Burden of chronic cough in the UK: results from the 2018 National Health and Wellness Survey

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Shareable abstract (@ERSpublications)
The prevalence and burden of chronic cough (daily cough for ⩾8 weeks) in the UK are poorly defined. This article reports an estimated 12-month prevalence of chronic cough in the UK of 4.9% and a lifetime prevalence of 6.2%. https://bit.ly/40YcEBY

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Abstract

Background Chronic cough, defined as daily cough for at least 8 weeks, negatively affects quality of life and work productivity and increases healthcare resource utilisation. We aimed to determine the prevalence and burden of chronic cough in the UK.

Methods Study participants were general population respondents to the 2018 UK National Health and Wellness Survey (NHWS). Respondents completed survey questions relating to health, quality of life, work productivity and activity impairment, and use of healthcare resources. Prevalence estimates were projected to the UK population using post-stratification sampling weights to adjust for sampling bias. The population with chronic cough was matched 1:3 with a group without chronic cough, using propensity score matchingon age, sex and the modified Charlson Comorbidity Index.

Results Of 15 000 NHWS respondents, 715 reported chronic cough in the previous 12 months and 918 during their lifetime. Weighted to the UK adult population, the 12-month prevalence of chronic cough was 4.9% and lifetime prevalence was 6.2%. Prevalence of chronic cough was higher among older respondents and those with smoking histories. Chronic cough respondents experienced higher rates of severe anxiety and depression in the past 2 weeks than matched controls. Poor sleep quality and loss of work productivity were also observed. More chronic cough respondents visited a healthcare provider in the past 6 months than respondents without chronic cough with a mean of 5.8 and 3.7 visits per respondent, respectively.

Conclusion Adults with chronic cough report lower quality of life, reduced work productivity and greater healthcare resource utilisation than matched controls without chronic cough.

Introduction

British and European guidelines define chronic cough in adults as a daily cough lasting at least 8 weeks [1, 2]. Chronic cough can occur as a symptom of other chronic conditions including asthma and gastro-oesophageal reflux disease [1–4].

The prevalence of chronic cough in adults in the UK has not been accurately determined. Previous estimates are limited by their definition of chronic cough, scale or population of interest. A meta-analysis published in 2015 estimated the overall regional prevalence of chronic cough in European countries as 12.7% [5]. Furthermore, a survey of 9077 residents of southeast England reported that 12.2% of respondents experienced coughing on at least half the days of the year, but the survey did not include questions about duration of daily cough and the sample population included both children aged ⩾5 years and adults [6]. Similarly, the prevalence of chronic cough (defined as greater than weekly coughing bouts) was 12% among 4003 respondents aged 50–59 years in West Yorkshire [7].

Chronic cough is associated with significant clinical burden and quality of life (QoL) impacts. Common comorbidities include acid and non-acid reflux, irritable bowel syndrome, asthma, obesity, COPD and sleep apnoea [7–10]. People with chronic cough can cough up to several hundred times per day and commonly report anxiety, depression, frustration, pain, fatigue and stress urinary incontinence, as well as cough-associated impairment of work productivity and social activities [11–20]. In addition, chronic cough is a frequent cause of visits to primary and secondary healthcare providers and is associated with higher rates of healthcare resource use (HCRU) [9, 21, 22]. However, population-level systematic comparisons of health, QoL, HCRU and work productivity in people with and without chronic cough have not been performed, and thus the burden of chronic cough in the UK is not well characterised.

The objective of this study was to describe the prevalence of self-reported chronic cough in the adult UK population. We also aimed to describe patients' demographics, health characteristics, QoL and HCRU compared to matched non-chronic cough general population controls.

Methods

Study subjects

Subjects were respondents to the UK National Health and Wellness Survey (NHWS) between April and July 2018. The NHWS is a self-administered, internet-based surveys conducted annually in the UK and other countries. Potential respondents to the NHWS were recruited through an existing general-purpose web-based consumer panel using targeted quota sampling according to age and sex to ensure a demographic composition broadly representative of the UK adult population. Adult respondents aged ⩾18 years who could read and write in English were eligible to complete the 2018 UK NHWS.

Respondents with lifetime chronic cough were those who answered "yes" to the question "Have you ever experienced chronic cough (daily, for 8 weeks or longer)?" Respondents with 12-month chronic cough were those who answered "yes" to the question "Have you experienced chronic cough (daily, for 8 weeks or longer) within the past 12 months?".

NHWS respondents with chronic cough in the past 12 months were matched 1:3 with respondents without chronic cough by propensity score, using criteria of age (as a continuous variable), sex and the modified Charlson Comorbidity Index (mCCI; modified to exclude COPD). COPD was excluded from the matched Charlson Comorbidity Index (CCI) score as COPD is a condition commonly associated with chronic cough. Propensity scores were estimated as regression probability using logistic regression modelling, controlling for age (as a continuous variable), sex and mCCI. To substantiate the representativeness of UK samples within the 2018 NHWS respondents, descriptive comparisons between NHWS data and publicly available population data were generated (supplementary Table S1).

The study protocol and survey were granted exemption from review by the Pearl Institutional Review Board. Respondents were informed of study details and provided their consent to participate online immediately before completing the NHWS. No identifiable personal information was included in the anonymised survey.

Study design

This cross-sectional matched study was designed to estimate the prevalence of self-reported chronic cough in the UK. The secondary objectives were to describe the sociodemographic characteristics of adults with chronic cough, and to characterise the burden of chronic cough by collecting patient-reported information on health characteristics and QoL, sleep difficulties, and work and activity impairment, as well as HCRU, compared to adults without chronic cough.

Methods

The NHWS survey assessed demographics, health and wellness history and HCRU. The NHWS survey included validated patient-reported health outcome instruments.

Health-related QoL was measured using the Medical Outcomes Study 12-item Short Form Survey Version 2 (SF-12v2; QualityMetric Inc., Lincoln, RI, USA) [23], the six-dimensional health state short form (SF-6D) [24] and the EuroQol 5-Dimension Health Questionnaire (EQ-5D) (EQ-5D-5L™; EuroQol Research Foundation) [25]. The SF-12v2 survey is calculated with the mean score set at 50 and the standard deviation at 10 with higher scores representing better health. The SF-6D health utility score is derived from the SF-12v2 and is a preference-based health utility index, with 0 representing death and 1 perfect health [24]. The composite index score was reported for the EQ-5D descriptive system, with 0 representing death and 1 the best possible health state. The EQ-5D also includes a vertical visual analogue scale (VAS),

asking respondents to indicate on a number line their self-rated health for that day with 0 representing the "worst imaginable health state" and 100 representing the "best imaginable health state".

Self-reported anxiety was assessed using the General Anxiety Disorder 7-item scale (GAD-7) [26]. Respondents were asked to rate the frequency of seven anxiety symptoms in the last 2 weeks ranging from 0 (not at all) to 3 (nearly every day) with severe anxiety indicated by a score of 15–21.

Self-reported depression was assessed with the Patient Health Questionnaire 9-item scale (PHQ-9) [27]. Respondents rated the frequency of depressive symptoms in the last 2 weeks ranging from 0 (not at all) to 3 (nearly every day). A score of 20–27 represents severe depression.

All respondents to the NHWS were asked whether they had ever experienced sleep apnoea and among those, whether they had received a physician's diagnosis of sleep apnoea. To measure difficulties with sleeplessness or difficulty sleeping, respondents were asked whether they regularly experience each of: difficulty falling asleep, waking during the night and not being able to get back to sleep, waking up several times during the night, waking up too early (such as before the alarm clock), sleep apnoea, poor quality of sleep, daytime sleepiness and difficulty staying awake.

The Work Productivity and Activity Impairment Questionnaire consists of four metrics: absenteeism (the percentage of work time missed because of one's health in the past 7 days), presenteeism (the percentage of impairment experienced while at work in the past 7 days because of one's health), overall work productivity loss (an overall impairment estimate that is a combination of absenteeism and presenteeism) and activity impairment (the percentage of impairment in daily activities outside of work because of one's health in the past 7 days) [28]. Only respondents who reported being employed part- or full-time were prompted to provide data for absenteeism, presenteeism and total work impairment. All respondents provided data for activity impairment.

HCRU was defined by the occurrence (yes/no) as well as the number of visits to healthcare providers within the past 6 months for any cause. Visits to any healthcare provider, as well as visits to selected specialists, the emergency department (ED) and hospitalisations are reported.

Analysis

Prevalence was calculated as the proportion of the 15 000 UK NHWS respondents who reported having chronic cough anytime in their lifetimes and in the prior 12 months. Estimates of 12-month prevalence were also calculated in demographic subgroups by age, sex and smoking status. Smoking was defined as current and former smokers *versus* those who had never smoked.

Prevalence estimates were projected to the 2018 UK population using post-stratification Horvitz–Thomas sampling weights calculated from the Organization for Economic Cooperation and Development to weight the UK data based on age and sex [29] to adjust for sampling bias. The denominators for prevalence estimates were the number of adults who completed the 2018 UK NWHS (N=15 000) and weighted equivalents (N=51 514 995).

All other comparisons between the matched populations with and without chronic cough were conducted on the unweighted data using either two-tailed t-tests or the chi-squared test. $p<0.05$ was considered statistically significant.

Results

Prevalence of chronic cough

In 2018, 15 000 adults completed the UK NHWS. Of those, 918 (6.1%) reported having had chronic cough at some point in their lifetime and 715 (4.8%) reported experiencing chronic cough in the past 12 months. Weighted prevalence estimates for the UK population were 6.2% for lifetime chronic cough and 4.9% for chronic cough in the prior 12 months, and were higher among older age groups (6.4% among $\geqslant$65 years) and among current and former smokers (6.3%) (table 1).

Sociodemographic information

As expected, NHWS respondents who reported chronic cough in the prior 12 months (n=715) had similar sex and age distributions with propensity-score matched controls without chronic cough (n=2145; table 2). The distribution of employment status, household income and education level between the two groups was also similar.

TABLE 1 Chronic cough lifetime and 12-month prevalence estimates among UK adults

Characteristic	Total NHWS sample	Chronic cough prevalence			
		Lifetime		12-month period	
		Unweighted	Weighted[#]	Unweighted	Weighted[#]
Total	15 000 (100)	918 (6.1)	6.2	715 (4.8)	4.9
Sex					
Male	6591 (43.9)	368 (5.6)	5.5	299 (4.5)	4.4
Female	8409 (56.1)	550 (6.5)	6.8	416 (4.9)	5.3
Age, years					
18–29	2960 (19.7)	155 (5.2)	5.4	110 (3.7)	3.9
30–39	2476 (16.5)	129 (5.2)	5.3	92 (3.7)	3.7
40–49	2498 (16.7)	148 (5.9)	5.7	110 (4.4)	4.3
50–64	3651 (24.3)	250 (6.8)	6.8	194 (5.3)	5.3
⩾65	3415 (22.8)	236 (6.9)	7.2	209 (6.1)	6.4
Smoking status					
Never smoked	8124 (54.2)	387 (4.8)	4.7	294 (3.6)	3.7
Current or former smoker	6876 (45.8)	531 (7.7)	7.9	421 (6.1)	6.3

Data are presented as n (%). Weighted data values are presented as % only. NHWS: National Health and Wellness Survey. [#]: prevalence estimates were projected to the 2018 UK population using post-stratification Horvitz–Thomas sampling weights calculated from the Organization for Economic Cooperation and Development to weight the UK data based on age and sex [29].

Health-related characteristics

Health-related characteristics are compared between chronic cough respondents and their matched controls in table 3 and figure 1. Compared to respondents without chronic cough, chronic cough respondents had similar mCCI (mean: 0.59 *versus* 0.63; p=0.53), but were significantly more likely to have a history of smoking (58.9% *versus* 48.0%), be obese (27.8% *versus* 22.9%), not exercise (49.8% *versus* 42.5%) and

TABLE 2 Sociodemographic characteristics of respondents with and without chronic cough in the past 12 months[#]

Characteristic	Chronic cough	Matched controls without chronic cough	p-value[¶]
Respondents n	715	2145	
Sex			0.60
Male	299 (41.8)	873 (40.7)	
Female	416 (58.2)	1272 (59.3)	
Age, years			0.95
18–29	110 (15.4)	311 (14.5)	
30–39	92 (12.9)	266 (12.4)	
40–49	110 (15.4)	323 (15.1)	
50–64	194 (27.1)	605 (28.2)	
⩾65	209 (29.2)	640 (29.8)	
Employment status[+]			0.12
Employed	328 (45.9)	1056 (49.2)	
Not employed	387 (54.1)	1089 (50.8)	
Household income			0.38
<£40 000/declined to answer	550 (76.9)	1615 (75.3)	
⩾£40 000	165 (23.1)	530 (24.7)	
Education level			0.16
Not completed university/declined to answer	495 (69.2)	1424 (66.4)	
Completed university	220 (30.8)	721 (33.6)	

Data are presented as n (%). [#]: respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents with no chronic cough in the last 12 months; [¶]: p-values for chronic cough *versus* non chronic cough were calculated for weighted values using the chi-squared test; [+]: employed category includes individuals who are full-time, part-time or self-employed, and not employed category includes individuals who are unemployed, disabled, retired, students or homemakers.

TABLE 3 Health characteristics of respondents with chronic cough and matched controls without chronic cough in the past 12 months[#]

Characteristic	Chronic cough	Matched controls without-chronic cough	p-value[¶]
Respondents n	715	2145	
Physician-diagnosed COPD	94 (13.1)		
mCCI, mean±SD	0.63±1.33	0.59±1.24	0.53
Number of comorbidities			0.58
0 comorbidities	486 (68.0)	1474 (68.7)	
1 comorbidity	126 (17.6)	394 (18.4)	
⩾2 comorbidities	103 (14.4)	277 (12.9)	
Smoking status			<0.001
Current smoker	210 (29.4)	352 (16.4)	
Former smoker	211 (29.5)	678 (31.6)	
Never-smoker	294 (41.1)	1115 (52.0)	
Alcohol consumption			0.10
None	149 (20.8)	465 (21.7)	
<1–3 times per week	442 (61.8)	1379 (64.3)	
>3 times per week	124 (17.3)	301 (14.0)	
Body mass index			<0.001
Obese (⩾30.0 kg·m^{-2})	199 (27.8)	491 (22.9)	
Not obese/unknown or declined to answer	516 (72.2)	1654 (77.1)	
Exercise[+]			<0.001
Yes	359 (50.2)	1233 (57.5)	
No	356 (49.8)	912 (42.5)	
Anxiety severity[§]			<0.001
None (0–4)	307 (42.9)	1428 (66.6)	
Mild (5–9)	179 (25.0)	418 (19.5)	
Moderate (10–14)	115 (16.1)	186 (8.7)	
Severe (⩾15)	114 (15.9)	113 (5.3)	
Depression severity[f]			<0.001
None–minimal (0–4)	245 (34.3)	1283 (59.8)	
Mild (5–9)	168 (23.5)	413 (19.3)	
Moderate (10–14)	112 (15.7)	235 (11.0)	
Moderately severe (15–19)	99 (13.8)	123 (5.7)	
Severe (⩾20)	91 (12.7)	91 (4.2)	

Data are presented as n (%) unless stated otherwise. mCCI: modified Charlson Comorbidity Index.[#]: respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and CCI (modified to exclude COPD) with respondents with no chronic cough in the last 12 months. [¶]: p-values for chronic cough *versus* no chronic cough were calculated for weighted values using the chi-squared test.[+]: an answer of Yes indicates that the respondent exercised vigorously for at least 20 min at least 1 day in the past month for the purpose of improving or maintaining health, to lose weight or for enjoyment. [§]: anxiety symptoms over the prior 2 weeks on the 0–21 General Anxiety Disorder 7-item scale [26]. [f]: depression symptoms over the prior 2 weeks on the 0–27 Patient Health Questionnaire 9-item scale [27].

have higher rates of anxiety (57.1% *versus* 33.4%) and depression (65.7% *versus* 40.2%) in the past 2 weeks (table 3; p<0.001 for all comparisons). Almost twice as many respondents with chronic cough reported having moderate anxiety symptoms in the prior 2 weeks, and three times as many reported severe anxiety symptoms compared with respondents without chronic cough (p<0.001). Those with chronic cough more frequently reported suffering from mild to severe depression symptoms, including three times as many who reported severe depression symptoms (p<0.001; table 3 and figure 1), compared to matched controls.

Health-related QoL

Chronic cough respondents scored lower (indicating worse health) on the SF-12v2 module than did matched controls without chronic cough: 41.7 *versus* 47.1 (mental health component) and 43.4 *versus* 48.7 (physical health component; p <0.001 for each; table 4). Chronic cough respondents scored lower than those without chronic cough on both the SF-6D (0.63 *versus* 0.72; p<0.001) and EQ-5D (0.71 *versus* 0.81; p<0.001). On the EQ-5D-5L VAS scale, respondents with chronic cough scored 17% lower (indicating worse health) than those with chronic cough (59.3 *versus* 70.5; p<0.001).

TABLE 4 Health outcomes of respondents with chronic cough compared to matched controls without chronic cough in the past 12 months[#]

Summary score	Chronic cough[¶]		Matched controls without chronic cough[+]		p-value[§]
	n	Mean±SD	n	Mean±SD	
SF-12v2					<0.001
Mental component	715	41.7±11.5	2145	47.1±10.7	
Physical component	715	43.4±11.3	2145	48.7±10.7	
SF-6D					
Utility	715	0.63±0.14	2145	0.72±0.15	<0.001
EQ-5D-5L					<0.001
VAS score	715	59.3±25.7	2145	70.5±24.5	
Utility	715	0.71±0.19	2145	0.81±0.18	
Productivity impairment (% of work hours missed in the past 7 days)[f]					<0.001
Absenteeism	307	17.0±28.9	996	8.0±21.3	
Presenteeism	299	35.9±29.5	974	20.2±27.0	
Overall work impairment	307	42.3±35.0	996	24.3±31.8	
Activity impairment %	715	44.2±30.7	2145	27.9±30.4	<0.001

SF-12v2: Medical Outcomes Study 12-item Short Form Survey Version 2; EQ-5D-5L: EuroQol 5-Dimension Health Questionnaire ; VAS: visual analogue scale. [#]: respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents with no chronic cough in the last 12 months; [¶]: n=715; [+]: n=2145; [§]: p-values for chronic cough *versus* no chronic cough were calculated for weighted values using the two-tailed t-test; [f]: results reported among employed respondents only.

Chronic cough respondents reported experiencing 16% greater daily activity impairment in the prior 7 days than did the matched controls (p<0.001; table 4). Among employed respondents, those with chronic cough reported more than twice the level of absenteeism (p<0.001) and a 15% higher rate of presenteeism (p<0.001) in the prior week than those without chronic cough (table 4 and figure 2). Overall, employed chronic cough respondents experienced higher rates of overall work productivity impairment in the prior week compared with matched controls (p<0.001).

Chronic cough respondents reported overall more sleep disturbances than their matched controls (table 5). More than twice as many chronic cough respondents reported regularly experiencing sleep apnoea than did

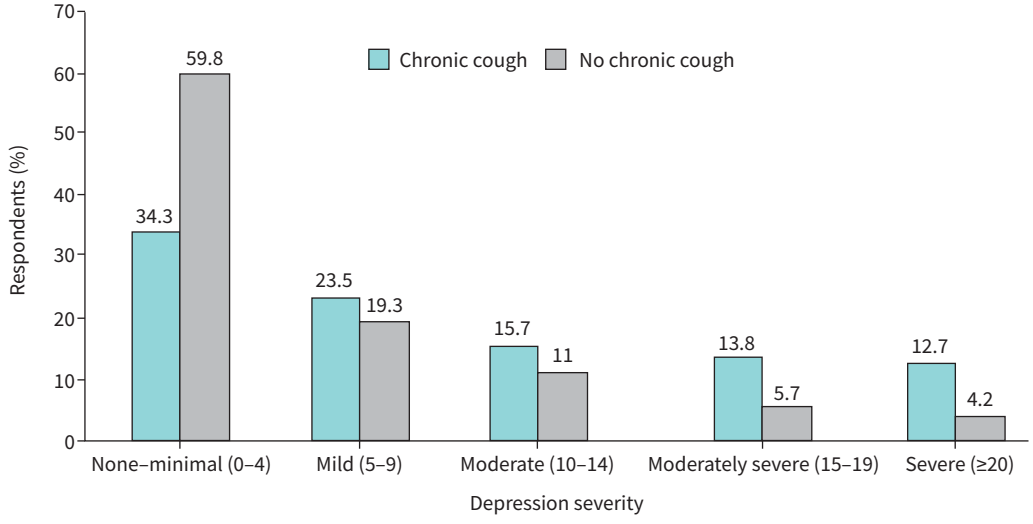

FIGURE 1 Depression severity (Patient Health Questionnaire 9-item (PHQ-9) scale) by chronic cough status. Respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents without chronic cough in the last 12 months. Depression symptoms over the prior 2 weeks were assessed on a scale of 0–27 using the PHQ-9 module [27]. n=715 (chronic cough); n=2145 (no chronic cough).

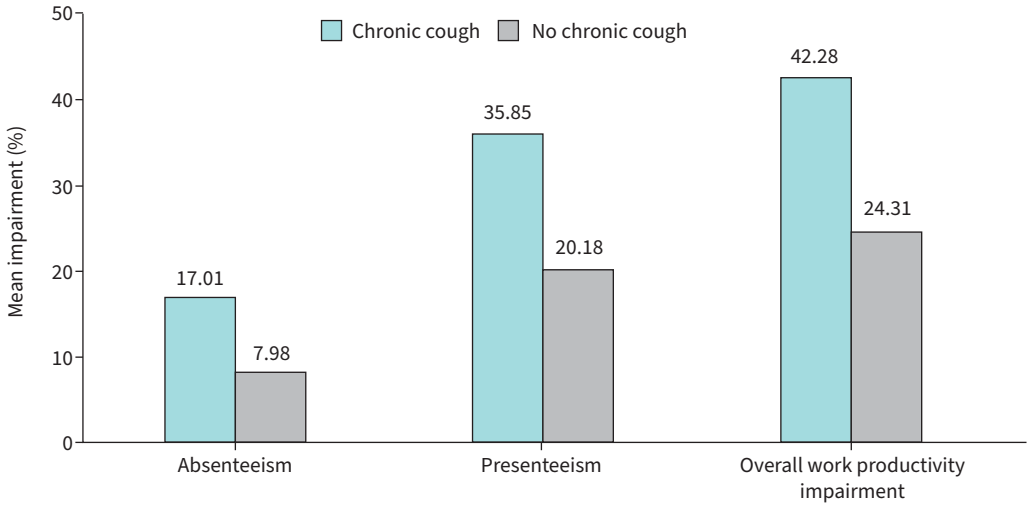

FIGURE 2 Work productivity loss by chronic cough status. Respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents without chronic cough in the last 12 months. Employed respondents (including full-time, part-time and self-employment) were asked to provide information about their absenteeism (percentage of work time missed because of one's health in the past 7 days), presenteeism (percentage of impairment experienced while at work in the past 7 days because of one's health) and total work productivity loss (an overall impairment estimate that is a combination of absenteeism and presenteeism). n=307 (chronic cough); n=996 (no chronic cough).

respondents without chronic cough (p<0.001). Between one-third and 45% of chronic cough respondents reported regularly experiencing difficulty falling asleep, waking during the night and being unable to get back to sleep, waking up several times during the night, waking too early, having a poor quality of sleep and daytime sleepiness, whereas between one-quarter and one-third of respondents without chronic cough reported the same (p<0.001 for each comparison). Twice as many chronic cough respondents reported regularly experiencing difficulty staying awake than did matched controls (p<0.001).

Healthcare resource use

While the majority of each group had visited a healthcare provider in the past 6 months, more chronic cough respondents had done so than had respondents without chronic cough (p<0.001) with a mean of 5.8

TABLE 5 Experience with sleep problems or symptoms in respondents with and without chronic cough in the past 12 months[#]

Problem or symptom	Chronic cough	Matched controls without chronic cough	p-value[¶]
Respondents n	715	2145	
Sleep apnoea, experienced during lifetime[+]	105 (14.7)	120 (5.6)	<0.001
Sleep apnoea, physician-diagnosed[+]	40 (5.6)	64 (3.0)	<0.001
Regularly experienced sleep disturbances			
Difficulty falling asleep	323 (45.2)	678 (31.6)	<0.001
Waking during night and not being able to get back to sleep	295 (41.3)	653 (30.4)	<0.001
Waking several times during night	283 (39.6)	573 (26.7)	<0.001
Waking up too early, such as before the alarm clock	275 (38.5)	552 (25.7)	<0.001
Sleep apnoea[+]	72 (10.1)	88 (4.1)	<0.001
Poor quality of sleep	281 (39.3)	495 (23.1)	<0.001
Daytime sleepiness	288 (40.3)	515 (24.0)	<0.001
Difficulty staying awake	149 (20.8)	182 (8.5)	<0.001

Data are presented as n (%) unless stated otherwise. [#]: respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents with no chronic cough in the last 12 months; [¶]: p-values for chronic cough *versus* no chronic cough were calculated for weighted values using the chi-squared test; [+]: sleep apnoea defined as the temporary absence of breathing.

and 3.7 visits per respondent, respectively (p<0.001; figure 3 and supplementary Table S2). Compared with matched controls, respondents with chronic cough were almost twice as likely to have visited the ED or to have been hospitalised during the prior 6 months (p<0.001 for each). During that period, chronic cough respondents had a mean of 0.35 hospitalisations and 0.48 ED visits each as compared to matched controls' 0.18 hospitalisations and 0.20 ED visits (p⩽0.002 for both). More chronic cough respondents visited a general or family practitioner, nurse practitioner/physician assistants, respiratory therapists, gastroenterologists and pulmonologists compared to matched controls (p<0.001 for each).

Discussion

In a representative sample of 15 000 adult UK residents, 4.8% reported chronic cough lasting ⩾8 weeks during the last 12 months, with a lifetime prevalence of 6.1%. When projected to the general population, we estimate a 12-month prevalence of 4.9% and lifetime prevalence of 6.2% for chronic cough among UK adults. Chronic cough was more prevalent in women than men and in respondents ⩾50 years old. Compared to matched controls without chronic cough, respondents with chronic cough were more likely to be obese and to be smokers. Adults with chronic cough reported poorer mental and physical health and QoL, with significantly higher rates of moderate/severe anxiety, mild to severe depression and sleep disturbances. Adults with chronic cough were more likely to visit emergency, general, and specialist respiratory or gastroenterology healthcare providers. Chronic cough was associated with impairment of daily activities and with reduced work productivity among employed respondents.

We present, to our knowledge, the first UK general population prevalence estimate for adult chronic cough that uses the definition of daily cough for at least 8 weeks. Our 12-month prevalence estimate of 4.9% is similar to the 5% prevalence estimate for daily cough during the prior 2 months that was reported in a previous English study, although respondents in the study were selected from a *Helicobacter pylori* screening and treatment cohort rather than a general population sample and participation was restricted to respondents aged 50–59 years [7]. A 2021 database study including records of adults 18 years and older from a northwest London dataset identified chronic cough in 2% of the population [30]. In this study, patients with chronic cough were defined as those with two or more recorded consultations coded as "cough-related" persisting for at least 8 weeks. These estimates may under-report the prevalence of chronic cough in the UK as they are limited by generalisability and potential coding omissions and errors, noting also that free text chart entries were not extracted into the dataset and therefore could not be analysed. The

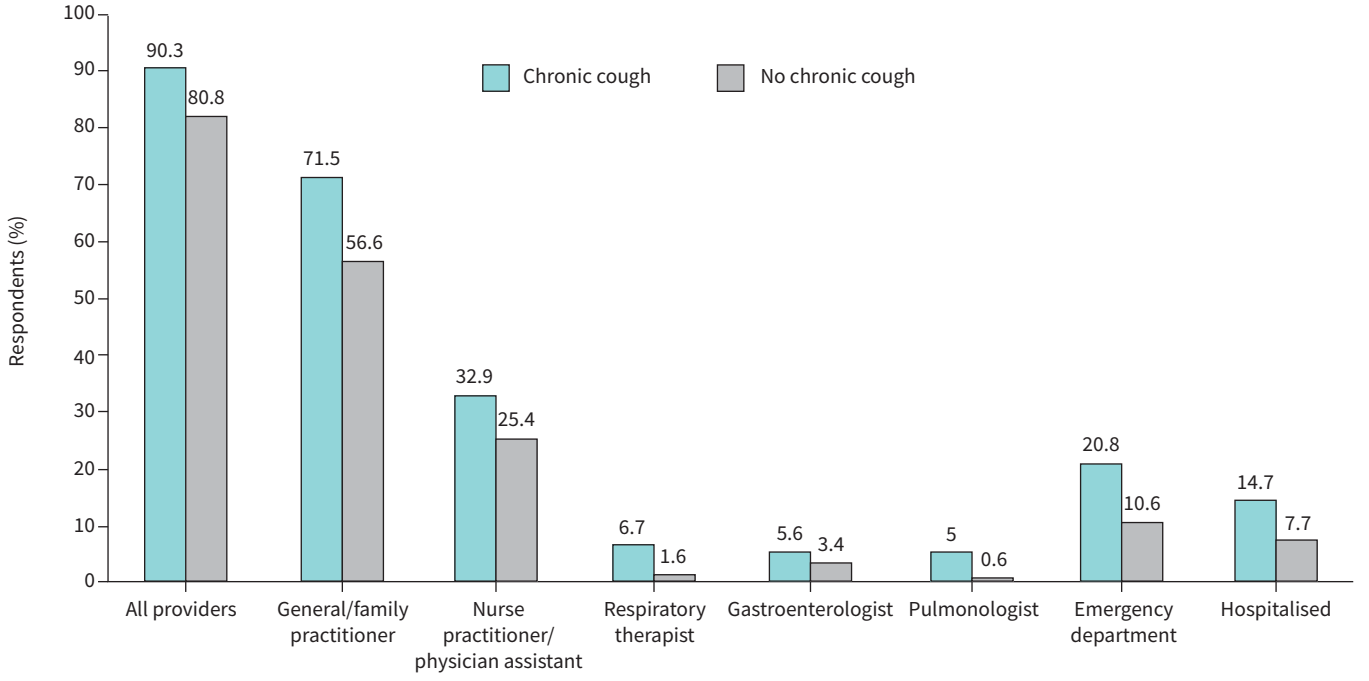

FIGURE 3 Healthcare resource use by chronic cough status. Respondents with chronic cough in the last 12 months were matched 1:3 for age, sex and Charlson Comorbidity Index (modified to exclude COPD) with respondents without chronic cough in the last 12 months. All respondents provided yes/no answers to questions about healthcare resource use over the prior 6 months. n=715 (chronic cough); n=2145 (no chronic cough).

previously mentioned 2015 meta-analysis reported a global overall prevalence of 9.6% and a European prevalence of 12.7%; however, the 90 studies included in the meta-analysis used a total of 19 different definitions of chronic cough, largely relying on older clinical guidelines that defined chronic cough as daily cough for ⩾3 months [5]. Only three of the included studies in the meta-analysis used the current 8-week definition, with the English study described above being the only one of these three studies to report on a European population. Further, only 16 of the 90 studies included in the meta-analysis assessed chronic cough as their primary outcome [5]. In addition to our prevalence estimates, we identified associations between chronic cough prevalence and sex, age, smoking history and obesity, in line with similar findings from previous studies [7, 9, 31].

Our age-, sex- and comorbidity-based matching strategy provides a unique comparison between people with and without chronic cough using a representative sample of the general UK population, allowing a more accurate characterisation of the burden of chronic cough in the UK. Previous studies have generally reported on the patient burden of chronic cough in specialised samples. For example, a study of a small group of UK cough clinic patients (n=67 matched to n=22 controls) identified associations between chronic cough and anxiety, depression and fatigue [16], and an analysis of a group of specialist-diagnosed patients from the USA matched to controls without chronic cough provided evidence for an association between chronic cough and obesity as well as higher HCRU [9].

Chronic cough has impacts on both physical and mental health [32, 33] with the impact on QoL reported to be similar to that of other respiratory diseases including COPD, asthma and bronchiectasis [34]. A number of studies have described the burden of chronic cough in patients who were not matched to controls without chronic cough, identifying high rates of sleep disturbances, anxiety, depression, HCRU, and activity and work productivity impairments [8, 13–15, 17]. People with chronic cough have been reported to have higher rates of anxiety and somatisation compared to established normal ranges [17]. The current study adds to this body of literature, providing a detailed characterisation of the overall burden of chronic cough in the UK population.

The economic burden of chronic cough has not been studied extensively. However, chronic cough is likely to have a significant economic burden as it has been reported to impact job productivity [1, 35]. A Finnish survey of public service employees in two towns in Finland found that cough caused a substantial socioeconomic burden by increasing the probability of a doctor's visit and sick leave days with 16.0% of respondents with chronic cough taking 7 or more sick days and 20.3% having three or more doctor's visits due to cough within a 12-month period [36]. In a large general population sample of adults aged 20–44 years from Sweden, Norway, Denmark, Iceland and Estonia, respondents with broadly defined chronic cough (*i.e.*, those who answered "yes" to the question "Have you in recent years been troubled by a protracted cough?") were significantly more likely to have taken >7 days sick leave in the preceding year and to have lower self-reported work ability scores [18]. These results are in line with our finding that UK respondents with chronic cough have significantly higher rates of absenteeism, presenteeism and lower overall work productivity than matched controls, thus continuing to strengthen the evidence that chronic cough has an economic impact. Further, the 2021 North West London dataset study described previously reported that there was an increase in the number of investigations performed in the 12 months following a chronic cough diagnosis [30]. Primary care chest radiographs and spirometry increased by 49% and 34%, respectively, in the year after the chronic cough diagnosis [30]. This increase was accompanied by an increase in chronic cough-associated healthcare utilisation costs with annual per patient per year costs increasing by 62.85% after the chronic cough diagnosis [30].

Despite the strengths of this study, there are some study limitations. Our study participants were general population respondents to the 2018 UK NHWS, which uses quota sampling to mimic the age and sex distributions of the UK general population, ensuring that the country-wide sample is broadly representative of those features. However, employment status and income are not used as recruitment targets; thus there may be differences between employment and income levels observed in our study relative to the general UK population. Furthermore, the NHWS is a cross-sectional survey that does not allow causal conclusions to be drawn. Our analyses include many self-reported measures recalled over the prior calendar year, without physician confirmation of diagnosis or diagnostic testing; these limitations might introduce recall and self-presentation biases. Survey questions focused on more recent timeframes (*e.g.*, previous week, 2 weeks, or month) to reduce recall bias, and "don't know" and "refuse to answer" options were included for sensitive questions to reduce self-presentation bias. Further, we did not have a specific way to capture productive cough and, therefore, we could not further stratify our results by productive and non-productive cough. Lastly, our analysis did not exclude current smokers, a factor related to an increased prevalence of

chronic cough in the present study. Comparisons of our study with others should take into consideration this feature of our design, along with our 8-week definition of chronic cough.

In conclusion, we estimate that 4.9% of UK adults have experienced chronic cough in the preceding 12 months, and 6.2% during their lifetime. The prevalence of chronic cough is higher among older adults and in those with smoking history; chronic cough respondents tended to be more obese than matched controls. Adults with chronic cough report lower QoL and greater work productivity losses than those without chronic cough, and use more general, specialist respiratory and gastroenterology, and emergency HCRU. Our findings provide a detailed characterisation of the prevalence and burden of chronic cough in the UK that will inform future efforts to raise awareness, promote management strategies, develop effective treatments, and consider the educational and support needs of patients with chronic cough.

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