (n=46)	"Do you usually cough like this [as much as 4 to 6 times per day, 4 or more days per week], on most days for 3 consecutive months or more during the year?"^{19,21,28,33,41,44,46,49,53,54,68,69,71,73,75,76,81,85,88} "Do you usually have cough first thing in the morning or during the day?" and "Do you cough like this for as much as 3 months each year?"^{23,65,72,87} "Do you usually cough on most days or nights for as long as 3 consecutive months each year during winter?"^{55,60,67,77,80} "Do you usually cough like this on most days for 3 consecutive months a year for at least 2 years?"^{27,32,36-39,42,45,63,74,78,79,86} "Do you usually cough when you get up?", which occurs for ≥ 3 months a year for ≥ 2 consecutive years^{40,70} "Do you usually cough like this on most days for 3 consecutive months a year for at least 3 years?"⁴³ Chronic cough for at least 3 months during last 12 months⁶² Daily productive cough for more than 3 months during the past 2 years⁶¹
	Cough ≥ 8 weeks (n=3)	Coughing bouts more frequent than weekly in the previous 2 months³⁴ Cough >8 weeks in the previous 12 months³¹ "At present, do you have cough?" and "How long have the symptoms lasted?"; 8 weeks or longer³⁵
	Cough ≥ 3 weeks (n=1)	Cough presenting as a sole or predominant symptom lasting for >3 weeks without abnormal X ray ²⁵
	No specific duration (n=6)	Cough every day or on half the days of the year²⁹ Cough more than once a week on average in the past year⁸² "Are you bothered by cough daily or frequently?"²² "Do you usually cough as much as four to six times a day, four or more days out of the week?"⁵⁷ Not specified definition^{59,66}
Chronic cough with phlegm, or chronic productive cough	Cough ≥ 3 months (n=3)	"Do you bring up phlegm when coughing on most days during periods of at least 3 months during at least 2 successive years?"^{47,50} "Have you had cough and phlegm on most days for as much as 3 months per year and for at least 2 successive years?"²⁴
	No specific duration (n=1)	Experienced chronic cough with phlegm over the past 12 months ²⁶
Longstanding cough	Longstanding cough	"Do you usually cough like this [as much as 4 to 6 times per day, 4 or more days per week], on most days for 3 consecutive months or more during the year?" ^{52,64}
	No specific duration (n=3)	"Have you had a persisting cough during the last year?"⁵¹ "Have you had longstanding cough during the last years?"⁴⁸ "Have you had problems with prolonged cough over recent years?"⁵⁶
Longterm cough	Cough ≥ 3 months (n=1)	"Do you usually cough like this on most days for 3 consecutive months a year for at least 2 years?" ³⁰
	No specific duration (n=1)	"Have you had long-standing cough during the last years?" ⁵⁸
Persistent cough	Cough ≥ 3 months (n=3)	"Do you usually cough during the day, or at night, in the winter?" and "Do you cough like this on most days for as much as 3 months each year?"²⁰ "Do you usually have a cough?" and "Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?" and "Do you usually cough like this on most days for 3 consecutive months or more during the year?"⁸³ Cough, with or without a cold, 4 days a week, for 3 months of the year for ≥ 1 year⁸⁴

Appendix Table S5. PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	P1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	P3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	P3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NA
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	P4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	P4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	P4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	P4-5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	P5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	P5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	P5 (quality score and weighting)
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	P5-6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	P5-6

Appendix Fig. S1. Forest plots for male-to-female ratio in 28 epidemiological studies using a 'cough ≥ 3 months' definition and random effects model. Study name indicates the first author and publication year, and they were ordered according to the study year (the number within the parenthesis). OR, odds ratio; 95% CI, 95% confidence interval.



Appendix Table S1. Characteristics of 70 studies which reported the prevalence of chronic, longstanding, or persistent cough in general adult populations

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Comstock, 1981 [28]	US	1977	Random sample, residents of Washington County, Maryland	Chronic cough ("Do you usually cough like this on most days for 3 consecutive months or more during the year?")	≥ 20 years	Total 4,035	Total 23.8% Males 23.8% Females 24.0%
Lebowitz, 1982 [49]	US	1970	Random sample, the Tucson study	Chronic cough (cough on most days for at least 3 months of the year)	≥ 15 years	Males 1,976	19.5%
Samet, 1982 [68]	US	1979	Random sample with stratification by sex and ethnicity from the 1978 R. L. Polk Directory for Bernalillo County	Chronic cough (cough on most days for 3 consecutive months or more during the year)	all ages	Females 2,059	Total 10.5% Males 12.5% Females 8.7%
Schenker, 1982 [69]	US	1978	Random sample from telephone directories	Chronic cough (usual cough on most days for 3 consecutive months or more)	17-74 years	5,670	8.9%
Krzyzanowski, 1986 [45]	Poland	1968	Random sample, the longitudinal Cracow study (1968-1981)	Chronic cough (symptoms almost every day lasting at least 3 consecutive months a year for at least 2 years)	19-70 years	Total 2,887 Males 1,263 Females 1,624	Total 16.3% Males 23.4% Females 10.8%
Korn, 1987 [43]	US	1974	Random sample, the 6-Cities cohort	Chronic cough (usually coughs as much as 4 to 6 times per day, 4 or more days per week, for 3 months a year, for at least 3 years)	25-74 years	8,515	14.5%
Rijcken, 1987 [67]	Netherlands	1967-1969	Random sample, the Vlagtwedde/Vlaardingen 1967/1969 study	Chronic cough (cough on most days or nights for as long as 3 consecutive months each year during winter)	15-65 years	Total 1,607 Males 905 Females 702	Total 12.4% Males 15.8% Females 9.1%
Krzyzanowski, 1988 [44]	France	1975	Random sample, the French PAARC study, seven cities throughout France	Chronic cough (cough almost every day for 3 consecutive months every year)	25-59 years	Total 16,464 Males 8,692 Females 7,772	Total 8.8% Males 11.9% Females 5.2%
Viegi, 1988 [79]	Italy	1980-1982	Multistage stratified geographic cluster sample	Chronic cough (cough for as much as 3 months of the year for at least 2 years)	8-64 years	Total 3,289 Males 1,580 Females 1,709	Total 9.0% Males 13.7% Females 4.7%
Mensinga, 1990 [55]	Netherlands	1970-1972	Random sample, the Vlagtwedde/Vlaardingen 1970/1972 study	Chronic cough (cough on most days or nights for as long as 3 consecutive months each year during winter)	17-49 years	Total 2,805 Males 1,426 Females 1,379	Total 10.0% Males 13.3% Females 6.6%
Bakke, 1991 [21]	Norway	1985	Random sample, the Hordaland County cohort	Chronic cough ("Do you have cough for 3 months or more altogether during a year?")	15-70 years	4,469	13.1%
Brown, 1991 [23]	Scotland	1984-1987	Population sample from the Scottish Heart Health Study, Scotland mainland	Chronic cough (cough first thing in the morning and/or at any time during the day or night for as much as 3 months each year)	40-59 years	Total 10,359 Males 4,114 Females 5,220	Total 14.1% Males 16.4% Females 12.3%
Davydova, 1991 [30]	Russia	Not provided	Male sample (not specified)	Longterm cough (> 3 months per 2 years)	40-59 years	1,768	13.2%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Lundback, 1991 [52]	Sweden	1985	Postal survey, Norrbotten areas, northern Sweden	Longstanding cough ("Do you usually cough on most days for 3 consecutive months or more during the year?")	35-66 years	Total 5,698 Males 2,906 Females 2,792	Total 10.1% Males 9.5% Females 10.7%
Norboo, 1991 [60]	India	1987-1988	Contact all habitants of a Himalayan village	Chronic cough (either morning cough in winter, or daytime/night-time cough in winter or both were reported, and on most days for as much as 3 months each year)	≥ 20 years	Total 320 Males 154 Females 166	Total 34.7% Males 30.1% Females 38.0%
Tollerud, 1991 [75]	US	1984-1987	Random sample, the Normative Aging Study	Chronic cough (cough most days for 3 consecutive months or more during the year)	41-86 years	1,071	12.4%
Viegi, 1991 [78]	Italy	1980-1982 in Po Delta, and 1985-1988 in Pisa	Random sample	Chronic cough (cough for as much as 3 months of the year for at least 2 years)	8-64 years	6,206	10.3%
Cullinan, 1992 [29]	UK	1988-1989	General practice register sample	Chronic or persistent cough (Cough every day or on half the days of the year)	5-54 years	Total 9,077 Males 4,192 Females 4,885	Total 12.2% Males 14.1% Females 10.6%
Peat, 1992 [65]	Australia	1981 and 1990	Random sample, the Busseton study	Chronic cough (cough on the most mornings for at least 3 months of the year)	18-55 years	553	10.7% in 1981 13.1% in 1990
Xu, 1992 [85]	China	1986	Random sample, the Beijing Respiratory Health Study	Chronic cough (cough for 3 or more months of the year)	40-69 years	3,606	17.5%
Enright, 1994 [33]	US	1989-1990	Random sample, the Cardiovascular Health Study, four communities in US	Chronic cough (cough > 3 months)	≥ 65 years	Total 5,201 Males 2,219 Females 2,982	Total 9.2% Males 8.7% Females 9.2%
Lai, 1995 [47]	Hong Kong	1991-1992	Age-stratified random sample from a register of Hong Kong residents	Chronic cough with phlegm (cough up phlegm 3 consecutive months for 2 years)	≥ 70 years	Total 2,032 Males 997 Females 1,029	Total 10.0% Males 13.6% Females 6.4%
Matsuda, 1997 [54]	Vietnam	1995	Random sample	Chronic cough (cough for 3 or more months of the year)	mostly 20-50 years	368	6.0%
Yemaneberhan, 1997 [88]	Ethiopia	1996	Random sample, one urban and three rural areas	Chronic cough (cough for 3 months of the year)	all ages	Total 12,876 Males 9,844 Females 9,677	Total 1.5% Males 1.7% Females 0.9%
Dutu, 1998 [32]	Romania	1994	Random sample from Mihăești, Vâlcea (a rural population)	Chronic cough (<i>tusei cornice</i> in Romanian, cough that comes at most of the days or night for at least 3 consecutive months for the last 2 years)	≥ 18 years	Total 1,001 Males 439 Females 562	Total 12.3% Males 17.5% Females 8.2%
Nriagu, 1999 [62]	South Africa	not specified	Random sample	Chronic cough (chronic cough for at least 3 months during last 12 months)	not specified	1,060	33%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Sobradillo, 1999 [72]	Spain	1997	Random sample, the IBERPOC study, seven areas of Spain	Chronic cough (<i>tos habitual</i> in Spanish; cough for the last 3 months and usual cough in the morning)	40-69 years	Total 4,035 Males 1,976 Females 2,059	Total 13.5% Males 19.9% Females 7.4%
Zemp, 1999 [86]	Switzerland	1991	Random sample, the SAPALDIA study	Chronic cough ("Do you usually cough during the day, or night, on most days for as much as 3 months each year?" and answer of ≥ 2 to the question "For how many years have you coughed like this?")	18-60 years	9,651	5.2%
Cheng, 2001 [26]	Taiwan	1994	Two-stage random sample of paid employees	Chronic cough and phlegm (experience chronic cough with phlegm over the past 12 months)	25-65 years	Total 15,345 Males 9,746 Females 5,599	Total 10.9% Males 12.0% Females 9.1%
Lindström, 2001 [50]	Sweden and Finland	1995	Random sample, a part of the FinEsS study	Chronic productive cough ("Do you bring up phlegm when coughing on most days during periods of at least 3 months during at least 2 successive years?")	20-69 years	Total 13,737 Males 6,852 Females 6,885	Total 9.1% Males 9.6% Females 8.7%
Montnemery, 2001 [58]	Sweden	1992	Random sample, the OLIN study	Long-standing cough ("Have you had longstanding cough during the last years?")	20-59 years	8,469	12.5%
Venners, 2001 [77]	China	1999	Random sample, Beijing and Anqing	Chronic cough ("Do you always cough in the morning for 3 or more months during the winter?")	≥ 18 years	Total 3,709 Males 1,743 Females 1,996	Total 4.5% Males 5.7% Females 3.4%
Walraven, 2001 [81]	Gambia	1996-1997	Stratified cluster sample survey in random samples of one urban and one rural area	Chronic cough (cough for 3 months of the year)	≥ 15 years	Total 5,389 Males 2,228 Females 3,161	Total 1.0% Males 0.9% Females 1.0%
Huchon, 2002 [40]	France	2000	Small-scale model using 5 sample criteria; geographical area of residence, the type of habitat, the age of the index person, the profession and socioeconomic status, and the number of persons living in the household	Chronic cough ("Do you usually cough when you get up?", which occurs for ≥ 3 months a year for ≥ 2 consecutive years)	≥ 25 years	14,706	4.8%
Pallasaho, 2002 [64]	Sweden, Finland, and Estonia	1996	Random sample, the FinEsS study, Stockholm (Sweden), Helsinki (Finland), and Tallinn (Estonia)	Longstanding cough ("Do you usually cough on most days for 3 consecutive months or more during the year?")	20-64 years	Total 18,741 Males 8,160 Females 10,581	Total 20.3% Males 18.2% Females 22.0%
Turcic, 2002 [76]	Croatia	2000	Residents at senior home at Zagreb municipality	Chronic cough (cough lasting 3 months per year or more)	60-94 years	Total 622 Males 147 Females 475	Total 30.4% Males 31.3% Females 30.1%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Zhang, 2002 [87]	China	1999-2000	Random sample	Chronic cough ("Do you usually have cough first thing in the morning or during the day?" and "Do you cough like this for as much as 3 months each year?")	≥ 15 years	22,528	1.9%
Cerveri, 2003 [24]	Italy	1998-2000	Random sample, the ISAYA study	Chronic cough and phlegm ("Have you had cough and phlegm on most days for as much as 3 months per year and for at least 2 successive years?")	20-44 years	Total 18,645 Males 9,192 Females 9,453	Total 11.9% Males 11.8% Females 12.0%
Omenaas, 2003 [63]	Norway	1991	Random sample, the ECRHS phase I study	Chronic cough (Do you have cough for 3 months or more altogether during a year)	20-44 years	3224	9%
Kumar, 2004 [46]	India	1999-2001	Random cluster sample, one urban and one rural town in Punjab State	Chronic cough (cough day/night for > 3 months)	> 15 years	Total 3,603 Males 2,013 Females 1,590	Total 5.7% Males 6.4% Females 4.8%
Shin, 2004 [70]	Korea	2001	Random sample, the Korean Health and Genome study, Ansan and Ansung	Chronic cough ("Have you had cough on most days for as much as 3 months per year and for at least 2 successive years?")	40-69 years	Total 8,140 Males 3,806 Females 4,334	Total 3.7% Males 3.2% Females 4.1%
Wang, 2004 [82]	China	not specified	Region-stratified random sample	Chronic cough (cough more than once a week on average in the past year)	18-70 years	2,532	12.8%
Iversen, 2005 [41]	Scotland	2001-2002	Random sample	Chronic or persistent cough (cough for at least 3 months of the year)	mean 52 years	2,596	19.1%
Skorge, 2005 [71]	Norway	1996	Random sample, the Hordaland Study	Chronic cough ("Do you have a cough for 3 months or more altogether during a year?")	26-82 years	2,401	12.6%
Amigo, 2006 [20]	Chile	2000	Random sample, a semirural area in Limache	Persistent cough in the last 12 months ("Do you usually cough during the day, or at night, in the winter?" and "Do you cough like this on most days for as much as 3 months each year?")	22-28 years	Total 1,232 Males 559 Females 673	Total 27.5% Males 28.4% Females 26.7%
Chen, 2006 [25]	China	2004	Cluster randomized sample from college students	Chronic cough (cough presenting as a sole or predominant symptom lasting for > 3 weeks without abnormal X ray)	mean age 21.2 years	Total 1,087 Males 648 Females 439	Total 3.3% Males 3.4% Females 3.2%
Ford, 2006 [34]	UK	2003	Random sample from 36 general practice databases, the H. pylori screening and treatment program	Chronic cough (coughing bouts more frequent than weekly in the previous 2 months)	40-49 years	Total 3,883 Males 1,704 Females 2,179	Total 12.0% Males 11.4% Females 13.2%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Hamzaçebi, 2006 [37]	Turkey	2002	Random sample, inhabitants of Samsun	Chronic cough ("Have you had on most days for as much as 3 months per year and for at least 2 successive years?")	15-85 years	Total 1,916 Males 810 Females 1,106	Total 10.6% Males 12.9% Females 9.0%
Jaén, 2006 [42]	Spain	1993-1994	Random sample, an urban area of Catalonia	Chronic cough (cough most of the days at least 3 months a year during 2 consecutive years)	20-70 years	Total 576 Males 280 Females 296	Total 16.1% Males 24.6% Females 8.1%
Nordenstedt, 2006 [61]	Norway	1995-1997	1995-1997 Random sample, Nord-Trøndelag Health Survey (HUNT)-2	Chronic cough (daily productive cough for more than 3 months during the past 2 years)	19-101 years	58,596	14.8%
Purty, 2006 [66]	India	2002	Simple random sample	Chronic cough (not specified)	≥ 60 years	320	11.3%
Chhabra, 2008 [27]	India	2005	All the residents of the upper middle class	Chronic cough (cough on most days for 3 consecutive months or more during the year for the past 2 years or more)	> 18 years	Total 3,465 Males 1,756 Females 1,709	Total 2.0% Males 2.0% Females 2.0%
Mossakowska, 2008 [59]	Poland	2002	Direct contact, the Polish Centenarians Program	Chronic cough (not specified)	≥ 100 years	Total 301 Males 43 Females 258	Total 13.0% Males 25.6% Females 10.9%
Wilson, 2008 [84]	China	2002	Random sample	Persistent cough (cough, with or without a cold, 4 days a week, for 3 months of the year for ≥ 1 year)	mean age 47.7 years	31,704	2.3%
Adams, 2009 [19]	Australia	2002-2004	Random sample, the North West Adelaide Health Study	Chronic cough (cough reported on most/every day in the past 3 months)	≥ 18 years	Total 3,960 Males 1,988 Females 2,072	Total 18.2% Males 18.5% Females 16.0%
Lötvall, 2009 [51]	Sweden	2008	Random postal survey, the West Sweden Asthma Study	Longstanding cough ("Have you had a persisting cough during the last year?")	16-76 years	Total 18,087 Males 8,190 Females 9,897	Total 11.4% Males 10.2% Females 12.4%
Hersoug, 2010 [39]	Denmark	2006-2008	Random sample, the Health2006 study	Chronic cough ("Have you had coughing most days or nights?" and "Have you coughed this way for a minimum of 3 months in a year and for at least 2 successive years?")	18-69 years	3,471	15.6%
Songür, 2010 [74]	Turkey	2007	Recruitment by fliers	Chronic dry cough (cough occurring on most days for at least 3 months, lasting for more than 2 consecutive years)	44-61 years	1,082	7.3%
Voll-Aanerud, 2010 [80]	Europe	1998-2002	Random sample, the ECRHS phase II study	Random sample, the ECRHS phase II study	28-56 years	6,009	6.8%
Desalu, 2011 [31]	Nigeria	2009	Random sample	Chronic cough (cough > 8 weeks in the previous 12 months)	mean age 33.9 years	Total 472 Males 238 Females 234	Total 1.1% Males 0% Females 2.1%

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Appendix Table S1. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Hazenkamp-von Arx, 2011 [38]	Switzerland	2005	Random sample	Chronic cough (cough occurring on most days for at least 3 months, lasting for more than 2 consecutive years)	15-70 years	1,581	5.8%
Lam, 2011 [48]	Vietnam	2007-2008	Random sample	Longstanding cough ("Have you had longstanding cough during the last years?")	21-70 years	Total 5,782 Males 2,854 Females 2,928	Total 15.9% Males 15.8% Females 15.9%
Mahesh, 2011 [53]	India	2006-2009	2006-2009 Random sample, Mysore district	Chronic cough ("Do you cough on most days for as much as 3 months each year?")	≥ 30 years	Total 4,333 Males 2,322 Females 2,011	Total 2.5% Males 3.6% Females 1.2%
Milenkovic, 2011 [56]	Serbia	2003	Random sample	Longstanding cough ("Have you had problems with prolonged cough over recent years?")	20-80 years	Total 5,079 Males 2,466 Females 2,613	Total 32.2% Males 28.9% Females 35.1%
Wang, 2011 [83]	China	2008	Random cluster sample	Persistent cough ("Do you usually have a cough?" and "Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?" and "Do you usually cough like this on most days for 3 consecutive months or more during the year?")	mainly 30-39 years	7,614	1.5%
Bende, 2012 [22]	Sweden	2001	Random sample, the Skövde survey	Chronic cough ("Are you bothered by cough daily or frequently?")	≥ 20 years	Total 1,387 Males 667 Females 719	Total 6.3% Males 4.8% Females 7.6%
Fujimura, 2012 [35]	Japan	2011	Randomly selected email addresses	Chronic cough ("At present, do you have cough?" and "How long have the symptoms lasted?"; 8 weeks or longer)	≥ 16 years	Total 1,000 Males 6,460 Females 4,045	Total 2.2% Males 2.6% Females 1.5%
Gundersen, 2012 [36]	Norway	1997-1999	1997-1999 Invitations to all the habitants, the Hordaland Health Study	Chronic cough ("Have you had daily cough as long as a period of 3 months in both last years?")	40-45 years	Total 9,740 Males 4,595 Females 5,255	Total 9.9% Males 9.8% Females 9.9%
Mirabelli, 2012 [57]	US	1987-1989	Random sample, the ARIC study	Chronic cough ("Do you usually cough as much as four to six times a day, four or more days out of the week?")	45-64 years	Total 15,273 Males 6,833 Females 8,440	Total 9.7% Males 10.4% Females 9.1%
Song, 2013 [73]	Korea	2005-2006	Random sample, the KLoSHA study	Chronic persistent cough ("Do you usually cough as much as four to six times a day, four or more days a week?", and "Do you usually cough like this on most days for 3 consecutive months or more during the year?")	≥ 65 years	Total 796 Males 352 Females 444	Total 4.6% Males 4.0% Females 5.2%

Appendix Table S2. Characteristics of 19 studies excluded due to definition issues

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Dutu, 1980 [95]	Romania	1970-1980	Inhabitants of Bucarest district which undertook regular medical examination of respiratory and cardiovascular functions over the last 10 years	Chronic bronchitis (cough for 3 consecutive months per year during the cold season in at least the last 10 years)	60-85 years	Total 751 Males 374 Females 377	Total 16.0% Males 21.9% Females 11.9%
Wicht, 1981 [107]	South Africa	Not provided	Random sequential sample based on Belville's voters list, being a representative sample of the white adult population of Belville	"Do you usually cough like this on most days for 3 consecutive months or more during the year?"	≥ 18 years	Total 504 Males 271 Females 234	Total 8.1% Males 12.2% Females 3.4%
Pertuze, 1986 [104]	Chile	1979	Census sample of a subpopulation in Rancagua province	Chronic bronchitis (cough and phlegm for 3 months of the year for 2 successive years)	> 14 years (mean 35.7)	Total 549 Males 224 Females 325	Total 21.9% Males 22.3% Females 21.5%
Burr, 1987 [90]	UK	not specified	Random sample	Cough (cough on most days for as much as 3 months each year)	65-74 years	513	27.3%
Littlejohns, 1989 [103]	UK	not specified	General practice register sample	Chronic bronchitis (cough and phlegm for 3 months of the year for 2 successive years)	40-70 years	Total 1,444 Males 635 Females 809	Total 11.3% Males 16.7% Females 7.2%
Grievink, 1998 [100]	Netherlands	1994-1995	Random sample, the MORGEN study	Cough ("Do you cough when getting up during winter time on most days for at least 3 months a year?")	20-59 years	6,555	6.8%
Cetinkaya, 2000 [91]	Turkey	1996	Random sample	Chronic bronchitis (presence of cough and phlegm on most days during at least three months per year for at least two previous years)	20-83 years	Total 1,023 Males 461 Females 562	Total 13.5% Males 17.8% Females 10.0%
von Hertzen, 2000 [105]	Finland	1978-1980	Two-stage stratified cluster sample, the Mini-Finland Health Survey	Chronic bronchitis (cough with phlegm production on most days for at least 3 months a year during at least 2 consecutive years)	≥ 30 years	Total 7,217 Males 3,322 Females 3,895	Total 10.5% Males 15.7% Females 6.1%
Coultas, 2001 [92]	US	1988-1994	Probability sampling, the NHANES III study	Cough ("Have you had a cough most days for 3 or more consecutive months per year?")	≥ 45 years	5,743	10.8%
Golshan, 2002 [99]	Iran	2000	Random sample	Chronic bronchitis (history of chronic productive cough for at least three months a year in the last two years)	1-81 years	561	3.4%
Jakeways, 2003 [101]	UK	1991	Random sample	Cough ≥ 3 months ("Do you usually cough during the day, or at night, during the winter", and "do you usually cough like this for as much as 3 months of the year?")	18-70 years	2,633	9.3%

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Appendix Table S2. Continued

Study, publication year [reference]	Region	Study year	Recruitment, study population	Definition and text excerpts	Age	Sample size	Chronic cough (%)
Ehrlich, 2004 [96]	South Africa	1998	Random sample, the South African Demographic and Health Survey	Chronic bronchitis (usual cough with phlegm every day for at least 3 months a year for at least 2 successive years)	≥ 15 years	Total 13,826 Males 5,649 Females 8,073	Total 2.7% Males 2.5% Females 2.9%
Frostad, 2006 [98]	Norway	1972	Random sample	Cold-induced long-lasting cough and phlegm ("During the last 2 years, have you had a cough and/or phlegm in connection with a cold for more than 3 weeks?")	15-70 years	Total 17,678 Males 8,147 Females 9,531	Total 21.6% Males 20.9% Females 22.1%
Ko, 2006 [102]	Hong Kong	2003-2004	Age-stratified random sample from a register of Hong Kong residents	Cough up phlegm 3 consecutive months for 2 years	≥ 70 years	1,524	10.5%
Desalu, 2010 [94]	Nigeria	2005-2006	Random sample	Dry cough [1] answering "yes" to the question "Do you usually cough, either during the day or at night?" and 2) answering "no" or "not sure" to the question "Do you usually cough up phlegm from your chest, either during the day, at night or first thing in the morning?" and then answering "no" to the question "Do you cough up phlegm like this on most days for as much as three months each year?"]	20-44 years	498	9.6%
Freitas, 2011 [97]	Brasil	2009	Cluster sample from in 3 administrative regions in Distrito Federal	Cough ≥ 3 weeks (at least 3 weeks with productive cough as of the date of the interview)	≥ 15 years	629	5.4%
de Oca, 2012 [93]	South America	2002	Two-stage cluster sample, the PLATINO study	Chronic bronchitis (cough and phlegm on most days > 3 months for 2 years)	≥ 40 years	5,571	3.2%
Accordini, 2013 [89]	Italy	2007-2010	Random sample, the GEIRD study	Chronic bronchitis (cough and sputum on most days for a minimum of 3 months a year and for at least 2 successive years)	20-44 years	Total 18,873 Males 5,006 Females 5,488	Total 12.6% Males 12.6% Females 12.7%
Wheaton, 2013 [106]	US	2007-2010	Stratified, multistage probability sample, the NHANES 2007-2010 study	Frequent cough (usually cough on most days for 3 consecutive months or more during the year)	40-79 years	Total 5,139 Males 2,572 Females 2,567	Total 10.4% Males 10.5% Females 10.3%

Appendix Table S3. Summary of research purpose and assessed quality of 70 included studies*

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Comstock, 1981 [28]	To evaluate the effects of exposure at home to tobacco smoke by other household members and to fumes from the use of gas as a cooking fuel on respiratory symptoms and ventilatory functions	1	1	2	3	1	1	9
Lebowitz, 1982 [49]	To investigate the relationship of risk factors and respiratory symptoms in a white community population	1	1	2	3	1	1	9
Samet, 1982 [68]	To characterize the epidemiologic feature of respiratory diseases among Hispanics	0	1	2	3	1	1	9
Schenker, 1982 [69]	To analyze the relationships between cigarette tar content, smoking habits, and respiratory symptoms in women	1	1	2	3	1	1	9
Krzyzanowski, 1986 [45]	To study the relation of mortality to ventilatory functions and respiratory symptoms during a 13-year follow up period	1	1	2	3	1	1	9
Korn, 1987 [43]	To examine the relationships between occupational exposure to dust/gases/fumes and chronic respiratory symptoms	1	1	2	3	2	1	10
Rijcken, 1987 [67]	To study the relationship of airway responsiveness to respiratory symptom prevalence	1	1	2	3	1	1	9
Viegi, 1988 [79]	To analyze the relationships of respiratory symptoms with sex, age, smoking habit and socioeconomic status in an unpolluted area of Northern Italy	1	1	2	3	1	1	9
Krzyzanowski, 1988 [44]	To assess the effect moderate occupational exposure to dust, gases or chemical fumes on the prevalence of respiratory symptoms and ventilatory function	1	1	2	3	2	1	10
Mensinga, 1990 [55]	To study the relationships of the prevalence of respiratory symptoms with skin test reactivity or blood eosinophilia	1	1	2	3	1	1	9
Bakke, 1991 [21]	To examine the relationship of occupational airborne exposure to respiratory symptoms and asthma	1	1	2	3	1	1	9
Brown, 1991 [23]	To examine the relationships of chronic cough and chronic phlegm with smoking history	1	1	2	3	1	1	10
Davydova, 1991 [30]	To elucidate the role of short-term and long-term cough in prediction and diagnosis of chronic bronchitis	1	0	2	0	1	0	4
Lundback, 1991 [52]	To assess the prevalence of respiratory symptoms and their relationship to demographic data in adults living in Norrbotten, northern Sweden	1	1	2	3	1	1	9
Norboo, 1991 [60]	To investigate the prevalence of respiratory illness, and to study the relationships with the level of domestic pollution in a Himalayan village	0	1	2	3	0	1	7
Tollerud, 1991 [75]	To investigate the relationships of atopy markers to the prevalence of respiratory symptoms in middle-aged or older men	1	1	2	3	0	1	8
Viegi, 1991 [78]	To report prevalence rates of respiratory symptoms, diseases, and risk factors in two Italian general population samples exposed to different levels of air pollution	1	1	2	3	2	1	10
Cullinan, 1992 [29]	To measure the prevalence of persistent cough and sputum in south east England	1	0	2	3	1	1	8
Peat, 1992 [65]	To estimate whether the prevalence of asthma in adults increased over a nine year interval	1	1	2	3	1	1	9
Xu, 1992 [85]	To investigate the association of occupational dust/gas/fume exposures with chronic respiratory symptoms and pulmonary functions in Beijing	1	1	2	3	1	1	9
Enright, 1994 [33]	To examine the prevalence and the correlates of major respiratory symptoms and lung diseases in the elderly	1	1	2	3	2	1	10
Lai, 1995 [47]	To investigate the prevalence of respiratory symptoms and diseases in the elderly	1	0	2	3	1	1	8
Matsuda, 1997 [54]	To investigate the relationship between occupational exposure to dust/chemicals and chronic respiratory symptoms in Vietnam	1	1	2	3	0	1	8

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Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Yemaneberhan, 1997 [88]	To investigate the role of environmental factors leading to the differences in the prevalence of wheeze and asthma between urban and rural areas	1	1	2	3	1	1	9
Dutu, 1998 [32]	To determine the prevalence of respiratory symptoms of asthma and chronic bronchitis	1	1	2	3	1	1	9
Nriagu, 1999 [62]	To determine the prevalence of asthma and respiratory symptoms among the childhood and adult population in a heavily-polluted urban area of Durban, South Africa	0	1	2	3	0	1	7
Sobradillo, 1999 [72]	To estimate the prevalence of chronic respiratory symptoms and chronic airflow limitation in 7 areas of Spain	1	1	2	3	2	1	10
Zemp, 1999 [86]	To investigate the association between long-term ambient pollution exposure and respiratory symptoms	1	1	2	3	2	1	10
Cheng, 2001 [26]	To examine the prevalence of job stress, and their associations with health complaints in Taiwan	0	0	2	3	0	1	6
Lindstrom, 2001 [50]	To study the influence of different smoking categories on prevalence of respiratory symptoms and chronic bronchitis in Northern Sweden and Northern Finland	1	0	2	3	1	1	8
Montnemery, 2001 [58]	To test whether living environment, occupation and social position are risk factors for asthma and chronic bronchitis/emphysema	1	0	2	3	1	1	8
Venners, 2001 [77]	To evaluate established environmental determinants of respiratory health, chronic indoor exposures to SO ₂ and PM ₁₀ and respiratory health status in three areas of China: a large city, a small city, and a rural agricultural region	1	1	2	3	1	1	9
Walraven, 2001 [81]	To compare the prevalence of asthma, smoking and chronic cough in rural and urban Gambia	1	1	2	3	1	1	9
Huchon, 2002 [40]	To determine the prevalence of chronic bronchitis in the French adult population, to identify the role of known risk factors for chronic bronchitis, and to assess rates of chronic bronchitis diagnosis and lung function evaluation in patients with chronic bronchitis	0	1	2	3	2	1	9
Pallasaho, 2002 [64]	To assess whether differences exist in prevalence of asthma, chronic bronchitis, and respiratory symptoms between three Baltic capitals, and to examine risk factor profiles for respiratory conditions	1	1	2	3	2	1	10
Turcic, 2002 [76]	To study the prevalence of respiratory symptoms and diseases in older subjects, and its relationships to residence place, occupation and smoking history	0	1	1	3	0	1	6
Zhang, 2002 [87]	To determine the effects of occupational and environmental exposure on respiratory symptoms in adults in rural Beijing	0	1	2	3	1	1	8
Cerveri, 2003 [24]	To assess the prevalence of chronic cough and phlegm and to evaluate clinical characteristics and risk factors in young adults	1	0	2	3	2	1	9
Omenaas, 2003 [63]	To investigate whether dietary vitamin C intake is related to self-reported respiratory symptoms in young adults of a community	1	1	2	3	1	1	9
Kumar, 2004 [46]	To study the association of outdoor air pollution with chronic respiratory morbidity in Punjab, India	1	1	2	3	1	1	9
Shin, 2004 [70]	To examine the prevalence of undiagnosed airflow obstruction and its relation with respiratory symptoms in middle-age adults in Korea	1	1	2	3	1	1	9
Wang, 2004 [82]	To understand the epidemiology of symptomatic gastroesophageal reflux and to explore their risk factors	0	0	2	3	1	1	7
Iversen, 2005 [41]	To investigate the epidemiology of chronic respiratory diseases in Scotland, and to explore the relationship between quality of life and geographic location in those reporting disease	1	1	2	3	2	1	10
Skorge, 2005 [71]	To investigate the impact of indoor exposures on respiratory symptoms	1	1	2	3	1	1	9

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Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Amigo, 2006 [20]	To assess the associations between smoking and respiratory symptoms, lung function and bronchial hyperresponsiveness in young adults in Chile	1	1	2	3	1	1	9
Chen, 2006 [25]	To study the prevalence of cough and its risk factors in young college students in Guangzhou	1	0	2	3	0	1	7
Ford, 2006 [34]	To explore the relationship between cough and various risk factors including gastrointestinal diseases	1	0	2	3	1	2	9
Hamzacebi, 2006 [37]	To determine the prevalence of asthma and asthmatic symptoms and the relationships with age, gender and smoking behavior in Turkish adults living in Samsun	1	1	2	3	1	1	9
Jaén, 2006 [42]	To assess the association between lifetime occupational exposures and airflow obstruction	1	1	2	3	1	1	9
Nordenstedt, 2006 [61]	To investigate the relation between respiratory and reflux symptoms	1	1	2	3	1	1	9
Purty, 2006 [66]	To assess present morbidity pattern of rural elderly persons in India	1	0	2	3	0	0	6
Chhabra, 2008 [27]	To study the prevalence of respiratory morbidity and its associated factors in urban Delhi	0	1	2	3	0	1	7
Mossakowska, 2008 [59]	To assess the prevalence of asthma, allergy, and respiratory symptoms in the Polish centenarians	1	0	2	3	0	1	7
Wilson, 2008 [84]	To assess the prevalence of respiratory symptoms in relation to personal, occupational, and environmental risk factors in a heavy-industry area in China	1	1	2	3	1	1	9
Adams, 2009 [19]	To determine the prevalence of chronic cough that is not associated with diagnosed respiratory conditions, and to examine the impact on physical and mental health problems	1	1	2	3	1	2	10
Lötvall, 2009 [51]	To investigate the changes in asthma prevalence over the last 18 years	1	0	2	3	1	1	8
Hersoug, 2010 [39]	To investigate the associations between indoor particulate matter exposure and lower airway symptoms	1	1	2	3	1	1	9
Songur, 2010 [74]	To investigate the influence of reproductive factors on chronic respiratory symptoms and pulmonary function in premenopausal and postmenopausal women	0	1	2	3	0	1	7
Voll-Aanerud, 2010 [80]	To describe the association of respiratory symptoms with health-related quality of life	1	1	2	3	2	1	10
Desalu, 2011 [31]	To determine the prevalence of cough in an urban adult community population in Nigeria	1	1	2	3	1	1	9
Freitas, 2011 [97]	To estimate the prevalence of respiratory symptoms in 3 administrative regions in Distrito Federal, Brazil	1	1	2	3	1	2	10
Hazenkamp-von Arx, 2011 [38]	To investigate the impact of traffic exhaust on respiratory symptoms among adults living along a Swiss alpine highway corridor	1	1	2	3	1	1	9
Lam, 2011 [48]	To assess the prevalence of respiratory symptoms and their relation with demographic data among adults in rural and urban Vietnam	1	0	2	3	1	1	8
Mahesh, 2011 [53]	To estimate the prevalence of chronic cough and phlegm and to study their associated factors in Mysore district, India	1	1	2	3	1	1	9
Milenkovic, 2011 [56]	To estimate the prevalence of respiratory symptoms among adults in Belgrade, Serbia	1	0	2	3	1	1	8
Mirabelli, 2012 [57]	To examine associations between respiratory symptoms and occupation	1	0	2	3	1	1	8
Wang, 2011 [83]	To investigate the long-term effects of air pollution on prevalence of respiratory symptoms in adults in Beijing	0	1	2	3	1	1	8
Bende, 2012 [22]	Is chronic cough related to upper airway symptoms or other explanatory variables?	1	0	2	3	1	2	9
Fujimura, 2012 [35]	To investigate the incidence of cough in the general population in Japan	0	0	2	3	0	2	7

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Appendix Table S3. Continued

Study, publication year [reference]	Research purpose	Q1	Q2	Q3	Q4	Q5	Q6	Total (Max: 11)
Gundersen, 2012 [36]	To evaluate the prevalence of respiratory symptoms among adults residing in low outdoor air pollution areas	1	1	2	3	1	1	9
Song, 2013 [73]	To investigate the epidemiology of cough in the elderly, particularly in relation with their comorbidity	1	1	2	3	1	1	9

*Quality scoring and index were calculated using the following criteria¹⁴; Q1. Were the target population and the observation period well defined? Yes=1, No=0; Q2. Diagnostic criteria, Use of diagnostic system reported (DSM, ICD, RDC)=1, Own system/symptoms described/no system/not specified=0; Q3. Method of case ascertainment, Community survey/multiple institutions=2, Inpatient/inpatients and outpatients/case registers=1, Not specified=0; Q4. Administration of measurement protocol, Administered interview=3, Systematic casenote review=2, Chart diagnosis/case records=1, Not specified=0; Q5. Catchment Area, Broadly representative (national or multi-site survey)=2, Small area/not representative (single community, single university)=1, Convenience sampling/ other (primary care sample/treatment group)=0; Q6. Prevalence measure, Point prevalence (e.g. one month)=2, 12-month prevalence=1, Lifetime prevalence=0.

Appendix Table S4. Classification of definitions according to terminology and question among 70 epidemiological studies for chronic cough

Terminology	Cut-off duration	Text excerpts regarding the definition in specific publications (reference)
Chronic cough	Cough ≥ 3 months (n=46)	"Do you usually cough like this [as much as 4 to 6 times per day, 4 or more days per week], on most days for 3 consecutive months or more during the year?"^{19,21,28,33,41,44,46,49,53,54,68,69,71,73,75,76,81,85,88} "Do you usually have cough first thing in the morning or during the day?" and "Do you cough like this for as much as 3 months each year?"^{23,65,72,87} "Do you usually cough on most days or nights for as long as 3 consecutive months each year during winter?"^{55,60,67,77,80} "Do you usually cough like this on most days for 3 consecutive months a year for at least 2 years?"^{27,32,36-39,42,45,63,74,78,79,86} "Do you usually cough when you get up?", which occurs for ≥ 3 months a year for ≥ 2 consecutive years^{40,70} "Do you usually cough like this on most days for 3 consecutive months a year for at least 3 years?"⁴³ Chronic cough for at least 3 months during last 12 months⁶² Daily productive cough for more than 3 months during the past 2 years⁶¹
	Cough ≥ 8 weeks (n=3)	Coughing bouts more frequent than weekly in the previous 2 months³⁴ Cough >8 weeks in the previous 12 months³¹ "At present, do you have cough?" and "How long have the symptoms lasted?"; 8 weeks or longer³⁵
	Cough ≥ 3 weeks (n=1)	Cough presenting as a sole or predominant symptom lasting for >3 weeks without abnormal X ray ²⁵
	No specific duration (n=6)	Cough every day or on half the days of the year²⁹ Cough more than once a week on average in the past year⁸² "Are you bothered by cough daily or frequently?"²² "Do you usually cough as much as four to six times a day, four or more days out of the week?"⁵⁷ Not specified definition^{59,66}
Chronic cough with phlegm, or chronic productive cough	Cough ≥ 3 months (n=3)	"Do you bring up phlegm when coughing on most days during periods of at least 3 months during at least 2 successive years?"^{47,50} "Have you had cough and phlegm on most days for as much as 3 months per year and for at least 2 successive years?"²⁴
	No specific duration (n=1)	Experienced chronic cough with phlegm over the past 12 months ²⁶
Longstanding cough	Longstanding cough	"Do you usually cough like this [as much as 4 to 6 times per day, 4 or more days per week], on most days for 3 consecutive months or more during the year?" ^{52,64}
	No specific duration (n=3)	"Have you had a persisting cough during the last year?"⁵¹ "Have you had longstanding cough during the last years?"⁴⁸ "Have you had problems with prolonged cough over recent years?"⁵⁶
Longterm cough	Cough ≥ 3 months (n=1)	"Do you usually cough like this on most days for 3 consecutive months a year for at least 2 years?" ³⁰
	No specific duration (n=1)	"Have you had long-standing cough during the last years?" ⁵⁸
Persistent cough	Cough ≥ 3 months (n=3)	"Do you usually cough during the day, or at night, in the winter?" and "Do you cough like this on most days for as much as 3 months each year?"²⁰ "Do you usually have a cough?" and "Do you usually cough as much as 4 to 6 times a day, 4 or more days out of the week?" and "Do you usually cough like this on most days for 3 consecutive months or more during the year?"⁸³ Cough, with or without a cold, 4 days a week, for 3 months of the year for ≥ 1 year⁸⁴

Appendix Table S5. PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	P1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	P3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	P3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	NA
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	P4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	P4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	P4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	P4-5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	P5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	P5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	P5 (quality score and weighting)
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	P5-6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	P5-6

Appendix Fig. S1. Forest plots for male-to-female ratio in 28 epidemiological studies using a 'cough ≥ 3 months' definition and random effects model. Study name indicates the first author and publication year, and they were ordered according to the study year (the number within the parenthesis). OR, odds ratio; 95% CI, 95% confidence interval.

