Lifting Dyspnoea Invisibility: COVID-19 Face Masks, the Experience of Breathing Discomfort, and Improved Lung Health Perception –a French Nationwide Survey

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Title

Lifting dyspnoea invisibility: COVID-19 face masks, the experience of breathing discomfort, and improved perception of the importance of respiratory health by the general public — a French nationwide survey

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Take home message

Wearing COVID-19 face masks has resulted in the discovery of dyspnoea by the general public and heightened concern for respiratory health. This provides the respiratory community with a major communication opportunity.

Abstract

Question addressed*.* In contrast with pain, dyspnoea is not visible to the general public who lack the corresponding experiential baggage. We tested the hypotheses that the generalised use of face masks to fight SARS-CoV2 dissemination could change this and sensitize people to respiratory health.

Methods*.* General population polling (1012-person panel demographically representative of the adult French population –quota sampling method–; 517 women, 51%). 860 (85%) answered "*no*" to "*treated for a chronic respiratory disease*" ("respiratory healthy", RH) and 152 "yes" ("respiratory disease", RD). 14% of RH respondents reported having a close family member treated for a chronic respiratory disease (RH-family+ and RH-family-). Respondents described mask-related attitudes, beliefs, inconveniencies, dyspnoea, and changes in their respiratory health vision***.***

Results. Compliance with masks was high (94.7%). Dyspnoea ranked first among mask inconveniencies (RD 79,3%, RH 67.3%, p = 0.013). "Air hunger" was the main sensory dyspnoea descriptor. Mask-related dyspnoea was independently associated with belonging to RH-family+ (Odds Ratio [OR] [95% confidence interval (CI)]: 1.85 [1.16-2.98]) and removing masks to improve breathing (OR 5.21 [3.73-7.28]). It was negatively associated with considering masks effective to protect others (OR]: 0.42 [0.25-0.75]). Half the respondents were more concerned with their respiratory health since wearing masks; 41% reported better understanding patients' experiences.

Answer to the question. Wearing protective face masks leads to the mass discovery of breathing discomfort. It raises the public's awareness of what respiratory diseases involve and sensitises to the importance of breathing. These data should be used as the fulcrum of respiratory-health-oriented communication actions.

Introduction

Dyspnoea, or breathing discomfort [1], is the ubiquitous symptom of respiratory, cardiac and neuromuscular diseases, and of obesity and deconditioning. For those afflicted, dyspnoea is a life-reducing experience associated with fear and handicap. Yet dyspnoea is not very visible to the general public, in contrast with pain. Patients with chronic respiratory diseases often report an insufficient understanding of their suffering by others including caregivers [2], which adds to their burden. This "invisibility" of dyspnoea [3] impedes access to appropriate care [4] and raises human rights issues [5]. It originates, in part, from dyspnoea not being a universal human experience, while pain undoubtedly is. Healthy individuals are likely to have experienced "healthy breathlessness" due to physical exercise, but have no experiential way of understanding the combination of troubled breathing, fear, and powerlessness that characterises the daily life of dyspnoeic patients.

As the COVID-19 pandemic continues to surge, barrier measures remain the primary means of limiting viral circulation until mass immunisation is achieved [6]. Face masks are recommended [7] and have been increasingly adopted [8]. They have practical drawbacks [9, 10], which can be an obstacle to their correct use [11]. Face masks slightly increase airway resistance and carbon dioxide concentration in the breathing zone [12, 13]: this can suffice to make breathing conscious, and possibly unpleasant if the sensory experience is associated with negative emotions. This defines dyspnoea [1]. Although dyspnoea is often mentioned conversationnally as a mask-related inconveniency, its frequency, intensity, characteristics, and risk factors have not been systematically studied. Their description could help improve the use and acceptance of face masks, the protective importance of which cannot be discussed. We hypothesised that mask-related dyspnoea would be a frequent occurrence and would depend on activity levels and individual-related factors. Likewise, we hypothesised that the frequency and intensity of mask-related dyspnoea would be higher in patients being treated for chronic respiratory diseases. Furthermore, face mask-related dyspnoea is likely to be the first encounter with dyspnoea for most people. It therefore has the potential to change the general public's perception of what it means to experience breathing difficulties[14], namely to improve dyspnoea visibility. Within this frame, we predicted that face mask-related dyspnoea would be described as very intense by healthy individuals despite the masks not representing a critical physical constraint. We also predicted that patients with a chronic respiratory disease as well as healthy individuals with a family member treated for a chronic respiratory disease would experience more frequent and intense mask-related dyspnoea. Finally, we predicted that healthy individuals reporting mask-related dyspnoea would also report increased concern about their respiratory health and would report a better understanding of the experience lived by patients with chronic respiratory disease [14]. Using a methodology that has previously helped understand some aspects of the epidemiology and characteristics of dyspnoea in the general population [15-17], we tested the above hypotheses by conducting a cross-sectional survey in a sample demographically representative of the French adult population.

Methods

Survey Conduct and Respondents

The survey was conducted in France by the French Institute of Public Opinion *(Institut Français d'Opinion Publique,* IFOP) between November 3 and 6, 2020 using the quota sampling method to ensure demographic representativeness. Respondents over 18 were recruited in successive waves from a web-based panel comprising 750 000 persons, in such a way as to constitute a 1000-person sample matching census data of the French population with respect to gender, age, socio-professional categories and place of residence after stratification by region and type of agglomeration. Respondents completed the questionnaire online (10-20 minutes). All questions had to be answered for participation to be registered.

Ethics

The study was conducted in accordance with the ethical guidelines of the *European Society for Opinion and Market Research* of which IFOP is a signatory. It was approved by the local ethical committee (*Comité d'Éthique de la Recherche Sorbonne Université*; #2020-092). Participants read and approved an information notice before completing the questionnaire.

Questionnaire Development

A multidisciplinary group of investigators (from respiratory medicine, intensive care, palliative care, psychology, nursing, and sociology) developed a first questionnaire. A focus group of eight laypersons, men and women aged 25-88, gave feedback on this version, allowing adjustments in the choice of questions and their wording. Two survey experts from IFOP monitored the process, provided input throughout, and approved the final version that was adapted to meet IFOP technical requirements.

Questionnaire content

The questionnaire (see "*English translation of the survey questionnaire*" in the electronic supplement) explored five domains:

- domain 1: demographic characteristics;
- domain 2: respiratory health (respondent or close family members treated or not for respiratory disease or congestive heart failure; tobacco consumption; practice of a breathing-oriented activity);
- domain 3: attitudes towards wearing a face mask and perceived inconveniencies;
- domain 4: mask-related dyspnoea ("*Does wearing a face mask cause you any breathing difficulties...*")
    - at rest or during very light activities (e.g. walking at one's own pace on the flat);
    - during moderate effort (fast walking or walking uphill, climbing stairs, carrying a load, talking when walking) or under emotional stress;
    - during intense efforts (sports).

Respondents who reported mask-related dyspnoea were asked to:

- rate it on a numerical rating scale (NRS) from 1,"negligible breathing difficulties", to 10 "worst breathing difficulties that you can imagine") ;

- chose sensory descriptors among "air hunger/lack of air/smothering", "excessive effort to breathe", "chest tightness", "breathing heavily", "need to concentrate on breathing" and indicate the one that best applied [18];

- chose emotional descriptors among "anger/irritation", "frustration", "anxiety", "sadness/depression", and "fear" and indicate the one that best applied;

- domain 5: impact of wearing a face mask on the perception of one's respiratory health and of the respiratory health of others.

Respondents were also asked to provide three words or expressions associated with the inconveniencies of wearing a protective face mask.

Statistical analyses

Analyses were performed on unweighted data using R v4.0.3. Qualitative data were expressed as numbers and percentages and compared using Fisher's exact test. Quantitative variables were expressed as the median and inter-quartile range (IQR). Because some of the variables' distributions did not respect the assumptions required to use parametric tests, the comparison between respondents reporting and not reporting being treated for chronic respiratory disease and the comparison of respondents reporting and not reporting having a relative treated for chronic respiratory disease were all performed using the Mann-Whitney U test, for the sake of consistency. P-values were corrected for multiple comparisons using Benjamini-Hochberg procedure, with a false discovery rate of 5% [19]. A p-*value* <0.05 (2-sided) was set as the level of significance. In respondents not reporting being treated for respiratory diseases ("respiratory healthy" group [RH]), multivariate logistic regressions were performed to test for risk factors of mask-related dyspnoea (at rest, during exertion, or in either circumstance), intensity of mask-related dyspnoea, and change in attitudes regarding diseases. Odds ratios (OR) and their 95% confidence interval were computed. All covariates with a corrected p-value <0.2 were candidates for inclusion in the multivariate models. We also included sex, age, smoking status, having a family member treated for a respiratory disease and the practice of breathing-oriented activities in the models regardless of the univariate p-value, as these variables were considered relevant. All covariates included in the logistic regressions respected the assumptions required for use of parametric procedures. Backward stepwise procedures based on the likelihood-ratio test determined the variables included in the final models. All variables adjusted on the other covariates with a p-value below <0.05 were kept in the final model. To corroborate the relevance of the variables selected to conduct the stepwise analysis, we performed a penalized regression of the "Lasso" type (least absolute shrinkage and selection operator) [20]. This approach can estimate the coefficients and select the covariates of the model at the same time (but it has not yet been associated with a consensual approach to provide reliable confidence intervals and p-values for the corresponding coefficients). The fitting is based on a term of penalization (lambda), that eliminates non-informative coefficients by shrinking them to zero [20]. We first fitted the Lasso regression model on 80% of the

observations. On this sample, lambda was determined by tenfold cross-validation to minimize the mean squared error. Model accuracy of the Lasso regression, or the probability to predict accurately the observed outcome, was then computed on the remaining 20% observations.

Textual analyses

The words or expressions chosen by each participant in answer to "*when you think about difficulties caused by wearing a face mask, which three words come to mind?"* were first lemmatised and then merged as individual verbatim to perform a correspondence factorial analysis on the matrix crossing individuals and lemmas as active categories, followed by descending hierarchical classification. The resulting classes were tested for statistical association with reporting or not face mask-related dyspnoea at rest. Then, based on the factorial coordinates produced by this initial step, a descending hierarchical classification was performed. The textual analysis was conducted usigng the IRaMuTeQ 0.7 alpha 2 R-based software with a French dictionnary (Laboratoire d'Études et de Recherches Appliquées en Sciences Sociales, Université de Toulouse 3 – Paul Sabatier, Toulouse, France). Finally, the resulting classes were tested for statistical association with reporting or not face mask-related dyspnoea at rest (Chi^2 test) [21, 22].

Results

Population

A total of 1012 respondents were included (517 women [51.1%]). Of these, 152 (15%) answered "*yes*" to "*are you treated for a chronic respiratory or for congestive heart failure*" ("respiratory disease" [RD] population) and 860 (85%) answered “no” ("respiratory healthy" [RH] population)(Table 1, Figure 1**)**. RD respondents were more often men (60.5% vs. 46.9%; p=0.012), were older (57.5 vs 49.0; p<0.001), more often past smokers (44.7% vs. 26.2%; p=0.006), and more often retired (53.9% vs. 36.9%)(Table 1). RH respondents more often reported breathing-oriented activities (Table 1; list of activities in Table S1). One hundred twenty RH respondents (14%) reported having a close family member treated for a chronic respiratory disease or congestive heart failure (RH-family+ category). There was no significant difference between RH-family+ and RH-family- except for breathing-oriented activities (p=0.006)(Table S2).

Attitudes and Beliefs Toward Face Masks

Face masks were reportedly used systematically or most often by 94.7% of respondents, similarly in the RH and RD populations (Table S3). The perceived benefit-inconveniency balance was largely favorable (87.2% either completely or somewhat agreed), without RH-RD differences. RH respondents more often reported a favorable benefit-inconveniency balance for themselves (p=0.003) and others (p=0.003). There was no significant difference between RH-family+ and RH-family-.

General Inconveniencies

Among general inconveniencies (Table S4), "*breathing difficulties*" and "*glasses steaming up*" were most commonly ranked first (25.6% for both).Three classes were identified by textual analysis (Figure 2). Class 1 (61.6%) had a dominant ‘respiratory’ connotation, Class 2 (21.8%) a ‘bothering’ connotation, and Class 3 (16.6%) a ‘positive’ connotation. Classes 1 and 2 were significantly

associated with reporting face mask-related dyspnoea at rest. Class 3 was significantly associated with reporting the absence of face mask-related dyspnoea at rest.

Dyspnoea

Face mask-related dyspnoea was frequently reported, and more so by the RD population than by the RH population (79,3% vs. 67.3%, respectively, p = 0.013) and for each activity level (rest: 58.0% vs. 37.8%; moderate: 75.3% vs. 59.9%; intense: 72.3% vs. 56.4% [p<0.05])(Figure 3). Furthermore, in the RH population, face mask-related dyspnoea was more frequently reported by ~~the~~ RH-family+ respondents than by RH-family- respondents during moderate efforts (71.7% vs. 58.0%, p = 0.018)(Figure 3). There was no difference in face mask-related dyspnoea between RH-family+ and RD (Figure 3).

All circumstances considered, 75.4% of the respondents reported removing the mask to breathe more easily at some point (RH 73.9%, RD 83.3%, p=0.012)(Table S3) .

Median dyspnoea ratings were generally high with a wide dispersion (Table 2 and Figure S1). Strikingly, RH respondents rated dyspnoea 7.00 (median)[2.00-10.00](interquartile range). RD respondents provided significantly higher ratings, but the differences were of limited magnitude. There was no difference between RH-family+ and RH-family-.

Respondents reporting dyspnoea favored "*air hunger*" among sensory descriptors (72.5%; best descriptor in 59.3% of cases, Figure S2). Among emotional descriptors, "*Anger/irritation*" was the most frequently reported (46.5%; best descriptor 37.4%), followed by "*frustration*" (36.9 and 26.7%, respectively) and "anxiety" (34.0% and 26.0%)(Figure S2) RH-family+ respondents chose "*fear*" more often than RH-family- respondents (16.8 + vs. 7.6%, p=0.012)(Figure S2).

In multivariate analysis, mask-related dyspnoea at rest or during moderate effort was independently associated with having a close relative treated for chronic respiratory disease (Odds Ratio [OR] [95% confidence interval (CI)]: 1.85 [1.16-2.98]) and with removing face masks to improve breathing (OR 5.21 [3.73-7.28])(Figure 4). It was negatively associated with considering face masks an effective protection for others (OR 0.42 [0.25-0.75])(Figure 4). The only variable associated with the intensity of mask-related dyspnoea at rest was "air hunger" (OR 2.82 [1.74-4.53])(Figure 4). For mask-related dyspnoea intensity during moderate effort, independently associated variables were age below 65 years (OR 1.62 [1.02-2.56]), active smoking (OR 1.66 [1.01-2.75]), removing the mask to breathe more easily (OR 2.62 [1.52-4.51]), and using air hunger (OR 2.03 [1.38-2.97]) and anxiety (OR 1.59 [1-2.53]) as descriptors (Figure 4). The results of the Lasso regressions were consistent with the those provided by the stepwise regressions in terms of the variables and the coefficients (Table S5).

Attitude Changes

In the RH population, 46.9% of respondents answered "*more than before*" to "*have you become more aware of the importance of your breathing*", 51.2% to "*the privilege of not having to worry about one's breathing*", and 30.4% to "*fearing a respiratory illness"?* These changes were significantly associated with being a woman, reporting dyspnoea at rest, and considering face

masks effectively protective (Figure S3 and Table S5). Forty-one percent of RH respondents answered "*more than before*" to"*have you become more aware of what people with respiratory illnesses may experience*" (see associated variables in Figure S3 and Table S5) .

Discussion

Main findings

As hypothesised, this study shows that wearing a face mask as a barrier measure is frequently associated with dyspnoea, and that this depends on activity level and health status (RD respondents experienced dyspnoea more often). The term "dyspnoea" is appropriate: dyspnoea is defined as "breathing discomfort" [1], or the conscious perception of an abnormal breathing activity associated with a negative emotional change, which is precisely what the survey respondents reported. Indeed, they predominantly chose "air hunger" to characterise mask-related breathing difficulties. This is the main descriptor used by dyspnoeic patients [23-25] and the most strongly associated with anxiety or fear [2, 26, 27]. Contrary to patients, however, the respondents did not rank anxiety first, but favored "anger" and "frustration". This may relate to the knowledge that mask-related dyspnoea is transitory, is not a marker of disease, and is possible to control through mask removal. Dyspnoeic patients lack such control.

The respondents ranked breathing difficulties first among mask-related inconveniencies (on a par with "glass steaming up" , the importance of which probably reflects the general public's concern for vision health [28]) and the "respiratory connotation" semantic cluster was the most prevalent. Nevertheless, mask-related dyspnoea did not negatively impact reported compliance with mask-wearing recommendations that was extremely high, noting that at the time of the study masks were legally prescribed in public places in the country. The proportion of respondents reporting removing their mask to breathe more easily (75.4%) was less than the proportion reporting wearing a mask (94.7%). Positive mask-wearing drivers (compliance with rules, belief in protective value) were thus more potent than negative ones. Notably, believing that face masks effectively protect others from contamination was negatively associated with reporting mask-related dyspnoea. This observation suggests that positive messages about the efficacy of face masks should effectively overcome putative dyspnoea-driven reluctance.

Strength and weaknesses

The study followed state-of-the-art polling methodology, under the auspices of an internationally renowned specialised organisation (IFOP). The quota sampling method ensured demographical representativeness [29], which was further confirmed by the 15% proportion of respondents reporting being treated for a chronic respiratory disease or cardiac insufficiency –and the repartition of the corresponding diseases (Table 1)–. Indeed, this figure does correspond to French epidemiological data (see electronic supplement, "*Comparison of the frequency of chronic respiratory diseases reported by respondents to the survey with French epidemiological data*"). In the same vein, the 95% proportion of our respondents reporting wearing a face mask "always" or

"often" when mandatory may seem high, but it is only slightly higher than the nationwide proportion recorded at the exact same time by the French national institute for public health (COVIPREV program, https://www.santepubliquefrance.fr/). This suggests behavioural representativeness on top of demographic representativeness. Of note, given recently voiced concerns about stepwise regressions [30], we corroborated this approach by using a "Lasso" penalized regression. The coherence of the corresponding two sets of coefficients lends credibility to the results.n~~However,~~ Nevertheless, we acknowledge that the study has limitations. Some are inherent to its unsupervised and self-declarative nature. For example, we did not seek any form of corroboration of the diagnostic of chronic respiratory diseases. We did not determine the proportion of respondents who had suffered fom COVID-19 (that should have been of about 10% –including asymptomatic forms–at the time of the survey [31]), and we did not ask any question about mental health, in general or in relation to mask wearing. Also, the study does not describe the impact of masks on activity, particularly in the RD population, and no information was gathered to evaluate masks misuse (e.g. not covering the nose).

Meaning

This study provides insights into dyspnoea invisibility. Firstly, as hypothesised, dyspnoea was described as very intense by healthy individuals. Ratings reported by RH respondents for dyspnoea at rest (median of 7) are higher than those considered intolerable by hospitalised dyspnoeic patients (ratings of 4 or more are unacceptable for 54% of hospitalised dyspnoeic patients)[25]. Yet several studies showed that masks do not impair laboratory-evaluated cardiorespiratory performance [12, 32]. We believe that the very high dyspnoea ratings provided by "respiratory healthy" people illustrate an incapacity to imagine what "the worst possible breathing difficulties" could be, namely what disease-related dyspnoea truly represents for afflicted patients. We also believe that this incapacity relates with the lack of previous dyspnoeic experiential baggage. The contrast between physiological data (insignificant impact of face masks on exercise [32-34]) and psychophysiological data (intense mask-related dyspnoea in this study) exemplifies the rift between "measurement" and "experience" that contributes to dyspnoea invisibility [35]. Secondly, also as hypothesised, our data indicate that having a close relative treated for a chronic respiratory disease can influence one's relationship to breathing. Likewise, the RH-family+ group was better aligned with the RD group than with the RH-family- group regarding dyspnoea frequency. RH-family+ respondents more frequently chose "fear" to describe mask-related dyspnoea than RH-family- ones (16.8 vs. 7.6%, $p = 0.012$). Also, belonging to the RH-family+ group was independently associated with reporting dyspnoea at rest and during moderate effort. These findings are consistent with experimental data indicating that seeing someone experience dyspnoea induces dyspnoea and malaise [36, 37], and with clinical data indicating that seeing a relative die with respiratory difficulties is associated with delayed and difficult grieving [38]. By symmetry, this illustrates the rarity of direct or indirect exposure to dyspnoea in the general population. Thirdly, in line with our predictions [14], a large number of respondents answered that wearing a mask had made them aware of the good fortune of not ordinarily being continually

preoccupied by their own breathing and changed both their degree of preoccupation with their own breathing and their perception of the experience of patients with chronic respiratory disease. We acknowledge that we cannot exclude that fear of the disease also a role in the reported attitude changes, keeping in mind that our questions were carefully phrased to relate putative attitude changes to the wearing face masks.

Conclusions and perspectives

From an immediately practical point of view, the frequency and the characteristics of face mask-related dyspnoea call for specific communication actions that should primarily target patients suffering from cardiorespiratory illnesses. For these patients, it should be made clear that face masks can worsen dyspnoea but that this phenomenon is not threatening and can be controlled: it therefore should not cause people to deprive themselves of an effective protection. Of note, patients suffering from cardiorespiratory illnesses could also be the primary focus of studies evaluating putative masks designed to make breathing easier. The same message (possibility of breathing discomfort but not threatening and controllable and not worth risking catching or disseminating the virus) should be addressed to the general population.

The survey shows that mask removal is commonly used to relieve dyspnoea. To reduce misuse (e.g. not covering the nose), brief temporary mask removal should be promoted as a guilt-free action, provided recommendations similar to those regarding coughing and sneezing (for example, something like "in the event of breathlessness, find an isolated location in a well-ventilated environment or outside and remove the mask briefly")

Most importantly, 95% of the respondents reported wearing masks, and 70% reported mask-related dyspnoea. This equates to about 35 million French adults discovering what it means to be bothered by one's breathing because of a constraint. This represents a mass experiential discovery of dyspnoea with the positive consequence of making dyspnoea more visible to those free of respiratory diseases. We believe that this provides the respiratory health community with leverage to sensitise the public to respiratory health better and that face mask-related dyspnoea could and should be used positively as a "respiratory communication" tool.

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Table 1. Description of the global study population and of the "respiratory healthy" and "respiratory disease" subgroups (RH and RD, respectively)

	Whole population (n = 1012)	**Respiratory healthy group [RH]** [(a)] (n = 860, 85 %)	**Respiratory disease group [RD]** [(b)] (n = 152, 15%)	**p** [(c)]
Women n, (%)	517 (51.1%)	457 (53.1%)	60 (39.5%)	**0.012**
Median age[IQR]	50.00 [34.00, 65.00]	49.00 [33.00, 62.00]	57.50 [44.00, 71.00]	**<0.001**
Socioprofessional status				**0.014**
Farm work	7 (0.7)	5 (0.6)	2 (1.3)	
Artisans or shopkeep	33 (3.3)	31 (3.6)	2 (1.3)	
Senior managem	108 (10.7)	95 (11.0)	13 (8.6)	
Middle managem	158 (15.6)	141 (16.4)	17 (11.2)	
Employe	173 (17.1)	157 (18.3)	16 (10.5)	
Labour	134 (13.2)	114 (13.3)	20 (13.2)	
Retired or not in w	399 (39.4)	317 (36.9)	82 (53.9)	
Education				0.877
Living area [(d)]				0.187
Tobacco consumption				**0.006**
Act	199 (19.7%)	170 (19.8%)	29 (19.1%)	
P	293 (29.0%)	225 (26.2%)	68 (44.7%)	
Ne	520 (51.4%)	465 (54.1%)	55 (36.2%)	
Treated for chronic respiratory disease or congestive heart failure				
Asth	58 (5.7)		58 (38.2)	
CO	24 (2.4)		24 (15.8)	
Heart fail	36 (3.6)		36 (23.7)	
Ot	57 (5.6)		57 (37.5)	
Close family member treated for chronic respiratory disease or congestive heart failure				0.330
Ove	135 (13.3%)	120 (14.0%)	15 (9.9%)	
Asth	62 (45.9%)	54 (45.0%)	8 (53.3%)	
CO	15 (11.1%)	14 (11.7%)	1 (6.7%)	
Heart fail	35 (25.9%)	30 (25.0%)	5 (33.3%)	
Ot	40 (29.6)	4 (26.7)	36 (30.0)	
Breathing-oriented activity [(e)]				**0.002**
Often or from time to ti	316 (31.2%)	247 (28.7%)	69 (45.4%)	
Rarely or e	696 (68.8%)	613 (71.3%)	83 (54.6%)	

[(a)] answered "no" to "treated for chronic respiratory disease or congestive heart failure"
[(b)] answered "yes" to "treated for chronic respiratory disease or congestive heart failure"; asthma 38%–5,7% of the overall population–; COPD 25% –3.75% of the overall population–, heart failure 16% –2.4% of the overall population–, cystic fibrosis 1% mentioned cystic fibrosis –0.15%–.
[(c)] corrected for multiple comparisons (n=69)

[(d)] three categories: urban-Paris area; urban-outside Paris area; rural

[e] see details in Table S1

Table 2. Dyspnoea ratings according to circumstances and respondent categories (for a better apprehension of the differences, the corresponding distributions are provided in Figure SX in the electronic supplement).

	Whole population (n = 1012)	**Respiratory healthy group [RH]**[(a)] (n = 860, 85 %)	**Respiratory disease group [RD]** [(b)] (n = 152, 15%)	**p** [(c)]
Dyspnoea rating at rest (medi ran	7.00 [2.00, 10.00]	7.00 [2.00, 10.00]	8.00 [2.00, 10.00]	0.035
Dyspnoea rating during moder exerti (median, ran	7.00 [1.00, 10.00]	7.00 [1.00, 10.00]	8.00 [2.00, 10.00]	0.020
Dyspnoea rating during spo (median, range	8.00 [1.00, 10.00]	8.00 [1.00, 10.00]	8.00 [5.00, 10.00]	0.481
	spiratory healthy gro [RH] (n = 846)[(e)]	**RH-family-** [(f)] (n=726, 86%)	**RH-family+** [(g)] (n=120, 14%)	**p** [(c)]
Dyspnoea rating at rest (medi ran	7.00 [2.00, 10.00]	7.00 [2.00, 10.00]	7.50 [3.00, 10.00]	0.285
Dyspnoea rating during moder exerti (median, ran	7.00 [1.00, 10.00]	7.00 [1.00, 10.00]	7.50 [3.00, 10.00]	0.111
Dyspnoea rating during spo (median, range	8.00 [1.00, 10.00]	8.00 [1.00, 10.00]	9.00 [3.00, 10.00]	0.054

[a] answered "no" to "treated for chronic respiratory disease or congestive heart failure"

[b] answered "yes" to "treated for chronic respiratory disease or congestive heart failure"

[c] corrected for multiple comparisons (n=69)

[d] 553 of the respondents declared never wearing a face mask during this type of activity.

[e] 14 patients answered never wearing a mask

[f] answered "no" to "close family members treated for chronic respiratory disease or congestive heart failure"

[g] answered "yes" to "close family members treated for chronic respiratory disease or congestive heart failure"

Figure captions.

Figure 1. Distribution of the study subpopulations.

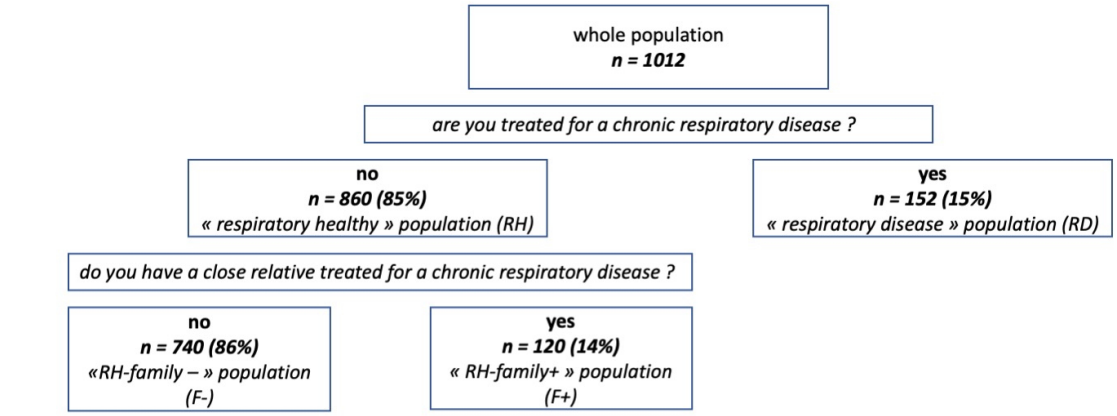


Figure 2. Textual analysis of the respondents' answers to the question **"***when you think about difficulties caused by wearing a face mask, which three words come to mind?***"**
Following lemmatisation of the respondents' verbatim, correspondence factorial analysis and descendent hierarchical classification identified three semantic classes. Class 1 had a dominant 'respiratory' connotation, class 2 had a dominant 'bothering' connotation, class 3 had a 'positive' connotation (words with a respiratory connotation appear in bold typeface). Class 1 and Class 2 were significantly associated with reporting face mask-related dyspnoea at rest (Chi^2 test), whereas Class 3 was significantly associated with not reporting face mask-related dyspnoea at rest (Chi^2 test).

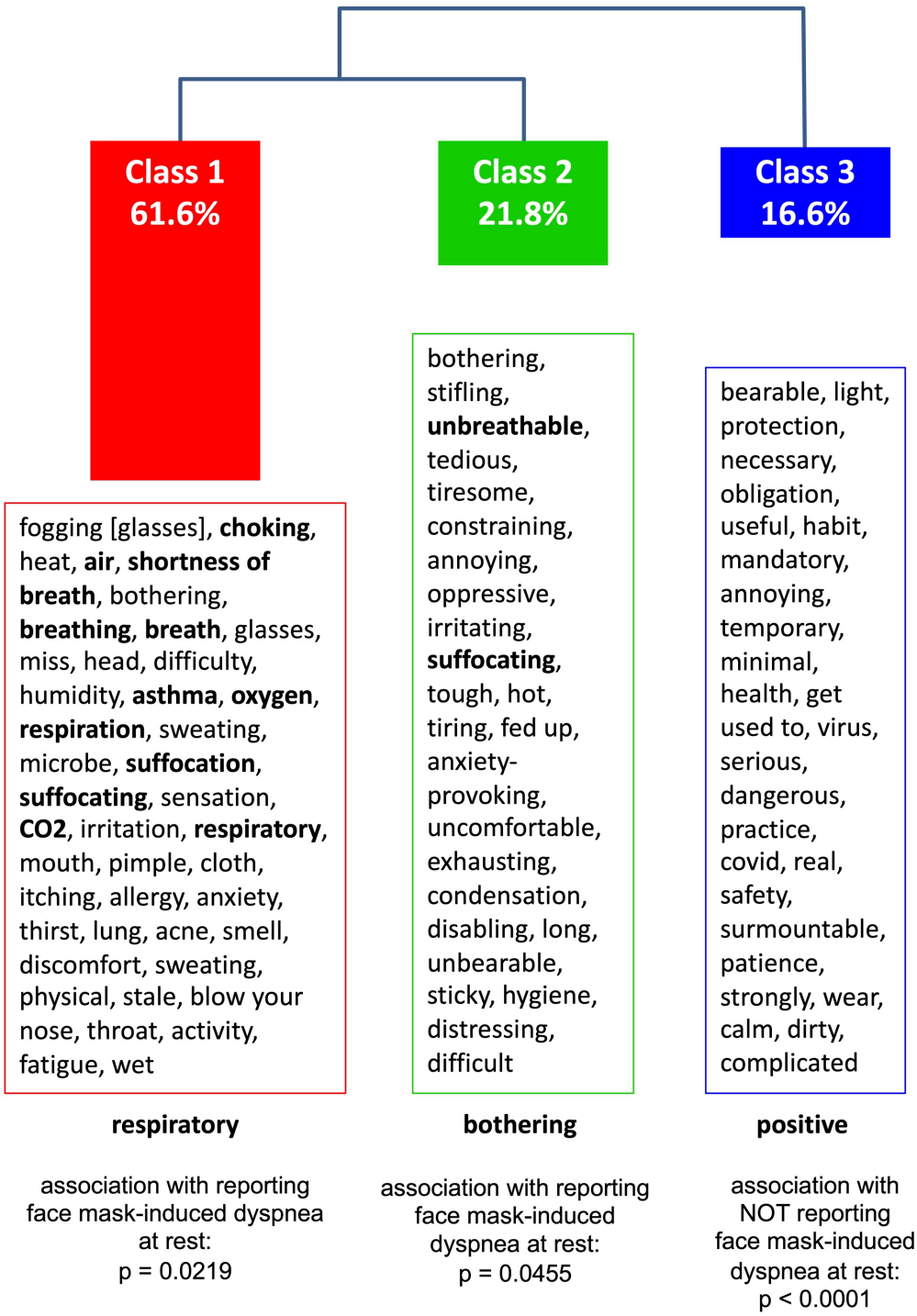

Class 1
61.6%
Class 2
21.8%
Class 3
16.6%
fogging [glasses], choking, heat, air, shortness of breath, bothering, breathing, breath, glasses, miss, head, difficulty, humidity, asthma, oxygen, respiration, sweating, microbe, suffocation, suffocating, sensation, CO2, irritation, respiratory, mouth, pimple, cloth, itching, allergy, anxiety, thirst, lung, acne, smell, discomfort, sweating, physical, stale, blow your nose, throat, activity, fatigue, wet
bothering, stifling, unbreathable, tedious, tiresome, constraining, annoying, oppressive, irritating, suffocating, tough, hot, tiring, fed up, anxiety-provoking, uncomfortable, exhausting, condensation, disabling, long, unbearable, sticky, hygiene, distressing, difficult
bearable, light, protection, necessary, obligation, useful, habit, mandatory, annoying, temporary, minimal, health, get used to, virus, serious, dangerous, practice, covid, real, safety, surmountable, patience, strongly, wear, calm, dirty, complicated
respiratory
association with reporting face mask-induced dyspnea at rest:
p = 0.0219
bothering
association with reporting face mask-induced dyspnea at rest:
p = 0.0455
positive
association with NOT reporting face mask-induced dyspnea at rest:
p < 0.0001

Figure 3. Frequency of mask-related dyspnea. Left panel, comparison of « respiratory healthy » and « respiratory disease » populations (answer no or yes to « treated for chronic respiratory disease or congestive heart failure » question, RH vs. RD, respectively). Right panel, comparison of « respiratory healthy—family + » and respiratory healthy — family-) populations (answer no or yes to « close relatives treated for chronic respiratory disease or congestive heart failure » question). Horizontal bar: mean value in the whole study sample. p-value : *** <0.001; ** <0.01; * <0.05

Note that during intense effort, 55.5% of the respondents reported never wearing a mask; among the 44.5% who wore a mask during intense effort, 59.0% reported mask-related dyspnea.

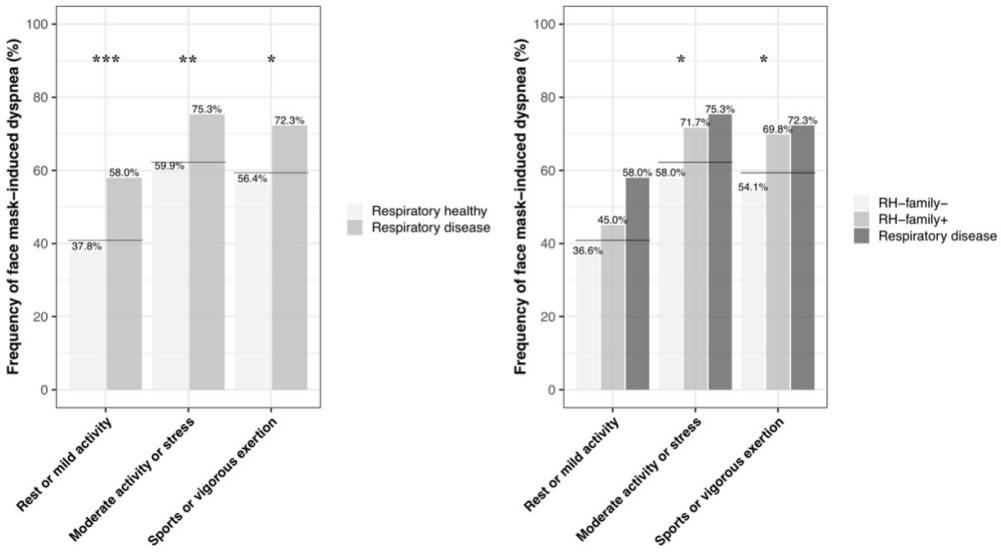
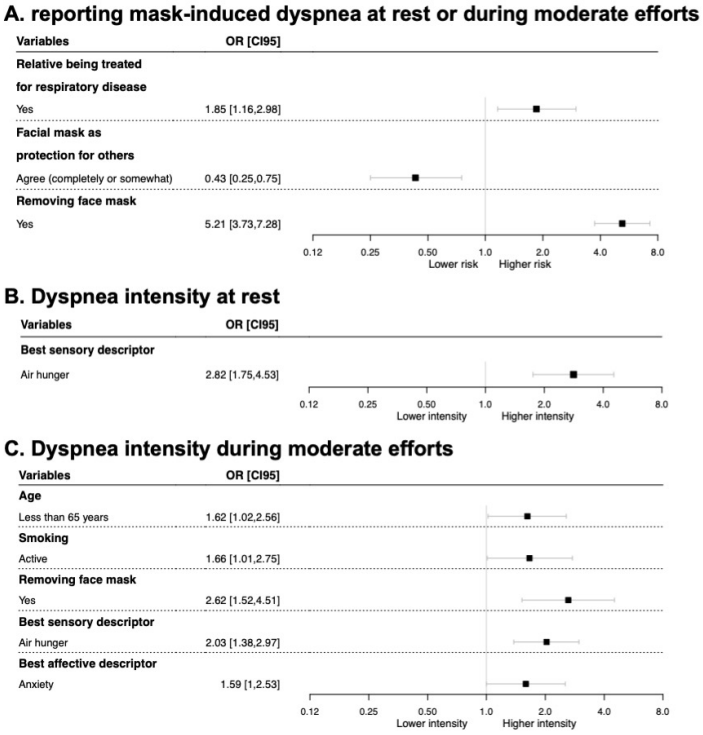


Figure 4. Variables independently associated with reporting mask-related dyspnea at rest or during moderate effort (A) and with dyspnea intensity at rest (B) or during moderate effort (C) according to multivariate analysis.

A. Relative being treated for respiratory disease p=0.008; facial mask as protection for others p = 0.002; removing face mask p<0.001.

B. Best sensory descriptor p<0.001.

C. Age p = 0.041; smoking p=0.041; removing face mask p<0.001; best sensory descriptor p<0.001, best affective descriptor p=0.044



Electronic supplement

Lifting dyspnoea invisibility: COVID-19 face masks, the experience of breathing discomfort, and improved perception of the importance of respiratory health by the general public — a French nationwide survey

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English Translation of the Survey Questionnaire

IFOP - Face masks for COVID protection survey

1. Information about the survey

This survey has been commissioned by a healthcare team (the *department of respiratory medicine,* Pitié-Salpêtrière hospital, Paris) and a research team (*UMRS1158* Inserm research unit, Sorbonne University). You have been selected to take part in the study because you belong to one of the sample groups of the IFOP, an authorised polling institute.

The survey aims to describe and understand your use and experience of using protective face masks to prevent the spread of COVID-19. The questionnaire will take under 15 minutes to complete. You will be asked questions about yourself, how you use face masks, what drawbacks you perceive there to be, and how wearing a face mask may affect your breathing.

The survey should allow us to improve our understanding of the perceptions of wearing face masks, in particular from a respiratory point of view, and thus to develop strategies for informing and teaching.
The answers are completely anonymous and under no circumstances will it be possible for your answers be traced back to you.

The answers will be analysed by the IFOP, an authorised polling institute, in collaboration with the commissioning teams and may be used for scientific publication.

The IFOP institute is authorised to perform polls and as such it stores and processes data and guarantees that all applicable data protection regulations will be respected.

The study does not, in theory, contain any questions that might make you feel uncomfortable and has been approved by the Sorbonne University's research ethics committee, under the code name "SondageMasquesBarrières" (ProtectiveMaskPoll).

You can stop participating or decide not to answer certain questions and there are no consequences for doing so, including in relation to your membership of the IFOP sample group.

For further information about this study, or to be informed about the results, please send an email to the following address: sondage_masques_respiration@umrs1158.fr

Note that you cannot participate if you have previously had a COVID-19 diagnosis.

Please tick the box to confirm that you have read this information and agree to take part in the study.

2. Content of the survey

Q1. *All participants* **When you think about wearing a face mask, what three words (verbs, adjectives, expressions, etc.) come to mind?**
(Open question, no suggested answers)

Q2. *All participants* **And when you think about difficulties caused by wearing a face mask, which three words (verbs, adjectives, expressions, etc.) come to mind?**
(Open question, no suggested answers)

Q3. *All participants* **Are you, or is a member of your close family (parent, child or partner) currently being treated for a chronic respiratory disease or heart disease?** *(Two answers are possible)*
- Yes, I am
- Yes, a member of my close family is (parent, child, partner)
- No

Q4. *For those who answered Yes, I am' to Question 1* **Which chronic respiratory disease(s) or heart disease(s) are you being treated for?** *(More than one answer may be provided.)*

Random rotation of items
- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Cystic fibrosis
- Heart failure
- Other Please give details: _____

Q5. *For those who answered 'Yes, a member of my close family' to Question 1* **Which chronic respiratory disease(s) or heart disease(s) is/are the member(s) of your close family being treated for?***(More than one answer may be provided.)*
Random rotation of items
- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Cystic fibrosis
- Heart failure
- Other Please give details: _____

Q6. *All participants* **Do you yourself smoke, or have you ever smoked (tobacco, cigarettes, cigars or a pipe, but NOT electronic cigarettes)?***(One single answer is possible.)*
- Yes, I currently smoke
- Yes, I used to smoke, but I stopped completely
- No, I have never been a smoker

Q7. *For those who answered 'Yes, I used to smoke, but I stopped completely,' to Question 6* **How long ago did you stop smoking?** *(One single answer is possible.)*
- Less than one year ago
- Less than 5 years ago
- 5 years ago or more

Q8. *All participants* **Do you take part in any work or leisure activities that require voluntary breathing control?** *(One single answer is possible.)*
- Yes, often
- Yes, from time to time
- Yes, but rarely
- No, never

Q9. *For those who answered 'Yes' to Question 6* **Which activities?** *(You may provide more than one answer.)*
Random rotation of items
- Yoga
- Meditation
- Tai Chi or Qi Gong
- Martial Arts
- Swimming
- Dance
- Theatre
- Free diving, synchronised swimming
- Deep sea diving
- Playing a wind instrument
- Other - Please give details: _____

Q10. *(One single answer is possible.)* **Where it is mandatory to wear a face mask under the protective measures against the coronavirus, do you always, often, occasionally, or never wear a mask in public spaces?***(One single answer is possible.)*
- Always
- Often
- Occasionally
- Never

Q11. *For those who answered 'occasionally' or 'never' to Question 8* **Why don't you respect the requirement to wear a face mask in public spaces where it is mandatory to wear one?***(More than one answer may be provided.)*
Random rotation of items
- Because I believe it is an infringement of my liberty
- Because I find it too limiting
- Because it prevents me from breathing normally
- Because it ends up being too expensive
- Other - Please give details: _____

Q12. *All participants* **When you wear a face mask to comply with the protective measures against the coronavirus**, **what type of face mask do you use?** *(One single answer is possible.)*
Random rotation of the first two items
- A single-use surgical mask
- A reusable fabric mask
- Both types of mask, interchangeably
- I never use a mask

Q13. *For those who answered that they wear a mask to Question 10* **Does wearing a face mask cause you any breathing difficulties when you are at rest** *(for example when you are sitting on public transport)*, **taking part in routine day-to-day activities involving only light exertion** *(such as walking at a normal pace)* **or having a conversation?** *(One single answer is possible.)*
- Yes
- No

Q14. *For those who answered 'Yes' to Question 11* **On a scale of 1 to 10, how would you rate the intensity of the most severe breathing difficulties you have experienced in these circumstances, where 1 represents negligible breathing difficulties, and 10 represents the worst breathing difficulties that you can imagine?***(Numerical rating scale from 1 to 10)*

Q15. *For those who answered that they wear a mask it Question 10* **Does wearing a face mask cause you any breathing difficulties when undertaking everyday activities involving moderate exertion or when you are under stress or experiencing strong emotions** (*walking quickly or uphill, walking while carrying shopping, climbing stairs, speaking while walking, speaking for long periods of time…)*?*(One single answer is possible.)*
- Yes
- No

Q16. *Those who answered 'Yes' to Question 13* **On a scale of 1 to 10, how would you rate the intensity of the most severe breathing difficulties you have experienced in these circumstances, where 1 represents negligible breathing difficulties, and 10 represents the worst breathing difficulties that you can imagine?***(Numerical rating scale from 1 to 10)*

Q17. *For those who answered that they wear a mask to question 10* **Does wearing a face mask cause you any breathing difficulties when taking part in sports and activities involving vigorous exertion** *(running, cycling, at the gym, etc.)***?***(One single answer is possible.)*
- Yes
- No
-I never wear a mask for this type of activity

Q18. *Those who answered 'Yes' to Question 15* **On a scale of 1 to 10, how would you rate the intensity of the most severe breathing difficulties you have experienced in these circumstances, where 1 represents negligible breathing difficulties, and 10 represents the worst breathing difficulties that you can imagine?***(Numerical rating scale from 1 to 10))*

Q19. *For those who answered 'Yes' to Questions 12, 14 or 16* **From the following list of physical sensations, how would you describe the breathing difficulties caused by the face mask?** *(More than one answer may be provided.)*
Random rotation of items
- air hunger/lack of air/smothering
- need to make an abnormal effort to breathe
- chest tightness or compression
- sensation of breathing heavily
- need to concentrate on breathing
- other (please give details: _____)

Q20. *For those who gave several answers to question 17* **Which of the following best describes your breathing difficulties?***(One single answer possible/ do not only leave the items selected as 'yes' from question 17.)*
Random rotation of items
- air hunger/lack of air/smothering
- need to make an abnormal effort to breathe
- chest tightness or compression
- sensation of breathing heavily
- need to concentrate on breathing
- other: [reminder of the quote in question 18]

Q21. *For those who answered 'Yes' to Questions 12, 14 or 16.* **From the following list, which word(s) would you use to describe what you feel about the breathing difficulties caused by the face mask?** *(More than one answer may be provided.)*
Random rotation of items
- anxiety
- anger/irritation
- frustration
- sadness/depression
- fear

Q22. *Those who gave several answers to Question 19* **Which of the following best describes your breathing difficulties?** *(One single answer possible/ do not only leave the answers 'yes' from question 19.)*
Random rotation of items
- anxiety
- anger/irritation
- frustration
- sadness/depression
- fear

Q23. *For those who answered that they wear a mask to Question 10* **Do you sometimes remove your mask, even for just a few moments, because you feel the need to breathe better?***(One single answer is possible.)*
- Yes, often, both at rest or after exertion
- Yes, sometimes, for example at rest after I have been wearing it for a long time
- Yes, but only during or after exertion
- No, never

Q24. *For those who answered that they wear a mask to Question 10* **Which three of the following drawbacks of wearing a face mask do you consider to be the most important? *First? Second? Third?(****Three answers possible, in descending order)**
Random rotation of items
- Feeling hot
- Smelling my own breath
- Speech impediment
- Breathing difficulties

- Financial cost
- Always needing to carry a face mask with me
- Difficulties understanding what other people say
- Difficulties recognising other people who are wearing a face mask
- Discomfort around my ears
- Difficulties identifying other people's facial expressions
- Difficulties expressing my own emotions
- Unattractive look
- Glasses steaming up
- Accusatory / disapproving looks from other people if you forget your mask
- Difficulties wearing glasses (other than glasses steaming up) or hearing aids
- Other Please give details: _____

Q25. *For those who answered that they wear a mask to Question 10* **Do you personally think that wearing a face mask is more uncomfortable when you also need to wear a scarf, hat, or hood, etc.?***(One single answer is possible.)*
- Yes, it is more uncomfortable
- No, it is not more uncomfortable than in other situations

I don't know. I haven't ever experienced this situation.

Q26. *For those who answered that they wear a mask to Question 10* **Since you began wearing a face mask, have you become more aware of…?** *(One single answer is possible per item.)*
Yes, more than before / Yes, but no more than before / No, not particularly
- What people with respiratory diseases may feel like?
- The importance of breathing
- What a privilege it is not to have to worry about your breathing

Q27. *For those who answered that they wear a mask to Question 10* **Since you began wearing a face mask, would you say that you are worried about one day having a disease that impairs your breathing?** *(One single answer is possible.)*
- Yes, more than before
- Yes, but no more than before
- No, not particularly

Q28. *All participants* **How far do you agree with the following statement: 'The effectiveness of face masks in protecting <u>the person wearing the mask</u> is a good reason to put up with the inconveniences'?** *(One single answer is possible)*
- Completely agree
- Agree somewhat
- Disagree somewhat
- Completely disagree

Q29. *All participants* **How far do you agree or not agree with the following statement: 'The effectiveness of the face mask in protecting <u>the people around the person wearing the mask</u> is a good reason to put up with the inconveniences'?** *(One single answer is possible.)*
- Completely agree
- Agree somewhat
- Disagree somewhat
- Completely disagree

Comparison of the frequency of chronic respiratory diseases reported by respondents to the survey with French epidemiological data.

In France, the prevalence of asthma was estimated to be 6-7% of the adult population in 2018 (1). In 2020, epidemiological modeling led to believe that COPD concerned 9.3% of adults aged 45 or mor (2), which would correspond to 4.5-5% of the whole adult population if the prevalence of COPD was zero before 45, a very conservative hypothesis. The prevalence of congestive heart failure was estimated to 2.3% of the adult population in 2008 (3), a figure deemed stable over time according to the French observatory on heart failure. These 3 diseases alone can therefore concern up to 15% of the adult population, not counting the obstructive sleep apnea syndrome –in 2017, 2.3% of French adults were treated with continous positive airway pressure (4)–. Marginally, the prevalence of cystic fibrosis in adults is estimated to be 7/100 000, or 0.007 % (5).

A 15% proportion of people reporting being treated for a chronic respiratory disease or cardiac insufficiency (our "RD" subpopulation) is perfectly in line with the above epidemiological data. This concordance strenghtens the notion that our study sample is actually demographically representative of the French population. In addition, the distribution of the different diseases named by the respondents was coherent: among the 15% of the respondents who answered "yes" to the question "Are you [...] currently being treated for a chronic respiratory disease of heart disease ?", 38% mentioned asthma –5,7% of the overall population–, 25% mentioned COPD, namely –3.75% of the overall population–, 16% mentioned heart failure –2.4%— of the overall population, and 1% mentioned cystic fibrosis –0.15%–.

1. Raherison-Semjen C et al. [Prevalence and management of asthma in French adults in 2018: the Asthmapop study]. Abstract presented during the 23rd "Congrès de Pneumologie de Langue Française" (French speaking respiratory medicine annual scientific meeting).
https://www.sciencedirect.com/science/article/abs/pii/S0761842518303711

2. Burgel PR et al. An attempt at modeling COPD epidemiological trends in France. *Respir Res* 2018: 19: 130.
https://respiratory-research.biomedcentral.com/articles/10.1186/s12931-018-0827-7

3. Saudubray T et al. [Prevalence and management of heart failure in France: national study among general practitioners of the Sentinelles network]. *Rev Med Interne* 2005: 26: 845-850.
https://europepmc.org/article/med/15935520

4. Mandereau-Bruno L, Leger D, Delmas MC. Obstructive sleep apnea: A sharp increase in the prevalence of patients treated with nasal CPAP over the last decade in France. *PLoS One* 2021: 16: e0245392.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0245392

5. Burgel PR. [Epidemiological trends of cystic fibrosis in France: 10-year perspective]. *Arch Pediatr* 2016: 23: 12S14-12S18.
https://www.sciencedirect.com/science/article/abs/pii/S0929693X17300568?via%3Dihub

Figure S1. Dyspnoea ratings according to circumstances and respondent categories (distributions). RH: respiratory healthy group; RD : respiratory disease group; RHF+: RH family+; RHF-: RH-family-; VAS: visual analogic scale.

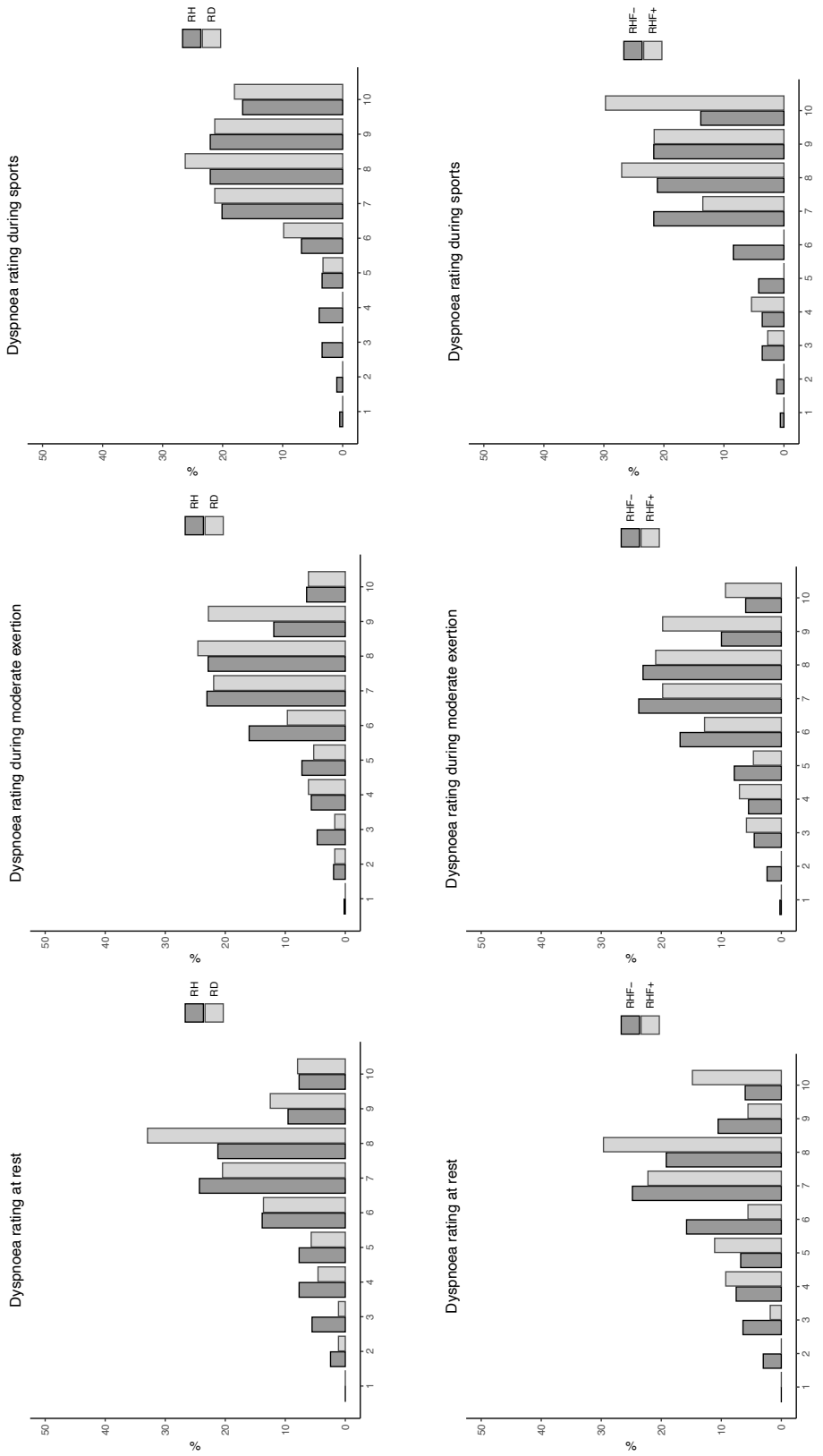


Figure S2. Sensory and affective descriptors of face mask-related dyspnoea

(Whole: all respondents having reported dyspnoea, irrespective of the circumstance; RH: respiratory healthy respondents; Respiratory disease: respondents reporting being treated for a chronic respiratory disease; RH-family+: respondents without respiratory diseases reporting having a close family member treated for a chronic respiratory disease; RH-family-: respondents without respiratory diseases reporting not having a close family member treated for a chronic respiratory disease. *: p=0.012)

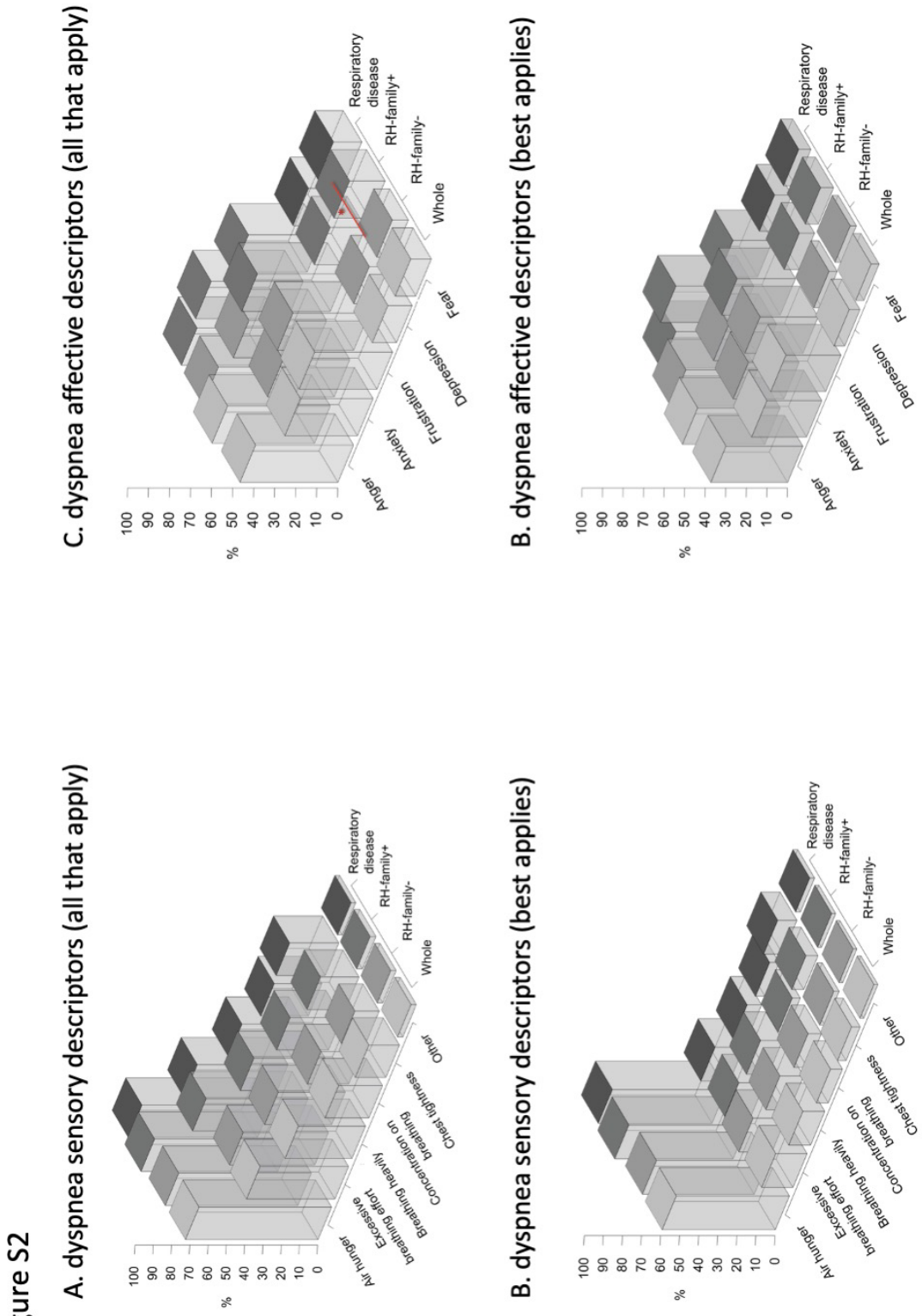
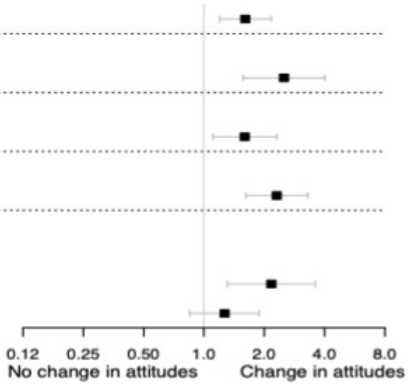


Figure S3. Variables independently associated with changes in representation towards breathing and respiratory diseases regarding oneself (A) and others (B) according to multivariate analysis.

A. Gender p=0.002; facial mask as protection for others p <0.001; difficulty to breathe at rest p=0.011, difficulty to breathe during moderate exertion p<0.001; difficulty to breathe during sports p=0.005
B. Employment p=0.004; facial mask as protection for others p = 0.004; difficulty to breathe during moderate exertion p<0.001; difficulty to breathe during sports p=0.039

A. Changes regarding oneself

Variables	OR [CI95]
Gender	
Women	1.61 [1.2,2.17]
Facial mask as protection for others	
Agree (completely or somewhat)	2.51 [1.57,4.01]
Difficulty to breath at rest	
Yes	1.6 [1.11,2.31]
Difficulty to breath during moderate exertion	
Yes	2.31 [1.62,3.3]
Difficulty to breath during sports	
No	–
Yes	2.17 [1.31,3.6]
Never wear mask for sports	1.27 [0.85,1.89]



B. Changes regarding others

Variables	OR [CI95]
Employment	
Retired or unemployed	–
Working class	1.74 [1.23,2.44]
Middle and upper classes	1.11 [0.78,1.56]
Facial mask as protection for others	
Agree (completely or somewhat)	1.96 [1.23,3.13]
Difficulty to breath during moderate exertion	
Yes	1.92 [1.39,2.65]
Difficulty to breath during sports	
No	–
Yes	1.38 [0.85,2.22]
Never wear mask for sports	0.88 [0.59,1.33]

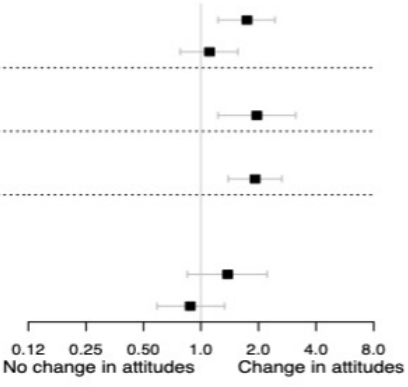


Table S1. Breathing-oriented activities reported by the "respiratory healthy" respondents

	Respiratory healthy group [RH] (1) (n = 860, 85 %)
Swimming — total **(%)**	78 (9.1)
— *Women* (%)	33 (7.2)
— *Men* (%)	45 (11.2)
Mindfulness — total **(%)**	36 (4.2)
— *Women* (%)	21 (4.6)
— *Men* (%)	15 (3.7)
Dance — total **(%)**	27 (3.1)
— *Women* (%)	24 (5.3)
— *Men* (%)	3 (0.7)
Yoga — total **(%)**	26 (3.0)
— *Women* (%)	19 (4.2)
— *Men* (%)	7 (1.7)
Martial arts — total **(%)**	24 (2.8)
— *Women* (%)	6 (1.3)
— *Men* (%)	18 (4.5)
Taï-chi, Qigong — total **(%)**	10 (1.2)
— *Women* (%)	5 (1.1)
— *Men* (%)	5 (1.2)
Scuba diving / diving — total **(%)**	8 (0.9)
— *Women* (%)	1 (0.2)
— *Men* (%)	7 (1.7)
Apnoea / synchronised swimming — total **(%)**	8 (0.9)
— *Women* (%)	2 (0.4)
— *Men* (%)	6 (1.5)
Wind instrument — total **(%)**	7 (0.8)
— *Women* (%)	2 (0.4)
— *Men* (%)	5 (1.2)
Acting — total **(%)**	5 (0.6)
— *Women* (%)	2 (0.4)
— *Men* (%)	3 (0.7)
Other (1) — total **(%)**	114 (13.3)
— *Women* (%)	59 (12.9)
— *Men* (%)	55 (13.6)

(1) answered "no" to "*treated for a chronic respiratory disease or congestive heart failure*"

Table S2_ Description of the subgroups of the "respiratory healthy" population (RH) according to the presence (RH-family+) or absence (RH-family-) of a close family member treated for a chronic respiratory disease or congestive heart failure.

	Respiratory healthy group [RH] (1) (n = 860)	**RH-family-** (2) (n=726, 86%)	**RH-family+** (3) (n=120, 14%)	**p** (4)
Women (%)	457 (53.1)	384 (51.9)	73 (60.8)	0.187
Median age [IQR]	49.00 [33.00, 62.00]	49.00 [34.00, 62.25]	45.50 [30.00, 60.25]	0.182
Socioprofessional status				0.796
Education				0.490
Living area (5)				0.533
Tobacco consumption				0.607
Active	170 (19.8)	143 (19.3)	27 (22.5)	
Past	225 (26.2)	191 (25.8)	34 (28.3)	
Never	465 (54.1)	406 (54.9)	59 (49.2)	
Practice of a breathing-oriented activity				**0.006**
Often or from time to time	247 (28.7)	196 (26.5)	51 (42.5)	
Rarely or never	613 (71.3%)	544 (73.5%)	69 (57.5%)	

(1) answered "no" to "treated for chronic respiratory disease or congestive heart failure"
(2) answered "yes" to "close family members treated for chronic respiratory disease or congestive heart failure"
(3) answered "no" to "close family members treated for chronic respiratory disease or congestive heart failure"
(4) corrected for multiple comparisons (n=69)
(5) three categories: urban-Paris area; urban-outside Paris area; rural

Table S3. Description of attitudes and beliefs toward the use of face masks.

	Whole population (n = 1012)	**Respiratory healthy group [RH]** (1) (n = 860, 85 %)	**Respiratory disease group [RD]** (2) (n = 152, 15%)	**p** (3)
Wearing a face mask in public places (4)				0.478
Systematically or most often (%)	958 (94.7)	811 (94.3)	147 (96.7)	
Occasionally or never (%)(5)	54 (5.3)	49 (5.7)	5 (3.3)	
Type of mask used				0.219
Surgical (%)	426 (42.1%)	358 (41.6%)	68 (44.7%)	
Reusable fabric mask (%)	243 (24.0%)	214 (24.9%)	29 (19.1%)	
Both types (%)	342 (33.8%)	288 (33.5%)	54 (35.5%)	
Perceived benefit/inconveniencies balance				
Favorable regarding one's own protection				1.000
Completely agree	426 (42.1%)	361 (42.0%)	65 (42.8%)	
Agree somewhat	419 (41.4%)	355 (41.3%)	64 (42.1%)	
Disagree somewhat	107 (10.6%)	92 (10.7%)	15 (9.9%)	
Completely disagree	60 (5.9%)	52 (6.0%)	8 (5.3%)	
Favorable regarding the protection of others				0.401
Completely agree	474 (46.8%)	398 (46.3%)	76 (50.0%)	
Agree somewhat	409 (40.4%)	356 (41.4%)	53 (34.9%)	
Disagree somewhat	88 (8.7%)	70 (8.1%)	18 (11.8%)	
Completely disagree	41 (4.1%)	36 (4.2%)	5 (3.3%)	
Removing face mask to breathe more easily				**0.012**
Yes, often, both when resting or after exertion	225 (22.6)	177 (20.9)	48 (32.0)	
Yes, sometimes, when resting after I've been wearing it for a long time	332 (33.3)	293 (34.6)	39 (26.0)	
Yes, but only during or after exertion	194 (19.5)	156 (18.4)	38 (25.3)	
No, never	245 (24.6)	220 (26.0)	25 (16.7)	

(1) answered "no" to "treated for chronic respiratory disease or congestive heart failure"
(2) answered "yes" to "treated for chronic respiratory disease or congestive heart failure"
(3) corrected for multiple comparisons (n=69)
(4) prescribed by law at the time of the study
(5). The reasons invoked to explain never wearing a mask were "*It prevents me from breathing normally*" (63%), "*It is generally too constraining*" (53%), "It restricts my freedom" (36%), "It is too expensive" (14%), or another motive (14%). Several answers were possible.

Table S4. Main mask-related inconveniencies (items chosen first within a 15-item list).

	Whole population (n = 1012)	Respiratory healthy group [RH] (1) (n = 860, 85 %)	Respiratory disease group [RD] (2) (n = 152, 15%)	p (3)
First reported drawback of wearing face mask				0.401
Breathing difficulties (%)	259 (25.6)	209 (24.3)	50 (33.1)	
Glasses steaming up (%)	259 (25.6)	227 (26.4)	32 (21.2)	
Difficulties understanding what other people say (%)	82 (8.1)	69 (8.0)	13 (8.6)	
Feeling hot (%)	72 (7.1)	61 (7.1)	11 (7.3)	
Difficulties wearing glasses (other than glasses steaming up) or hearing aids (%)	64 (6.3)	50 (5.8)	14 (9.3)	
Speech impediment (%)	52 (5.1)	48 (5.6)	4 (2.6)	
Always needing to carry a face mask with me (%)	49 (4.8)	43 (5.0)	6 (4.0)	
Discomfort around my ears (%)	38 (3.8)	33 (3.8)	5 (3.3)	
Difficulties recognising other people who are wearing a face mask (%)	29 (2.9)	27 (3.1)	2 (1.3)	
Difficulties identifying other people's facial expressions (%)	29 (2.9)	25 (2.9)	4 (2.6)	
Financial cost (%)	25 (2.5)	20 (2.3)	5 (3.3)	
Smelling my own breath (%)	18 (1.8)	16 (1.9)	2 (1.3)	
Difficulties expressing your own emotions (%)	16 (1.6)	15 (1.7)	1 (0.7)	
Unattractive look (%)	9 (0.9)	9 (1.0)	0 (0.0)	
Accusatory / disapproving looks from other people if you forget your mask (%)	1 (0.1)	0 (0.0)	1 (0.7)	
Other (%)	9 (0.9)	8 (0.9)	1 (0.7)	

(1) answered "no" to "treated for chronic respiratory disease or congestive heart failure"
(2) answered "yes" to "treated for chronic respiratory disease or congestive heart failure"
(3) corrected for multiple comparisons (n=69)

Frequency of chronic respiratory diseases reported by respondents to the survey and comparison with the epidemiology of respiratory diseases in France.

In France, the prevalence of asthma was estimated to be 6-7% of the adult population in 2018 (1). In 2020, epidemiological modeling led to believe that COPD concerned 9.3% of adults aged 45 or mor (2), which would correspond to 4.5-5% of the whole adult population if the prevalence of COPD was zero before 45, a very conservative hypothesis. The prevalence of congestive heart failure was estimated to 2.3% of the adult population in 2008 (3), a figure deemed stable over time according to the French observatory on heart failure. These 3 diseases alone can therefore concern up to 15% of the adult population, not counting the obstructive sleep apnea syndrome –in 2017, 2.3% of French adults were treated with continous positive airway pressure (4)–. Marginally, the prevalence of cystic fibrosis in adults is estimated to be 7/100 000, or 0.007 % (5).

A 15% proportion of people reporting being treated for a chronic respiratory disease or cardiac insufficiency (our "RD" subpopulation) is perfectly in line with the above epidemiological data. This concordance strenghtens the notion that our study sample is actually demographically representative of the French population. In addition, the distribution of the different diseases named by the respondents was coherent: among the 15% of the respondents who answered "yes" to the question "Are you [...] currently being treated for a chronic respiratory disease of heart disease ?", 38% mentioned asthma –5,7% of the overall population–, 25% mentioned COPD, namely –3.75% of the overall population–, 16% mentioned heart failure –2.4%— of the overall population, and 1% mentioned cystic fibrosis –0.15%–.

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https://www.sciencedirect.com/science/article/abs/pii/S0929693X17300568?via%3Dihub

Table S5: Comparison of stepwise and LASSO penalized regression coefficients. The exponential value (odds-ratio) of the models are reported in the tables.

	Stepwise regression (final model)	LASSO regression
Difficulty to breathe at rest or during moderate exertion		
Gender		
Men	Ref	Ref
Women	-	1.04
Age		
65 years and older	Ref	Ref
Less than 65 years	-	1.15
Relative being treated for RD		
No	Ref	Ref
Yes	1.85 [1.16,2.98]	1.34
Facial mask as protection for others		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	0.43 [0.25,0.75]	0.67
Removing face mask		
Yes (sometimes, often or only during exertion)	Ref	Ref
Never	0.19 [0.14,0.27]	0.26
Model accuracy and lambda		
Model accuracy	0.75	0.74
Lambda	-	0.0242

	Stepwise regression (final model)	LASSO regression
Intensity of dyspnea at rest		
Employment		
Retired or unemployed	Ref	Ref
Working class	-	1.15
Middle and upper classes	-	-
Living area		
Urban - Paris Area	Ref	Ref
Urban - other areas	-	-
rural	-	1.02
Relative being treated for RD		
No	Ref	Ref
Yes	-	1.39
Type of face mask		
Single-used surgical mask	Ref	Ref

Reusable fabric mask	-	-
Both type of mask	-	0.79
Facial mask as protection for others		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	-	0.59
Removing face mask		
Yes (sometimes, often or only during exertion)	Ref	Ref
Never	-	0.80
Sensorial dimension		
Others	Ref	Ref
Air hunger	2.82 [1.75,4.53]	2.79
Emotional dimension		
Others	Ref	Ref
Anxiety	-	1.20
Model accuracy and lambda		
Model accuracy	0.55	0.56
Lambda	-	0.026

	Stepwise regression (final model)	**LASSO regression**
Intensity of dyspnea during moderate exertion		
Age		
65 years and older	Ref	Ref
Less than 65 years	1.62 [1.02,2.56]	1.26
Living area		
Urban - Paris Area	Ref	Ref
Urban - other areas	-	-
rural	-	1.07
Smoking		
Past or never	Ref	Ref
Active	1.66 [1.01,2.75]	1.26
Relative being treated for RD		
No	Ref	Ref
Yes	-	1.12
Breathing oriented activity		
Never or rarely	Ref	Ref
Often or from time to time	-	1.18
Facial mask as own protection		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	-	0.88

Removing face mask		
Yes (sometimes, often or only during exertion)	Ref	Ref
Never	0.38 [0.22,0.66]	0.55
Sensorial dimension		
Others	Ref	Ref
Air hunger	2.03 [1.38,2.97]	1.74
Emotional dimension		
Others	Ref	Ref
Anxiety	1.59 [1,2.53]	1.37
Model accuracy and lambda		
Model accuracy	0.69	0.66
Lambda	-	0.0174

	Stepwise regression (final model)	**LASSO regression**
What people with respiratory diseases may feel like		
Gender		
Men	Ref	Ref
Women	-	1.004
Employment		
Retired or unemployed	Ref	Ref
Working class	1.74 [1.23,2.44]	1.32
Middle and upper classes	1.11 [0.78,1.56]	-
Education		
12 years and below	Ref	Ref
above 12 years	-	1.10
Breathing oriented activity		
Never or rarely	Ref	Ref
Often or from time to time	-	1.02
First reported drawback of wearing face mask		
Others	Ref	Ref
Difficulties breathing	-	1.40
Type of face mask		
Single-used surgical mask	Ref	Ref
Reusable fabric mask	-	-
Both type of mask	-	1.03
Facial mask as own protection		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	-	1.22
Facial mask as protection for others		

Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	1.96 [1.23,3.13]	1.28
Difficulty to breathe at rest		
No	Ref	Ref
Yes	-	1.22
Difficulty to breathe during moderate exertion		
No	Ref	Ref
Yes	1.92 [1.39,2.65]	1.28
Difficulty to breathe during sports		
No	Ref	Ref
Yes	1.38 [0.85,2.22]	1.28
Never wear mask for sports	0.88 [0.59,1.33]	-
Model accuracy and lambda		
Model accuracy	0.63	0.60
Lambda	-	0.0148

	Stepwise regression (final model)	**LASSO regression**
Change regarding oneself		
Gender		
Men	Ref	Ref
Women	1.61 [1.2,2.17]	1.26
Education		
12 years and below	Ref	Ref
above 12 years	-	1.10
Facial mask as own protection		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	-	1.01
Facial mask as protection for others		
Disagree (completely or somewhat)	Ref	Ref
Agree (completely or somewhat)	2.51 [1.57,4.01]	2.24
Removing face mask		
Yes (sometimes, often or only during exertion)	Ref	Ref
Never	-	0.97
Difficulty to breathe at rest		
No	Ref	Ref
Yes	1.6 [1.11,2.31]	1.57
Difficulty to breathe during moderate exertion		
No	Ref	Ref
Yes	2.31 [1.62,3.3]	2.22

Difficulty to breathe during sports		
No	Ref	Ref
Yes	2.17 [1.31,3.6]	1.59
Never wear mask for sports	1.27 [0.85,1.89]	-
Model accuracy and lambda		
Model accuracy	0.68	0.61
Lambda	-	0.0191