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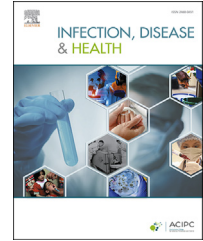
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Research paper

Respiratory infection prevention: perceptions, barriers and facilitators after SARS-CoV-2

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Abstract *Background:* Respiratory hygiene, especially in context of COVID-19, is of utmost importance. Healthcare professionals (HCPs) play an important role in the prevention of infections. Their perceptions of the subject are needed to tailor effective communication and training on prevention.

Methods: 20 French HCPs were questioned about their perceptions on respiratory hygiene and infections, by the means of recorded semi-structured interviews and a focus group. The interviews and focus group were transcribed then analysed through lexicometric and thematic content analyses.

Results: HCP discourse revolved around the use of face masks, the prevention and the characteristics of respiratory infections and the means to prevent them. COVID-19 excepted, HCPs considered respiratory infections as benign. They associated respiratory hygiene to the observance of cough etiquette, the preservation of lung health, the act of protecting oneself and others, and the adherence to safety protocols. Main barriers to good practices were organizational ones, such as the lack of consultation and mobilization of HCPs in the development of preventive measures, suboptimal information sharing and the physical and relational constraints of face masks. They advised means of improving communication and information promotion.

Conclusion: Since the pandemic crisis, HCPs have developed a better awareness about the prevention of respiratory infections. Except for COVID-19, respiratory infections are mostly

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considered as benign. Barriers and facilitators evoked by HCPs will help to build national communication and tools.

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Highlights

- HCPs had a high level of knowledge and perception of respiratory hygiene.
 - Burdens of face-masking were considered a strong barrier to cough etiquette.
 - Lack of involvement of HCPs in prevention strategies was another main barrier.
 - Lacklustre or inconsistent information sharing was the third main drawback.
 - It is recommended to address these issues to improve Respiratory Infection Prevention.
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Background

Cough etiquette, mask wearing, and hand hygiene have been highlighted during the COVID-19 crisis but are also paramount in preventing respiratory infections (RI) such as Influenza, Whooping Cough, Tuberculosis and Common Cold [1–3]. Transmission of the disease occurs when an infected individual sneezes or coughs, spreading droplets that carry infectious agents. Thus, control of the spread of pathogens by respiratory hygiene is the first and foremost way of avoiding healthcare associated infections in health facilities [4].

Basics of respiratory hygiene include social distancing, face mask wearing, handwashing, and sneezing and coughing into tissue or the fold of the elbow [5]. Despite the abundance and availability of information, poor compliance with these gestures hinders the prevention of RI [7–10]. Extra attention needs to be paid to HCPs, as their role exposes them to sick patients [11,12].

It is therefore important to develop an adapted intervention to strengthen knowledge and RI prevention [13,14]. Behavioural theories, such as Reasoned Action Theories and Planned Behaviour Theories, provide theoretical and practical insights that teach the importance of identifying attitudes, perceptions, intentions, beliefs, barriers and facilitators [15,16]. Studies identifying determinants of good hygiene in the context of HAIs are not lacking, but they tend to focus only on general perceptions of hygiene among health professionals or hand hygiene, whereas the ones taking a deeper look at respiratory hygiene are less frequent [17,18]. Finally, has the pandemic crisis raised awareness about RIs among HCPs? This study aimed to identify the perception of HCPs about RIs and the ways to prevent them, but also to identify the barriers they faced and the factors that could facilitate good practices.

Methods

A qualitative study was designed in 2021 by the national project MATIS *Transversal Support Mission for the Prevention of Healthcare-Associated Infections*, led by the CPIAS centers (Support Center for the Prevention of Healthcare-

Associated Infections) of Nouvelle-Aquitaine and Iles de Guadeloupe in France. The MATIS project is a national mission delegated by Santé Publique France and aims to create tools for assessment, training, and communication in terms of infection prevention and control. This study consisted of individual semi-structured interviews and one focus group proposed to healthcare professionals, questioning them on their own practices related to respiratory hygiene. These interviews and the focus group were conducted using an open, exploratory approach allowing for the abstraction and generalization of data (inductive approach) [19].

Participants

The study recruited, on a purposive sampling method, HCPs for individual interviews and 7 HCPs for the focus group, practicing in the French regions of Nouvelle-Aquitaine, Ile-de-France, La Réunion and Guadeloupe. Public facilities and private practices that could be representative of the population of healthcare workers were identified. In those facilities, targeted professionals were asked to participate based on the representativeness needs. Healthcare workers were progressively included until thematic saturation was reached [20]. Thematic saturation was reached at the 10th interview. Three additional interviews and a focus group were conducted to confirm the saturation. The final sample consisted of 13 participants for individual interviews and 7 participants for the focus group.

The total sample included 9 men and 11 women, 80% from mainland France (Nouvelle-Aquitaine, Ile de France) and 20% from overseas France (Guadeloupe, La Réunion), 30% worked in healthcare facilities, 15% worked in private practice, and 55% in social welfare facilities. The sample consisted of three chief executives or directors, two midwives, five nurses, seven physicians, one surgeon, one occupational therapist, and one health executive.

Measures

An interview grid, including open-ended and non-inductive questions, was developed for both the individual and focus-grouped interviews with the aim of identifying perceptions,

barriers, and facilitator for respiratory infection prevention (see Supplementary materials).

Procedure

Semi-directed individual interviews were conducted by a psychologist from the MATIS Team with no prior relationships with the included HCPs, and no previous history with the selected facilities. The participants were contacted by email with an explanation of the objectives of the study and the interview procedures. The interviews and focus group happened between March and May 2021 and were recorded using a Dictaphone.

Ethical considerations

This research has been declared to the CNIL (*Commission Nationale de l'Informatique et des Libertés, the French National Agency regulating Data Protection*) under the number 2207056 v 0. An information note and a consent form were sent to each participant. They were notified that they had the possibility of withdrawing at any time during the study and that they could obtain any additional information. The data was stored and processed, both anonymously and confidentially.

Data analysis

Each recording was transcribed in *verbatim* and the whole corpus of the interviews was prepared for textual analysis. A lexicographical analysis was performed to get a better understanding of the perceptions of the participants [21]. This allowed the observation of the frequency and the proximity or distance between words, by drawing up a lexicon of the words used in the corpus and dividing them into units which were subjected to a matrix (presence/absence of words in each unit). This matrix was then subjected to multidimensional analyses of the distance between words based on Chi2. Descending Hierarchical Analysis (DHA) was performed to observe the division of the discourse into different classes that regroup words close to each other. In each of these classes, a set of the most cited and most associated words were identified, and words with a chi-square value above 2 and with statistical significance ($p < .05$) were reported for each class. A thematic content analysis was then performed on each transcription. Each sentence of the corpus was manually associated and grouped together according to themes or a general idea, and each of these themes was reorganized to form a global understanding of the participants' perception. Thematic content analysis was performed until thematic saturation was reached, that is, when no new themes emerged in the last three analysed transcriptions in accordance with recommendations on qualitative research [22–24]. *Nvivo* was used for thematic content analysis, and *IRaMuTeQ* was used for lexicographical analysis [25]. Data extraction, lexicographical and thematic content analysis were independently performed by GB and NC, then compared to check for any disagreement or discrepancies. Consensus was then reached with all the authors of this study discussing the issues until agreement was complete.

Results

Description of the discourses

The DHA performed on the corpus allowed the emergence of 6 classes of forms on 86.95% of classified text segments. The dendrogram (see Fig. 1 below) obtained from DHA highlights three clusters of six classes that were correlated: classes 1 and 6, classes 2 and 3, classes 4 and 5.

Regarding the first cluster, the first ten characteristic words of Class 1 are: 'mask', 'carry', 'surgical', 'FFP2', 'put on', 'keep', 'operative', 'wear', 'block', and refer to the action of wearing masks when taking care of patients. The characteristic segments are congruent with this idea.

Sample verbatim: – 'We wear a surgical mask all the time when we are in the patients' rooms, but the FFP2 for us is compulsory for everything that is endoscopies and in particular upper digestive endoscopies, fibrosopies and so on.'

The first ten characteristic words of Class 6 are: 'face', 'see', 'complicated', 'normal', 'adapt', 'need', 'start', 'recognize', 'accustom', 'interest'. The lexical field of this class seems to refer to the difficulty of accustoming to the mask and the impediment they cause on communication with patients.

Sample verbatim: – 'Because even in normal times we have trouble making ourselves understood and, it's true that with the masks people don't see our faces so there is more difficulty in communication and understanding, that's for sure.'

Thus, it seems that the lexical field uniting class 1 and class 6 is the theme of face masks in general, their constraints on non-verbal communication, and the difficulties of getting accustomed to the mask.

The second cluster includes Class 3, of which the top ten characteristic words are: 'information', 'training', 'reminder', 'public', 'large', 'poster', 'miss', 'understand', 'explain', 'spot'. The lexical field of class 3 seems to refer to public communication needs regarding respiratory infections.

Sample verbatim: – 'If you don't have good hand hygiene, it won't work either, what really strikes me is the lack of information to the general public'

The first ten characteristic words of Class 2 are: 'establishment', 'outside', 'refer', 'share', 'team', 'relationship', 'follow', 'professional', 'policy', 'medicalize'. This class seems to be related to institutions and health professionals. A closer look at the characteristic segments reveals that the themes discussed revolve around sharing information and experiences among health professionals.

Sample verbatim: – 'On the other hand, what I think could be interesting is to have shared time with hygienists from outside the establishment'
—' there you go, shared feedback, I think it is interesting, in-house training on hand hygiene.'

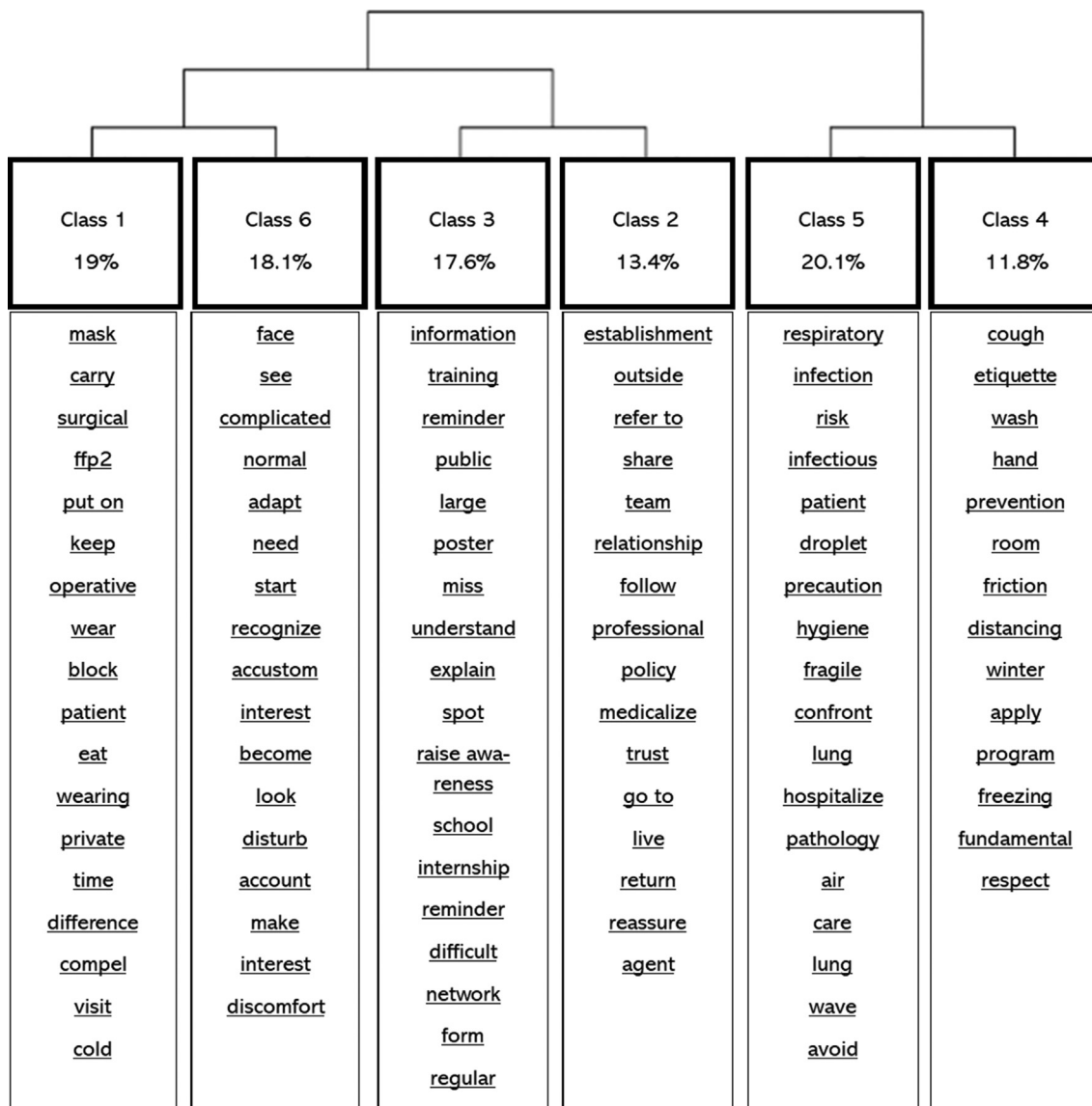


Figure 1 Dendrogram of the descending hierarchical classification (DHC).

The second cluster would thus refer to communication needs on RIs, both for the general population and the HCPs. HCPs particularly highlight the need to share and to train horizontally between themselves, based on their experiences.

Finally, the third cluster seems to refer to respiratory infections, their characteristics, their mode of transmission and their prevention and control measures.

The lexical field of class 5 displays characteristics of respiratory infections and includes the words 'respiratory', 'infection', 'risk', 'infectious', 'patient', 'droplet', 'precaution', 'hygiene', 'fragile', 'confront'.

Class 4 seems to have a lexical field focused on prevention measures against respiratory infections and cough etiquette. The top ten most associated words are 'cough', 'etiquette', 'wash', 'hand', 'prevention', 'room', 'friction', 'distancing', 'winter' and 'apply'. Hence, class 5 addresses the problem of respiratory infections while class 4 presents solutions to that problem.

Perceptions and knowledge about respiratory hygiene

Thematic content analysis divided HCP discourse into four main thematic categories. Firstly, HCPs associated respiratory hygiene with the observance of protective behavioural measures and cough etiquette such as the respect of handwashing, face-masking, social distancing, and the responsible use of tissues.

Sample verbatim: – 'The respect of the cough etiquette and then, of the precautions which will often be related to the infectious risk, it is true that if one has a suspicion of flu, one will observe particular precautions.'

Secondly, HCPs linked respiratory hygiene to pulmonary health and preservation of the lungs and respiratory capacities. They addressed behavioural measures, such as avoiding toxic environments and toxic habits (like smoking),

frequently aerating the room they live or work in, and having healthy habits like doing sport.

Sample verbatim: – ‘Respiratory hygiene? Good breathing capacity, clean air, no smoking ... That’s it and exercise.’

Thirdly, HCPs shared that respiratory hygiene was the act of ensuring one’s own safety and the safety of others. Thus, respiratory hygiene was a matter of protecting oneself and others by avoiding spreading any disease.

Sample verbatim: – ‘So, we are extremely vigilant in terms of respiratory hygiene ... to guarantee a maximum level of safety within the means that we have and that are currently known. For the patients, for the environment of the patients and for the protection of the professionals, of course.’

Finally, they mentioned that respiratory hygiene was also a matter of organizational measures and protocols, i.e., institutional efforts in establishing safety protocols and systematic precautionary measures in the workplace in order to prevent the spread of any disease.

Sample verbatim: – ‘It’s perhaps choosing the care with the necessary precautions, so there is always the standard precaution, which is always up to date and then, depending on the infectious risk, there may be more and more regulatory, air or droplet precautions ...’

When asked about their knowledge on respiratory infections, they first thought about COVID-19. When excluded, other RIs were also well known. They evoked their biological (virus, bacteria) and clinical features: diseases, location of the diseases (otorhinolaryngology, pulmonary), their gravity, their symptoms, and their impact (deterioration of health, risk of death, complications of care, increased risk for vulnerable people). HCPs identified respiratory infection control measures (see supplementary materials). Except for COVID-19, HCPs considered RIs to be of low gravity as they felt RIs do not have a very large impact and are mainly benign. Nevertheless, they mostly declared they wanted to keep some practices they implemented during the COVID-19 crisis: hand hygiene, face masks when needed and education of the patients.

Barriers and facilitators for RIs prevention

When asked about what could hinder the prevention of respiratory infections, and what would strengthen it, the participants evoked a set of themes listed in [Table 1](#). Verbatim samples are available in this table to highlight thematic content analysis.

HCPs evoked organizational issues. They had the perception they were left out of any decisions or discussions in establishing protocols or safety decisions. They also felt that a heavy workload, financial shortcomings, and a lack of adequate equipment or suitable workplaces were responsible for important difficulties in implementing respiratory hygiene prevention.

They also addressed barriers related to face masking. Physical constraints were related to the poor quality of masks, the discomfort of wearing them every day or the

bothersome fog they can induce on glasses. They mentioned relational barriers with patients and co-workers, as non-verbal communication and visual identification are impaired by masks.

Regarding prevention, they mentioned that actual messages and information on prevention of RIs remained unclear to the public. Most of HCPs evoked a lot of contradictory information and statements that could be confusing for them or the average person. Regarding COVID-19, the information and protocols were deemed too complex. They identified inconsistencies and contradictions in delivered messages and some information media were perceived as irrelevant and ineffective (especially paper posters and television spots). Paradoxically, they evoked both a counterproductive overload of information and a lack of reminders for a general audience.

HCPs pointed out individual related barriers specifically aimed at patients and the public, whose beliefs, behaviours and attitudes (resistance, unawareness, partial knowledge or partial compliance) can undermine the prevention of RIs with ineffective, skimp gestures or cough etiquette. They felt that individuals could underestimate or not understand the importance of respiratory hygiene.

In opposition to those barriers, they proposed facilitators, mainly revolving around communicative measures. They mentioned that they needed the right training to be able to be more effective in respiratory hygiene prevention. They felt that it was not just a matter of educating and informing, but also persuading and demonstrating by compelling and tangible evidence, like visual and educative tools or results from strong scientific studies.

Also, efforts to facilitate the integration of information are important. Hence, any means of clarifying information, of adapting it to the targeted audience, of prioritizing the most important content, was seen as desirable. They suggested that information could be facilitated via suitable media like posters and magazines, videos, TV or radio spots, especially via social networks and more ludic tools like serious games. They also advised making the information more accessible with timely reminders and repetition, also targeting relevant locations where it could be best dispatched to large audiences, such as schools or supermarkets.

Finally, they asked to be actively involved in prevention, and that it would be beneficial to establish horizontal communication between HCPs. Thus, a strong facilitator would be sharing feedback on their own practice and elaborating on their experiences and their practices in groups. They also evoked that receiving more support from health authorities and more financial and material means would empower them in the prevention of respiratory hygiene and patient education.

Discussion

This study, in a RI pandemic context, identified that HCPs had a high understanding of notions related to respiratory hygiene infections and prevention. But they perceived low gravity and consequences of RIs (except the case of COVID-19), which can be worrisome, as scientific literature tends to highlight a high level of knowledge about diseases, but poorer attitudes and behaviours in preventing them

Table 1 List of barriers and facilitators of prevention on respiratory hygiene.

Categories	Sub-categories	Content	Sample <i>verbatim</i>
Face mask-related barriers	Physical and comfort constraints	• Mask-wearing fatigue	—'So, I must admit that I'm getting tired of it! I've been wearing it all the time for more than a year, I've never been working from home like others! So, it's all the time ...'
		• Discomfort	—'The FFP2 is very uncomfortable, necessary but very uncomfortable. And beyond that I had quite a few colleagues who had problems dermatology-wise. Also, breathing problems, I think of an agent who can't stand and suffocates in fact, with the FFP2'
		• Difficulty of following instructions	—'And the FFP2, knowing that you must wear it for at least 4 h and especially not to take it off, it induces dehydration because inevitably you don't take it off to drink, you only take it off to eat, so you really have to calculate your break. So, it's not practical in terms of time management.'
	Relational barriers	• Poor quality of mask	—'At the moment you can find on the market surgical masks that are cheap and not of good quality, some fabric which does not allow a good air passage.'
		• Barrier to visual identification and non-verbal communication	—'We are supposed to be in the care, and the care can be mediated via a look, a smile, and all that is slowed down by the wearing of the mask where in fact as I told you we all look alike, and in the identification of the caregiver by the patient it seems complicated to me.'
		• Barrier to caregiver communication	—'What I find complicated is that I have old people who do not hear very well, it is true that there we see that the mask contributes even more to bad understanding.'
Organizational barriers	N/A	• Caregiver not involved in decisions	—'Protocols are written ... But not necessarily by uh ... by the carers, and even if sometimes we have ... We're caregivers, and we don't necessarily have a say, we're not asked for our opinion, even though we're the ones in the battlefield.'
		• Workload	—'We systematically disinfect all the tables after each, so it takes time between each patient, and it costs a lot.'
		• Lack of equipment	—'And with the covid, we found ourselves without any material, so we kept the information by saying be careful, you have to put on a surgical mask, be careful with personal contact, etc. You can do whatever you want if you don't have the equipment behind it, it's useless.'
		• Budgetary barriers	—'Yeah, that and all the equipment, each person uses the equipment and disinfects what they touch, that's a lot of products. It's not insurmountable but it's a lot. Add to that the masks that we're paying for!'
		• Unsuitable workplace	—'Well, being in an institution that is a bit old, no because we are not sure about the maintenance of the ventilation system ...'
Prevention-related barriers	Substance	• Complexity of information and protocols	—'About the protocols ... the sequence of what you have to take off or put on before entering the room of someone who is isolated, do you have to put on the cap first, then the gown, then the gloves? It was at first difficult, a lot of information to input.' —'Well, what was harder to understand was a bit ...

Table 1 (continued)

Categories	Sub-categories	Content	Sample verbatim
	Form	<ul style="list-style-type: none"> • Inconsistencies, contradictions and instability of information • Irrelevant media 	<p><i>All the inconsistencies ... All the inconsistencies of government decisions that have been taken. The closing of certain public places and then, on the other hand, the metro is packed, that sort of thing.</i></p> <p>—“I’m not sure whether we should go back to paper media or television media, perhaps more educative means would seem more effective to me.”</p>
		<ul style="list-style-type: none"> • Counterproductive overload 	<p>—“The problem is that when you post too many documents, and they change all the time, people don’t read them anymore. That’s the problem, there’s so much prevention around so many things that after a while people get drowned.”</p>
		<ul style="list-style-type: none"> • Not enough reminders 	<p>—“Often when there are awareness campaigns, they are just for a while. The problem is that information is lost over time and repetition is necessary to ensure that the information is continuous.”</p>
		<ul style="list-style-type: none"> • Patients in refusal or resistance • Unawareness and underestimation 	<p>—“And then you have people who are really, we hear it more or less in the media, there are people who are anti-mask. A lady who told me that if I forced her to put on the mask, she wouldn’t come to the consultation.”</p> <p>—“After all, in prevention, it’s not always because you have the knowledge that you’re going to apply your barrier measures. It’s more a matter of the person controlling himself. Again, it depends on beliefs. Some people will think that it’s not serious, it won’t be fatal. So much the worse if you are a bit sick.”</p>
Individual-related barriers	N/A	<ul style="list-style-type: none"> • Partial observance or knowledge 	<p>—‘I think it was well done but caught up in the movement and in the rush, I think there are things that escape us or that we haven’t thought about at the time. We can do things quickly, half-heartedly, and therefore have gestures that are not very effective. It’s difficult to think about everything all the time.</p>
		<ul style="list-style-type: none"> • Educate and inform 	<p>—‘Perhaps rethinking the training of professionals, in terms of prevention and the prevention message they should have, in their care.’</p>
		<ul style="list-style-type: none"> • Persuade and demonstrate 	<p>—‘I don’t know if it has much to do with respiratory infections, but you know there’s a little game where you have to wash your hands It’s a little machine where you put your hands in a Petri before hydroalcoholic solution and after. It highlights germs. Well, I invested in one, and I think it’s great because you can have the families, the residents, the doctors ... I don’t know, for respiratory infections, shouldn’t we create a system?’</p>
		<ul style="list-style-type: none"> • Suitable media • Clarify information 	<p>—‘We should make educational films in fact, or even serious game, they tend to be fun and appealing’</p> <p>—‘You have to give an intelligible, simple and intelligible message to the people. The acceptability of all constraints comes from understanding why and so you must explain in an intelligible way to the population and explain to them why they have to do it. If they don’t know why they won’t do it.’</p>
Communicative facilitators	Giving information	<ul style="list-style-type: none"> • Repeat and recall information 	<p>—‘In fact, use all possible communication channels, i.e. flash messages in waiting rooms, television</p>
	Facilitating information		<p>(continued on next page)</p>

Table 1 (continued)

Categories	Sub-categories	Content	Sample verbatim
Organizational facilitators	N/A	<ul style="list-style-type: none"> • Target the right places 	<p>spots, radio messages, and in fact above all its repetition, because often when there are awareness campaigns, they are just for a short time'</p> <p>—'And then it's training in workshops in places that the general public goes to. And today, in certain sectors, I can hardly see that the only places that could lend themselves to this kind of thing are the supermarkets. It has to be enclosed and conducive to dissemination. Because we are going to reach the whole population, from the youngest to the oldest. I think that the places where people buy basic necessities are the places where we should put the emphasis in terms of prevention.'</p>
		<ul style="list-style-type: none"> • Prioritize and adapt information 	<p>—'And that it be explained by people is above all that, in fact, that it is explicit and that we can do it with people. Like all trades, companionship is still a very good key in this world ... You have to clearly prioritize what you have to tell them and therefore individualize the message.'</p>
		<ul style="list-style-type: none"> • Support from health authorities 	<p>—'It was a real boost, but also a great relief for the teams to realize that the protocols or the accompaniments we had put in place were validated by higher authorities.'</p>
		<ul style="list-style-type: none"> • Involve teams of HCPs • Communication and feedback between HCPs • More financial and material resources 	<p>—'Feedback, shared feedback, working groups between professionals, I think it's interesting.'</p> <p>—'It's putting everyone in the loop, i.e. on all floors at all levels, orderlies, nurses, doctors ... To get together to talk about it, to develop protocols together.'</p> <p>—'Well, we need material, that was the big problem last year, when we don't have material, when we order, we annoy our director who tells us, 'Well yes, but I do what I can''.</p>

[7,8,26,27]. This lack of risk perception could be explained by a high sense of self-efficacy. Trusting one's own ability to deal with the danger of infection as a professional, or having confidence in central government, health policies or medical professionals are indeed known as factors of low risk perception in respiratory infection diseases [28]. They also mentioned individual related barriers, identifying those who refuse to abide by behavioural prevention or who underestimate the gravity and apply half-hearted measures. Previous studies demonstrated that a low level of exposure to disease-related information and low education and disease-related knowledge were associated with low-risk perception of respiratory infection disease [28]. This fact mirrors their concerns on education needs and the timing of information to a general audience.

Interestingly, they highlighted difficulties with face masking on an interpersonal level. This complaint has been previously heard, as studies and experts stated their impact on our ability to read emotions on one's face, or the burden they induce when dealing with vulnerable people (psychiatric, dementia or hearing loss issues) [29–31].

Organizational barriers, such as a lack of resources for implementing public health and social measures, or the

need of suitable workplace adjustments, were already identified in previous research and are considered as the most influential [32,33]. Those are among the most interesting issues encountered by HCPs, as they are critical to coordinating measures for HCPs, such as education, staffing optimization and vaccination, or facility planning [34]. HCPs stressed more importantly the lack of inclusion of HCPs in the development of preventative measures. This needs to be addressed as their role in prevention and their proximity with patients are crucial and decisive [14,34].

Thus, they highlighted the need to receive adequate training to be an effective agent of prevention and the need for more discussion and feedback between HCPs. This grievance needs to be heard as it is known that prior education on cough etiquette, awareness and knowledge on respiratory hygiene and feedback between HCPs and their supervisors are among the best predictors of proper respiratory hygiene [10,12,35].

They also emphasized the usefulness of more adapted or ludic media to promote effective prevention. They evoked social networks, which seem to be a viable solution, as they are known to be one of the main sources of information for people [36]. Serious games could also be a suitable option,

as they showed promising results in various cases of education and prevention [37].

The sample size remained modest but had well-balanced numbers as saturation was reached. We did not compare perceptions between mainland and overseas participants. In consequence, cultural differences might have not been taken into account. This study took place during the COVID-19 crisis. Hence, the perceptions assessed in this study could be more related to COVID-19 than to general respiratory infections. But results showed other RIs were well discussed in the healthcare-associated infection context. This study used an inductive approach, which requires starting from scratch and investigating with an open mind, free from background theories. Its results yielded interesting findings and identified the most immediate and current barriers and facilitating factors evoked by HCWs. Deductive designs using standardized frameworks such as the COM-B (Capability, Opportunity, Motivation, Behaviour) or the TDF (Theoretical Framework Domains) could be useful to confirm and to gain a deeper understanding of HCPs views [38,39]. Still, sufficient information was obtained to create the MATIS French national toolbox for the prevention of RIs in healthcare (including tools for ward evaluation, HCPs self-assessment, online training and awareness-raising videos and posters).

Conclusion

In a COVID-19 context, this study assessed the perceptions and knowledge of HCPs about respiratory hygiene, emphasizing a high level of control of those notions, but a low perception of risks associated with respiratory infections, COVID-19 excluded. They also identified a set of barriers, mainly focusing on the physical and relational constraints of face masks; the lack of consultation and mobilization of HCPs in the development of preventive measures and protocols; the complexity, abundance, inconsistency and contradiction of information; the unsuitability of communication media; and the beliefs, behaviours and knowledge of the general population on respiratory hygiene. In that respect, they proposed facilitators of prevention, including organizational support on communication between HCPs, and the improvement of the substance and form of preventive messages in order to promote them effectively. Health authorities could benefit from these results and develop programs tailored to those needs.

Authors' contributions

BQ,GB,AGV,RN,BJ and PP designed the protocol of the study. AGV and RN identified the people to be interviewed and organized the focus groups. GB led the interviews, focus groups, and was in charge of the transcript of the *verbatim* and extraction of the data. GB, AGV and NC performed qualitative analyses and interpreted the results. NC redacted the draft. BQ, AGV, RN, BJ, GB and PP participated in the modification and correction of the draft.

Provenance and peer review

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Conflict of Interest

The Author(s) declare(s) that there is no conflict of interest.

Appendix A. Supplementary data

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