Prevalence and risk factors of chronic cough in an adult community-dwelling Portuguese population

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Chronic cough is relatively common. This study highlights the complexity of chronic cough management and the need for further research and diagnostic tools to improve patient outcomes. https://bit.ly/3XPIyCc

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Abstract

Background Chronic cough is associated with high individual and social costs, mainly due to doctor visits and diagnostic investigations. The aim of the present study was to estimate the prevalence of chronic cough and identify risk factors associated with chronic cough in a community-based sample in the scope of the EpiCOUGH study.

Methods From 1 June to 31 August 2023, we recruited adults from the largest primary healthcare centres in Lisbon, Portugal, and invited them to participate in an online survey. Participants aged ⩾20 years with a registered email address were eligible. Data collection included a health questionnaire that recorded the presence, duration, frequency and impact of cough on daily activities. Chronic cough was defined as lasting longer than 8 weeks.

Results Of the 7285 adult healthcare users who agreed to participate, 2309 (31.7%) completed the questionnaire. Most were female (59.2%) and the mean±SD age was 51.6±13.5 years. The estimated prevalence of chronic cough was 7.23% (95% CI 6.24–8.36%). Chronic cough was associated with older age, being divorced/widowed, current smoking, obesity, asthma, working in a dusty environment and pet ownership. No cause was diagnosed in 23.36% of patients who consulted a doctor.

Conclusion Chronic cough was relatively common in the population studied. Our data emphasise the need to treat patients with chronic cough with strategies that address risk factors. This study also highlights the complexity of chronic cough management and the need for further research and diagnostic tools to improve patient outcomes.

Introduction

The cough reflex is an important physiological protective mechanism that prevents food, liquids, dust and chemicals from entering the lower respiratory tract [1]. Coughing is a common symptom that occurs in different conditions, from self-limited respiratory infections to more severe diseases such as tuberculosis or lung cancer. In many patients, the cough persists for less than 3 weeks (defined as acute cough) and, in other patients, it evolves to chronic cough, usually defined as persisting for more than 8 weeks [2, 3].

Chronic cough is associated with considerable costs, mainly due to visits to the doctor and diagnostic investigations [4]. In a meta-analysis published in 2015, the global prevalence of chronic cough was 9.6% [5]. Since then, additional data from different countries has been published, although its prevalence on community-based samples has been reported in only a few studies [6].

Endogenous (such as mucous or inflammation of airways) and exogenous stimuli (such as cold air, strong odours or smoke) can trigger the cough reflex [7]. Other factors may include drugs such as angiotensin-converting enzyme inhibitor treatment [8] or even exercise [9]. These factors may elicit cough and could exacerbate cough from a different underlying cause.

Different authors pointed out that the three main diseases associated with chronic cough [8] are upper airway cough syndrome (rhinosinusitis), asthma (reactive airways) and gastro-oesophageal reflux disease, named the three “Rs” (3Rs) [10].

However, some patients continue to cough even when therapeutic approaches for the presumably associated common and uncommon condition(s) have been optimised according to published best practice guidelines. This condition is known as refractory chronic cough [11, 12]. Its mechanisms are complex and may involve increased activity of the cough reflex.

Another critical condition occurs when, despite meticulous diagnostic and therapeutic trials, there are patients with chronic cough that do not fit into any disease category, resulting in unexplained chronic cough [11].

Given this, it could be reasonably suggested that cough is not always related to any other disease condition, but instead to a clinical entity with a distinct pathophysiology [9, 11, 13].

This new clinical entity, related to the cough reflex mechanisms, is now changing the cough paradigm [14]. Indeed, disease conditions, such as the 3Rs, may be less relevant than previously thought [15, 16], since the cough reflex has its neural regulation pathways [17]. These disease conditions could be associated with or act as triggers rather than direct cough causes [14].

This manuscript reports the results of Phase I of EpiCOUGH, a study conducted in Lisbon, Portugal, to better understand the epidemiology of cough. In Phase I, we aimed to estimate the prevalence of chronic cough and identify risk factors associated with chronic cough in a community-based sample.

Methods

Study design, setting and participants

Phase I of the EpiCOUGH study took place in Lisbon, Portugal. From 1 June to 31 August 2023, we conducted an online survey of the adult population (n=233 034) registered in the largest group of healthcare centres in Lisbon (ACES Lisboa Central) and meeting the inclusion criteria.

To be eligible for the study, participants had to be aged ⩾20 years old, have an email address registered in the ACES Lisboa Central Database and provide informed consent to participate.

Participants first received an email asking for their consent to be contacted for research studies. If the participant agreed, a second email was sent informing them of the EpiCOUGH study and its aims and giving them access to the health questionnaire. This questionnaire was only completed after the participants had given their digitally signed consent.

Sampling

The sample size calculation was based on the expected prevalence of chronic cough of 9% with an absolute precision of 2.5%. An oversample was conducted to account for a nonresponse rate of 80%. The effective sample size for each age and gender group was calculated as n/PR, where PR is the expected participation rate and n is the sample size calculated in the first step. Oversampling factors were defined by gender and age group. A total sample size of 2555 participants was required for this study.

A simple random sample was used as the study design, whereby the participants with email were allocated proportionally according to gender and age group.

Ethical issues

The procedures followed were in accordance with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki). The EpiCOUGH study was approved by the Ethics Committee of Nova Medical School and by the Regional Health Administration of Lisbon and Tagus Valley (ARSLVT), file number 101/CES/INV/2021. All participants provided informed consent to participate in the first phase of the study.

Data sources for health assessment

For data collection, we used an adapted version of the cough questionnaire from a previous web survey [18] included in the supplementary material. It included questions about the presence and duration of cough, the frequency of coughing episodes, and the time of day when it became most disturbing. This questionnaire also assessed the impact on daily life (*e.g.* "how troublesome are your cough symptoms at present?", "how troublesome are the cough symptoms in your daily living?" and "which items are especially troublesome?") and the need for medical consultations (*e.g.* "have you consulted a physician at a clinic or hospital for your current cough symptoms?" and "what diagnosis have you received for the cough symptoms? Select the most appropriate answer from the following items" with a list of possible diagnoses made by their doctors provided).

Case definition

The definition of chronic cough was based on duration criteria. It is characterised as a persistent cough for more than 8 weeks, as assessed by the questionnaire.

For the description of cough characteristics (symptoms and clinical monitoring), cough duration was categorised as acute (<3 weeks), subacute (3–8 weeks) or chronic (>8 weeks) [2, 19].

Sociodemographic, clinical and lifestyle factors

The sociodemographic variables considered for the present work were gender (male or female), age, education level (0–4 years, 5–9 years, 10–12 years, bachelor's, master's or PhD degree), marital status (single, married, divorced/widowed), employment status (active worker, retired, unemployed or other (student/unpaid household worker/other)).

Questions concerning lifestyle habits included smoking habits (never smoked, smoker or past smoker). Body mass index (BMI) was calculated as $kg \cdot m^{-2}$ and categorised according to the World Health Organization classification [20].

Clinical characteristics considered were a history of asthma (yes/no) and the presence of wheezing or whistling in the chest in the last 12 months (yes/no). Current asthma was defined as answering "yes" to ever having asthma and experiencing wheezing in the last 12 months [21].

Statistical analysis

Prevalence estimates for chronic cough were calculated based on gender and age groups (20–39, 40–49, 50–59, 60–69 and ⩾70 years).

To verify the representativeness of the sample compared to individuals aged 20 years or older registered in ACES Lisboa Central, we compared the participants of the EpiCOUGH study with the registered population in ACES Lisboa Central, focusing on their gender and age groups.

A descriptive analysis was conducted, considering sociodemographic data, anthropometric measurements, smoking habits and some clinical characteristics. Categorical variables were summarised using absolute frequencies (n) and proportions (%). Continuous variables were presented as mean values with their corresponding standard deviations (mean±SD). Univariate logistic regression was performed to compare participants with and without chronic cough.

A multivariable logistic regression approach was used to assess the factors associated with chronic cough. The following potential predictors of chronic cough were considered: sociodemographic factors, namely gender (male, female), age, marital status (married, single or divorced/widowed), education level (0–4 years, 5–9 years, 10–12 years, bachelor's, master's or PhD degree) and employment status (active worker, retired, unemployed or other (student/unpaid household worker/other); lifestyle, using BMI (underweight/normal, overweight and obesity) and smoking habits (nonsmoker, current smoker and past smoker); clinical factors, such as asthma (defined as reporting having asthma at least once and a report of wheezing in the last 12 months); and environmental factors (worked in a dusty place for more than a year and having a pet (dog or cat) at home). Subsequently, a backward conditional method was employed, sequentially removing variables that did not exhibit statistical significance and comparing the models through likelihood ratio tests until the final model was achieved.

Additionally, we provided a description of cough characteristics, encompassing symptoms and clinical monitoring, considering the cough categorised into three groups, namely acute, subacute and chronic. We also compared participants categorised by the presence or absence of problems caused by chronic cough in daily living.

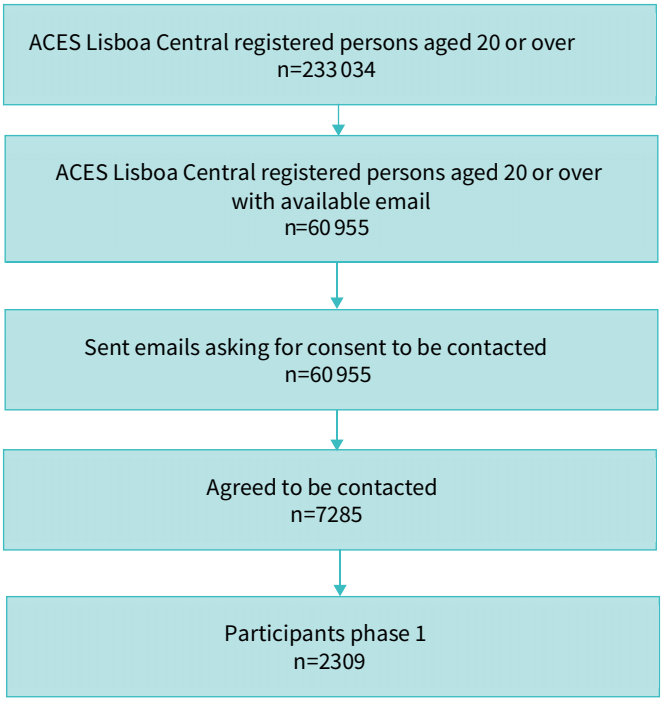

FIGURE 1 Flowchart of the EpiCOUGH study.

The level of significance used was 0.05. All analyses were performed using STATA IC v17 (Stata Statistical Software: release 17; StataCorp LP, Lakeway, TX, USA).

Results

Of the 233 034 people aged 20 years or older registered in ACES Lisboa Central, 60 955 had an available e-mail address to which the request for consent to participate was sent. Of these, 7285 agreed to participate and 2309 (31.7%) completed the questionnaire. The flowchart of the study is shown in figure 1.

To verify the representativeness of the EpiCOUGH sample, we compared the gender and age of participants with those registered in the ACES Lisboa Central population (table 1). In relation to gender, our sample is similar to the ACES Lisboa Central population. However, regarding age, some differences are noticeable, with our sample including more middle-aged participants and fewer young and elderly people (table 1).

Most of the participants were female (59.2%) and the mean±SD age was 51.6±13.5 years.

TABLE 1 Comparison of the study population with the adults registered in ACES Lisboa Central

Characteristic	EpiCOUGH (n=2309)	ACES Lisboa Central (n=233 034)
Gender		
Female	1368 (59.25%)	127 263 (54.61%)
Male	941 (40.75%)	105 771 (45.39%)
Age class (years)		
20–29	99 (4.29%)	31 800 (13.65%)
30–39	342 (14.77%)	43 965 (18.87%)
40–49	626 (27.04%)	43 707 (18.76%)
50–59	571 (24.67%)	35 227 (15.12%)
60–69	425 (18.36%)	30 812 (13.22%)
70–79	203 (8.77%)	25 279 (10.85%)
⩾80	43 (1.86%)	22 244 (9.55%)

Prevalence of chronic cough

A total of 354 (15.33%) participants reported cough, including 138 having acute cough, 49 experiencing subacute cough and 167 meeting the criteria for chronic cough. The estimated prevalence of chronic cough in our sample was 7.23% (95% CI 6.24–8.36%).

Risk factors associated with chronic cough

When compared participants with chronic cough with participants without chronic cough, participants presenting chronic cough criteria were slightly older (55.8±14.5 years *versus* 51.3±13.4 years), more frequently divorced or widowed (23.95% *versus* 15.55%), current smokers (35.33% *versus* 18.63%), obese (24.55% *versus* 14.24%), asthma patients (15.57% *versus* 8.5%), worked in a dusty place for more than a year (26.35% *versus* 15.08%) and had pets at home (47.90% *versus* 40.29%). Participants with chronic cough also had a lower level of education (35.93% with ⩽12 years of schooling *versus* 26.10%) and were more likely to be students/unpaid domestic workers (25.15% *versus* 16.76%). These results are shown in table 2. When we compared subjects with chronic cough with subjects without any cough, the results were similar (table S1).

The results of the multivariable analysis are presented in table 3. Chronic cough was significantly associated with older age, being divorced/widowed, current smoking, obesity, asthma, working in a dusty environment and pet ownership (table 3).

TABLE 2 Comparison of sociodemographic, lifestyle and clinical characteristics between participants with and without chronic cough

Characteristics	Chronic cough (n=167)	Non-chronic cough (n=2142)	Crude OR (95% CI)	p-value
Gender, n (%)				
Male	72 (43.11)	869 (40.57)	Reference	
Female	95 (56.89)	1273 (59.43)	0.90 (0.655–1.230)	0.519
Age (mean±SD), years	55.8±14.5	51.3±13.4	1.02 (1.013–1.036)	⩽0.001
Marital status, n (%)				
Single	48 (28.74)	551 (25.72)	1.39 (0.956–2.013)	0.085
Married	79 (47.31)	1258 (58.73)	Reference	
Divorced/widowed	40 (23.95)	333 (15.55)	1.91 (1.283–2.851)	0.001
Education level (years), n (%)				
0–4	4 (2.40)	17 (0.80)	3.23 (1.056–9.850)	0.040
5–9	18 (10.78)	84 (3.92)	2.94 (1.670–5.167)	⩽0.001
10–12	38 (22.75)	458 (21.38)	1.14 (0.754–1.716)	0.539
Bachelor's degree	69 (41.32)	946 (44.16)	Reference	
Master's degree or PhD	38 (22.75)	637 (29.74)	0.82 (0.544–1.231)	0.335
Employment status, n (%)				
Active worker	106 (63.47)	1597 (74.56)	Reference	
Retired	8 (4.79)	76 (3.55)	1.59 (0.746–3.373)	0.231
Unemployed	11 (6.59)	110 (5.14)	1.51 (0.786–2.887)	0.217
Student/unpaid household worker/other	42 (25.15)	359 (16.76)	1.76 (1.211–2.565)	0.003
Body mass index, n (%)				
Underweight	3 (1.80)	65 (3.03)		
Normal weight	70 (41.92)	1081 (50.47)	Reference (underweight/normal)	
Overweight	53 (31.74)	691 (32.26)	1.204 (0.835–1.736)	0.320
Obesity	41 (24.55)	305 (14.24)	2.110 (1.411–3.157)	⩽0.001
Smoking habits, n (%)				
Never-smoker	69 (41.32)	1094 (51.07)	Reference	
Current smoker	59 (35.33)	399 (18.63)	2.34 (1.626–3.380)	⩽0.001
Past smoker	39 (23.35)	649 (30.30)	0.95 (0.636–1.428)	0.815
Worked in a dusty place for more than a year, n (%)	44 (26.35)	323 (15.08)	2.01 (1.40–2.90)	⩽0.001
Moisture, such as mould and fungi, in the home, n (%)	45 (26.95)	571 (26.66)	1.01 (0.71–1.45)	0.935
Pets at home (cat or dog), n (%)	80 (47.90)	863 (40.29)	1.36 (0.99–1.87)	0.055
Asthma, n (%)	26 (15.57)	182 (8.50)	1.99 (1.27–3.10)	0.003

TABLE 3 Factors associated with chronic cough (multivariable logistic regression)

Factor	OR (95% CI)	p-value
Age	1.03 (1.020–1.046)	⩽0.001
Marital status		
Married	Reference	
Single/divorced/widowed	1.52 (1.100–2.109)	0.011
Smoking habits		
Never-smoker	Reference	
Current smoker	2.12 (1.454–3.088)	⩽0.001
Past smoker	0.72 (0.474–1.098)	0.127
Body mass index		
Underweight/normal	Reference	
Overweight	1.09 (0.749–1.596)	0.643
Obesity	1.93 (1.271–2.934)	0.002
Asthma	1.843 (1.158–2.934)	0.010
Worked in a dusty place for more than a year	1.776 (1.219–2.585)	0.003
Pets at home (cat or dog)	1.397 (1.006–1.939)	0.046

Healthcare utilisation

Regarding the use of medical facilities to treat chronic cough, 35.33% (n=59) had been treated in the past but not currently and 28.74% (n=48) were undergoing treatment in a medical facility (figure S1). The most diagnosed causes of chronic cough among those who consulted a physician were rhinosinusitis (16.82%), COPD (10.28%), asthma (9.35%) and gastro-oesophageal reflux disease (7.48%). It should be noted that 23.36% of patients who consulted a doctor were not diagnosed with a cause (figure 2).

Impact on daily life

Regarding the impact of chronic cough on daily life and the level of concern, 18% reported that the cough interfered with their daily life and 55% reported that their cough was troublesome even though they have no problems in daily life (figure S2). The most troublesome situations caused by chronic cough were waking up at night during sleep, difficulty making conversation and discomfort with other people. Only 22.75% of the respondents stated that they had no problems with chronic cough in their daily life (figure S3).

Almost half of the patients (48%) reported suffering from cough every day and 9% had it 4–6 days a week (figure S4). Patients with subacute and chronic cough reported more difficulties in maintaining a conversation and that their cough caused significant discomfort to other people (table 4).

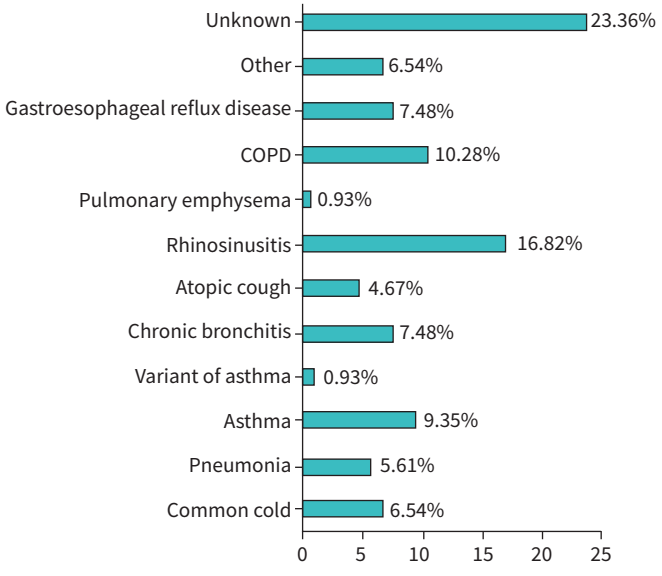

FIGURE 2 Diagnosed causes of cough among individuals with chronic cough who consulted a physician. "Other" includes vocal cord problems (n=2), smoking (n=2), bronchiectasis (n=2) and viral infection (n=1).

TABLE 4 Impact of cough in daily life

	Acute cough (n=138)	Subacute cough (n=49)	Chronic cough (n=167)
How bothersome are your cough symptoms currently, n (%)			
Does not cause any discomfort	10 (7.25)	2 (4.08)	14 (8.38)
No issues in daily life and almost no discomfort	36 (26.09)	11 (22.45)	32 (19.16)
No issues in daily life, but uncomfortable	78 (56.52)	27 (55.10)	91 (54.49)
Issues in daily life	14 (10.14)	9 (18.37)	30 (17.96)
The most bothersome consequence of the cough in daily life, n (%)			
Waking up during the night while sleeping	31 (22.46)	9 (18.37)	31 (18.56)
Unable to fall asleep	16 (11.59)	4 (8.16)	11 (6.59)
Unable to concentrate on work, household tasks or study	4 (2.90)	5 (10.20)	3 (1.80)
Having difficulties during eating	5 (3.62)	0	2 (1.20)
Having difficulties while driving a car	0	0	1 (0.60)
Having difficulties in maintaining a conversation	6 (4.35)	6 (12.24)	17 (10.18)
Restrictions on what you can do or eat	1 (0.72)	0	5 (2.99)
Causes discomfort to other people	10 (7.25)	6 (12.24)	17 (10.18)
Feeling embarrassed to cough in front of other people	9 (6.52)	2 (4.08)	10 (5.99)
Having difficulties during travel on public transportation	10 (7.25)	1 (2.04)	7 (4.19)
Having difficulties when going out, outdoors	3 (2.17)	0	0
Activity restriction, unable to exercise	3 (2.17)	2 (4.08)	7 (4.19)
Having urinary incontinence	8 (5.80)	2 (4.08)	11 (6.59)
Other	1 (0.72)	2 (4.08)	7 (4.19)
No specific discomfort	31 (22.46)	10 (20.41)	38 (22.75)

There was a higher proportion of females and current smokers amongst the participants with chronic cough who reported that the cough interfered with their daily living (table S2). A slightly higher percentage of participants in this group were overweight. Finally, this group also had a higher percentage of participants with asthma and with a history of working in a dusty environment.

Discussion

The prevalence of chronic cough has been studied by different authors [6]; however, few studies were conducted in a community-based setting. Chronic cough estimates depend on the definition used, as well as on the period and region of the world considered. In our study, we aimed to investigate the prevalence of chronic cough in an adult community-dwelling population in Portugal. We found a point prevalence of 7.23%, indicating that chronic cough is a relatively common problem in the population studied, even during the summer when respiratory conditions tend to improve. This prevalence is higher than those found in other studies that used the same definition of chronic cough, conducted in Europe [22–25], USA [26] and Asia [18, 27]. Those studies reported prevalences between 2.2% in Japan [18] and 6.3% in Italy [25].

Studies using other definitions that considered chronic cough as cough without having a cold on most days for at least 3 months each year, achieved higher prevalences, such as the BOLD study, in which the prevalences for Western Europe, North America and East Asia were 12.6%, 18.8% and 6.7%, respectively [28].

According to our study, chronic cough is not a rare phenomenon, showing a relatively high prevalence, suggesting that there is a great demand for health services addressing this issue and that proper strategies should be developed to tackle it.

Like previous authors [18, 29], we also conducted an online survey using a questionnaire adapted from the study by Fujimura [18]. The answer rate was 31.7%, which corresponds to the traditional range of 25–30% [30]. This indicates a good level of engagement from participants and contributes to the robustness of the data.

According to the literature [6], western countries present lower prevalences of chronic cough than Asian countries. This could be related not only to climate and air quality differences, but also to healthcare access, lifestyle and occupational factors, as well as cultural and genetic characteristics of the studied populations.

Our results show that chronic cough is more common in current smokers, people with a history of exposure to dusty work environments, obese people and individuals with asthma. This is in line with previous studies that also concluded that these characteristics are risk factors for chronic cough [6]. In addition, patients with chronic cough in our study were more likely to have pets at home and to be single/widowed and divorced, emphasising the importance of environmental and social factors for this condition.

Pets contribute to higher levels of allergens at home environments, such as dander and house dust mites, which may trigger respiratory conditions [31], particularly in those who are sensitised. The relationship between social factors and chronic cough should be further investigated to better understand the possible underlying mechanisms.

A high proportion of patients with chronic cough had already been treated or were undergoing treatment and the majority had a disease diagnosis. The most common were the diseases of the 3R spectrum (rhinosinusitis, asthma and gastro-oesophageal reflux disease) and COPD, although almost a quarter of chronic patients who consulted a doctor did not have a diagnosed cause for their cough. Patients who did not fit into any disease category could have unexplained chronic cough and this proportion (23.36% in our study) is similar to that reported in the Rotterdam study [32].

Most patients felt that the chronic cough interfered with daily life or was troublesome, suggesting that it had a negative impact on the patient's quality of life, an outcome that is often neglected. The need to offer personalised interventions that include psychological or social support could improve the effectiveness of pharmacological treatment and well-being [33].

One strength of our study is the large sample size, which allows an accurate estimation of chronic cough in the studied population. In addition, the community-based sample provides better and more accurate information from the people living in the area where the study was conducted. Conducting the study in summer, when respiratory symptoms usually improve, has also shown how persistent chronic cough can be and suggests that the prevalence may be higher in other seasons. The detailed analysis of risk factors also contributes to a better understanding of chronic conditions in order to improve their management.

Our study also has some weaknesses that need to be considered when interpreting the results. First the reliance on self-report introduces information bias which limits the ability to establish a causal relationship between risk factors and chronic cough. Additionally, self-reported measures may lead to inaccuracies due to recall bias.

Furthermore, conducting the study in a specific region limits its generalisability to other regions of Portugal. We should also note that the EpiCOUGH sample included more middle-aged participants and fewer young and elderly people, leading to nonresponse bias. In this sense, the results should be discussed with some caution in relation to the population of ACES Lisboa Central, particularly in these less-represented strata.

This study emphasises the importance of risk factors such as age, smoking, obesity and environmental exposures, which could be further investigated in long-term follow-up studies. These studies would help establish causal relationships and track the progression of chronic cough over time. Furthermore, investigating the effectiveness of personalised interventions targeting these risk factors could improve patient outcomes.

Conclusion

Our data stress the need to address patients with chronic cough using strategies that include smoking cessation, weight loss, reduction of occupational exposure, improvement of the home environment and support within the social framework. The significant proportion of patients with unexplained chronic cough also highlights the complexity of managing chronic cough and the need for more research on diagnostic tools and on new pharmacologic approaches to improve patient outcomes. The impact of cough on daily life also points to the importance of a comprehensive intervention, which should include psychological and social support, in addition to pharmacological treatment directed to the underlying cause(s).

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