



Barriers and facilitators on hand hygiene and hydro-alcoholic solutions' use: representations of health professionals and prevention perspectives

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SUMMARY

Background: Healthcare-associated infections pose a serious problem in terms of health and mortality. Their prevention is a necessity, and healthcare professionals are one of their main vectors. Thus, they must be at the centre of preventative strategies. As hydro-alcoholic solutions (alcohol-based hand rub) represent the most effective means of preventing these infections, it is necessary to identify the representations, barriers, and facilitators of their use.

Method: Forty-six healthcare professionals from two areas in France, New Aquitaine and Guadeloupe, were questioned about their practices through semi-structured registered interviews and four focus groups. Each interview and focus group were transcribed then analysed through lexicometric and thematic content analyses.

Results: The interviewed identified several barriers and facilitators related to the composition and characteristics of hydro-alcoholic solutions (unpleasantness, harmfulness, personal preferences for other hand hygiene products), personal factors (work habits, cognitive bias, lack of knowledge and communication) and organizational (professional constraints, product accessibility, financial resources).

Conclusion: Strategies to prevent healthcare-associated infections should be constructed with consideration of psychosocial facilitators and barriers for healthcare professionals in using hydro-alcoholic solutions. These strategies should also ensure that they are well informed about the effectiveness of alcohol-based solutions, through prevention campaigns and scientific articles. This awareness should equally be conveyed with educational tools that involve healthcare professionals and use the social dynamics of their work environment.

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Background

More than ever, in the context of the COVID-19 pandemic, hand hygiene (HH) is crucial in the fight against the spread of infection. It is repeatedly stated in numerous government messages calling for hand disinfection with hydro-alcoholic solution, alcohol-based hand rub (ABHR), as often as possible [1]. As easy as this example may be, HH is equally relevant in the prevention of healthcare-associated infections (HCAs) [2,3].

The most common HCAs include catheter-associated urinary tract infections, surgical site infections, ventilator-associated pneumonia and central line-associated bloodstream infection [4]. The numbers involved are overwhelming. In the United States, HCAs affect 1.7 million people, making them one of the top 10 causes of death in the USA [3]. In France, nearly one patient in 20 is affected by HCAs (4,000 deaths per year) [5]. At international level, the prevalence varies from 5 to 15% of hospitalized patients depending on the country concerned [3]. In addition to their prevalence and lethality, these infections are particularly costly and stressful for the patients [6–11]. Moreover, the rise of antimicrobial resistance is leading to the increased risk of facing untreatable HCAs [12].

Caregivers are among the main vectors of HCAs, as negligence of health professionals combined with failure to observe hygiene protocols, overwork, understaffing and the increasing number of patients may all contribute to the development of HCAs [13–15]. Poor HH is the most common vehicle for the transmission of HCAs [16]. Compliance with HH standards is the simplest and most important way of preventing and controlling HCAs. There are two ways of performing HH: rubbing hands with an ABHR or washing them with soap and water. When hands are visually clean and dry, ABHR is preferable as it is microbiologically more effective [17]. Most important ABHR allows a better compliance as it is easier and faster to perform [18]. Yet the adherence of healthcare professionals to HH or their knowledge of HCAs and related good practices are not optimal [3,19–24].

To contain the problem of HCAs, a preventative, effective and cost-effective approach is necessary [13,25,26]. Health psychology provides useful theoretical insights and socio-cognitive models (such as Reasoned Action Theories and Planned Behaviour Theories), which expose the processes underlying the establishment and maintenance of health behaviours. These stipulate that to induce an individual to develop such behaviours, it is essential to look at the attitudes, representations, intentions, barriers, facilitators, and the perceived social norms that one identifies about the behaviour in question [27,28]. Studies to identify these elements in the context of HCAs and HH are not lacking in the international literature [29–33]. However, those studies focus only on general

perceptions of hygiene among healthcare professionals, while studies taking a deeper look into the ABHR are scarce [34].

The national Transversal Support Mission for the Prevention of Healthcare-Associated Infections (MATIS)¹, led by the Support Centres for the Prevention of Healthcare-Associated Infections (CPIAS)² of New Aquitaine and Guadeloupe in France, aims to create tools for assessment, training, and communication in terms of infection prevention and control. As part of its mission (2018–2023), qualitative research was conducted. The main objective was to explore the representations of hand hygiene among health professionals, and the psychosocial barriers and facilitators associated to the use of ABHR, to obtain a better understanding of ABHR, HCAs, HH issues, and to develop adapted educational tools to promote HH.

Method

To meet this objective, individual or grouped interviews were proposed to healthcare professionals to make them reflect on their own practices related to HH and ABHR. These interviews were achieved through an open, interpretative, exploratory approach allowing abstracting and generalizing data (inductive approach) [35].

Participants

Forty-six healthcare professionals (22 individual interviews + 24 participants divided into four focus groups), with different professions and hierarchical status (and practicing in the French regions of New Aquitaine and Guadeloupe) were selected on a voluntary basis and included in the study. We first identified facilities and private practices that could be representative enough of the population of healthcare workers. In those facilities, we asked targeted professionals for participation based on our representativeness needs. Only one auxiliary nurse in a nursing home declined because of a lack of time. Healthcare workers were progressively included in this study until thematic saturation was reached [36]. The focus-group participants were recruited by email or by registering on CPIAS Guadeloupe website.

The average age was 44.1 years (25–74), and the average length of service was 11.8 years (6 months–36 years). The samples included 12 men and 34 women, including six managers (health executive, director, head of the department) and 40 caregivers (see Table I below).

Measures

An interview grid was developed for both the individual and focus-grouped interviews with the aim of identifying barriers and facilitator of the use of ABHR, in order to improve compliance with HH. This grid was used during telephone

¹ Mission d'Appui Transversal à la prévention des Infections associées aux Soins.

² Centre d'appui pour la Prévention des Infections Associées aux Soins.

Table I
Participants' sociodemographic data

Variables	New Aquitaine	Guadeloupe	Total
Sex			
M	10	4	14
F	12	20	32
Statut			
Manager	3	3	6
Caregiver	19	21	40
Patient	2	2	4
Profession			
Doctor	7	1	8
Dentist	2	0	2
Nurse	3	8	11
Nursing auxiliary	0	6	6
Midwife	1	1	2
Intern	2	0	2
Occupational therapist	0	1	1
Radiographer	0	2	2
Speech/language therapist	1	0	1
Health Executive	1	3	4
Director	2	0	2
Physiotherapist	1	1	2
Surgeon	1	0	1
Head of Department	1	0	1
Hospital Service Agent	0	1	1
Patient	2	2	4
Structure			
Hospital	7	3	10
Clinic	1	1	2
Nursing home/Retirement home	0	4	4
Private practitioners	14	2	16
Unknown	0	14	14

Note. M = Male; F = Female.

interviews and focus groups for both regions. It was organized around two main themes using open-ended, non-inductive questions:

- **Representations concerning ABHR:** assessing the use of ABHR in practice, information needs, individual and group barriers and facilitators for its use: *"How do you explain the fact that some caregivers do not always use ABHR?"* *"What could motivate healthcare professionals to use ABHR?"*
- **Ways to improve hand hygiene in general:** give professionals the opportunity to propose awareness techniques adapted for the field: *"What would you need in practice to improve your hand hygiene practices?"*

Procedure

Semi-directed individual interviews were conducted by telephone. The participants were contacted by email, with an explanation of the objectives of the study and the interview procedures. The interviews were conducted by a psychologist with no prior relationships with the included healthcare

professionals (HCPs), and no previous history with the selected facilities. Interviews happened between September 17 and November 3, 2018, lasted between 20 and 50 minutes and were recorded using a Dictaphone.

A written and oral explanation of the research objectives was given. The focus groups took place between 4 and 26 October 2018 and lasted between 63 and 86 minutes. Three were conducted in Guadeloupe (14 participants divided into three focus groups) and one in New Aquitaine (10 participants). The same interview grid was used for all the focus groups. The discussions were recorded with the permission of the participants.

Ethical considerations

This research has been declared to the Commission Nationale de l'Informatique et des Libertés (CNIL; the French National Agency regulating Data Protection) under the number 2207056. 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 were stored and processed anonymously and confidentially.

Data analysis

Each recording was transcribed verbatim and the whole corpus of the interviews was then prepared for textual analysis. The data from the interviews were processed from November 2018 to March 2019. Thematic content analysis was performed with *Nvivo* software on each transcription until thematic saturation was reached, that is when no new themes emerged in the last five transcriptions analysed. While thematic content analysis allows to interpret the corpus of texts, we also performed lexicographical analysis to get a better understanding of what our participants talked about [37,38]. This approach allows 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 will be the subject of a matrix (presence/absence of words in each unit). This matrix is then subjected to multi-dimensional analyses of the distance between words based on Chi2. Those analyses highlight how the discourse can be divided into different classes that regroup words close to each other (Descending Hierarchical Analysis), and how those different classes are opposed or mutually close on a graphic representation (Factorial Correspondence Analysis). Those are useful for assisting the reading of qualitative content, but still rely on subjective interpretation from the researcher. Two psychologists (EA and NC) performed the analyses using IRaMuTeQ [39,40].

Results

Barriers of the use of ABHR

When participants were asked what would prevent caregivers from using the hydro-alcoholic solution, the Descending Hierarchical Analysis (DHA) carried out on their answers divided the discourse into three classes (Table II below). Class 1 (14.7% of the discourse) seems to refer to a terminology of

Table II

Classes of discourse elaborated by DHA classification (Alceste Method) about barriers to the use of ABHR and profiles associated with the classes

	Classes	Words related
	Class 3 (48,4%)	Hand, Wash, Put on, Gel, Hydro-alcoholic, Use, Clean, Alcohol, ABHR, Smell, Skin, Leave, Friction, Times
Profile	Country	New Aquitaine
	Sex	Female ++
	Length of service	32,5–40,5 years ++, 24,5–32,5 years +
	Statut	Manager
	Profession	Speech/language therapist ++, Surgeon +, Dentist, Intern
	Structure	Private ++, Clinic
	Class 1 (14,7%)	Question, Habit, Returning, Forgetting, Handing over, Posing, Practical, Professional, Continuation, Serious, Medical, Work
Profile	Age	25–37years old ++
	Statut	Caregiver
	Profession	Nursing Auxiliary +++, Director +, Physiotherapist
	Structure	Hospital ++
	Classe 2 (36,9 %)	Hygiene, Doctor, People, Asking, Seeing, Service, Missing, Working, Training, Establishment, Nurse, Technical
Profile	Sex	Male ++
	Age	64–76years old ++
	Statut	Patient ++
	Profession	Hospital Service Agent ++, Head of Department

individual responsibility and personal factors (“question”, “habit”, “realize”, “forget”, “practice”, “consequence”, “obligation”). Class 2 (36.9% of the discourse) refers to organizational factors (“hygiene”, “doctor”, “service”, “lack”, “training”, “establishment”, “equipment”). Class 3 (48.4% of the speech) refers to ABHR products and their effect on hands (“hand”, “wash”, “gel”, “hydro-alcoholic”, “alcohol”, “ABHR”, “skin”, “friction”).

The thematic analysis strengthens this classification, as it highlights three types of barriers mentioned by the participants. The first relates to the composition of the product and its use, which is mainly a barrier of unpleasantness and harmfulness. First, ABHR hinders the comfort of the caregiver (unpleasant sensation, stickiness, unpleasant smell). It also raises the question of health. In case of wounds or cracks on the hands, ABHR gives a painful burning sensation. Thus, some healthcare professionals might perceive ABHR use as toxic and harmful for the skin in the long run. Some caregivers prefer wearing gloves. Others will prefer washing with soap, which is perceived as less aggressive and more efficient, while ABHR leaves a “false” impression of clean skin.

Representative verbatim sample: “Well, I don’t know if you’ve had the opportunity to use a lot of it, but it’s something that will burn your skin. And for some... In winter time, with the cold, you have dry skin, we’ve all been exposed to that... You have cracks forming in your hands because I use it... I don’t even know how many times a day I use it... We exceed almost 100 washes per day and so...”

The second type of barrier relates to intra- and inter-personal factors. These include, for example, the habits and automatisms associated with their practice. The automatic aspect of hand-washing leads to a drop in interest and vigilance, conducive to the occasional forgetfulness of using it. Those are also habits that the least experienced caregivers

have yet to adopt, or routines that are rooted too deep in older caregivers’ practices and that are difficult to change.

This category also features cognitive biases, such as beliefs and rumors circulating around ABHR. Participants mentioned the lack of conclusive studies on the effectiveness of ABHR, the long-term health consequences of repeated use of ABHR, or the supposed harm of ABHR on the destruction of the bacterial flora. It is also a question of poor risk assessment, or even risk minimization, as some respondents do not feel that the use of ABHR is relevant to their practices.

Representative verbatim sample: ‘As a result, it’s going to be very, very violent for the flora of the skin... which is going to degrade... Moreover, because of the American studies that have come out on the use of this hydroalcoholic solution... They did a study saying that they didn’t yet have enough data to know where we were going... we still don’t know in the long term if daily dose can be harmful to the skin. It was kind of imposed on us a few years ago. We were told that it was the solution to all our problem. But then... in the end, it can have repercussions on the caregivers.’

The last category of hindrance relates to organizational factors. It includes the perceived lack of time, mainly due to the high workload or the lack of staff, which lead to forgetfulness. This category also includes the issue of accessibility and availability of the product, as respondents evoked that sometimes no products were available at all, that they are not visible or not highlighted enough, and that they are not always practical to carry around.

Facilitators of the use of ABHR

A DHA classification divided the discourse into three classes. The first (39.3% of the discourse) relates to the incitement to use ABHR (‘hand’, ‘ABHR’, ‘washing’, ‘time’, ‘think’,

'explain', 'poster', 'effective', 'buy', 'use'). The second (45.1% of the discourse) relates to the collective involvement of caregivers ('work', 'take', 'awareness', 'staff', 'caregivers', 'understand', 'transmit', 'involve'). The third and last (15.5%) of the discourse refers to the accessibility of the product ('disposal, "door", "level", "mark", 'hallway, 'public', 'entry', 'room').

A Factorial Correspondence Analysis opposes its classes on an interesting orthogonal axis (Figure 1 below). The vertical axis opposes class 1 (black words) to class 2 (underlined and italic words), on a continuum that seems to distribute the words evoked, from top to bottom, between **individual and collective facilitators**. The horizontal axis opposes class 3 (grey words) to class 2, and seems to trace a continuum, from left to right, which distributes the words between **ABHR products-centred facilitators and prevention/communication-centred facilitators**.

Regarding thematic interpretation, the participants distinguished three types of facilitators to promote the use of ABHR (Table III below). These are firstly related to the product itself, which availability should be improved through better logistical management (small bottles, highlighting, sufficient replenishment), but also by highlighting the advantages in terms of time and efficiency compared to washing with soap.

The second type of identified facilitator is to encourage changes in the professional practices of healthcare givers. These feature reminding people that the use of ABHR is a

matter of patient safety and well-being, but also developing good habits of taking one's time, so that the use of ABHR does not remain a simple automatism, but a conscious and thoughtful gesture.

Representative verbatim sample: 'Sometimes we think that the risk is less direct and so we pay less attention to hand washing, we forget about it or do it too quickly, and that's where it happens. So... So there you go... That's why, you have to be vigilant all the time, and be mindful of what you're doing.'

Finally, the participants stressed the need for prevention around ABHR. To help them to engage in sustainable use of ABHR, live field demonstrations of the transmission of germs through educational tools and the effectiveness of hydro alcoholic solution (HAS) should be carried out. Caregivers should also be convinced of the effectiveness and non-toxicity of ABHR, but also of the risks of not respecting hygiene standards by promoting scientific articles free of conflicts of interest.

Representative verbatim sample: 'I hope that future studies will be done over the next few years that would demonstrate that there is no notable repercussions on daily use, that there is no risk of causing degenerative diseases. Depending on who decides to do the study and who actually conducts it, if it's the lab that asks for it, they're bound to hire someone who won't invalidate the use of the product or who won't say that it's very harmful in the long term for the professionals who use it. So... It has to come from a private

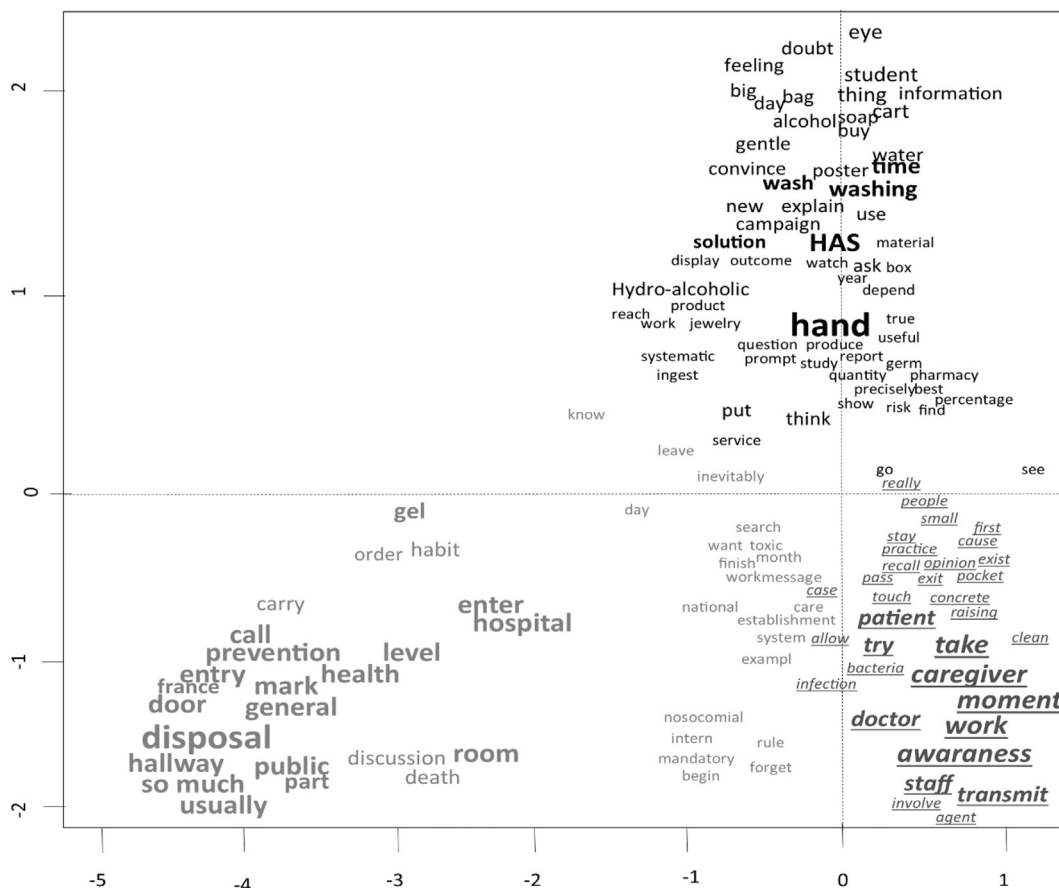


Figure 1. Factorial Correspondence Analysis of the discourse related to the facilitators of ABHR use, carried out on the classes obtained by Descending Hierarchical Analysis.

Table III
List of facilitators for the use of ABHR

Categories	Sub-categories	Details
Promoting access to the ABHR product	Improving accessibility	<i>Small, easily transportable flasks, highlight ABHR presence in the services and in the rooms, regularly replenishing the common containers</i>
	Diversity of textures and compositions	<i>To offer different choices of solutions and change for the preference of caregivers</i>
	Emphasis on practicality	<i>To present the advantages of HAS compared to soap washing, in terms of time and efficiency.</i>
Encouraging change in professional practices	Focusing on the patient's well-being	<i>To focus the use of ABHR on the well-being and health of the patient, which are undermined by HCAIS</i>
	Reminding the basics of hygiene Setting targets	<i>Clean clothes, remove jewelry, clean nails thoroughly. Standardized Hydro-Alcoholic Solutions Consumption Indicator levels to be achieved</i>
	Taking the time	<i>To develop good habits, to take one's time and become aware of the washing gesture and avoid forgetting.</i>
Convincing and preventing	Showing and demonstrating	<i>To demonstrate the transmission of germs in the field during treatment and the eradication of bacteria by ABHR.</i>
	Convincing and arguing	<i>To prove efficacy, relevance, risks, non-toxicity and health effects on the basis of sound scientific studies and without conflicts of interest.</i>
	Communicating and involving	<i>To inform, explain, question caregivers to raise their awareness and promote their interest and action.</i>
	Raising awareness among patients and visitors	<i>By means of welcome booklets, posters, communication by the caregivers</i>

organization... that makes the request alone and that this request is not made by the laboratory that supplies it. There must not be any conflict of interest and we must not feel that we are being cheated in the results.'

Faced with these facilitators, the participants proposed the skeleton of prevention and training interventions (Figure 2 below). The content of these training courses should, in their opinion, include the same content they mentioned in the previously identified facilitators. Finally, these interventions should be based on different support, each with a different purpose.

Discussion

Summary of results

When asked about ABHR, study participants show a clear and solid understanding of its disinfectant role, but they recognize that they use it only at times when there is a perceived

high risk of exposure. These results echo the recurrent problem found in the scientific literature: sufficient knowledge related to HCAIs, but insufficient adherence to hygiene protocols [19–24].

Thus, they identify a series of obstacles, related to the composition of the product or organizational factors in terms of lack of time and product availability which hinder them in the use of ABHR. They also acknowledge their own individual responsibility (underestimation of the risks involved, lack of knowledge, work habits that lead to omission). Incriminating the products, or one's own responsibility in the transmission of germs, is an innovative result, as the available literature so far shows that professionals mostly blame organizational and occupational aspects, such as insufficient cleaning of the work environment [41]. Seen through the prism of popular behaviour frameworks (such as the Behaviour Change Wheel (BCW)), respondents mainly identify the lack psychological capability, physical opportunity, reflective and automatic motivation in the promotion of HH and AHBR [42].

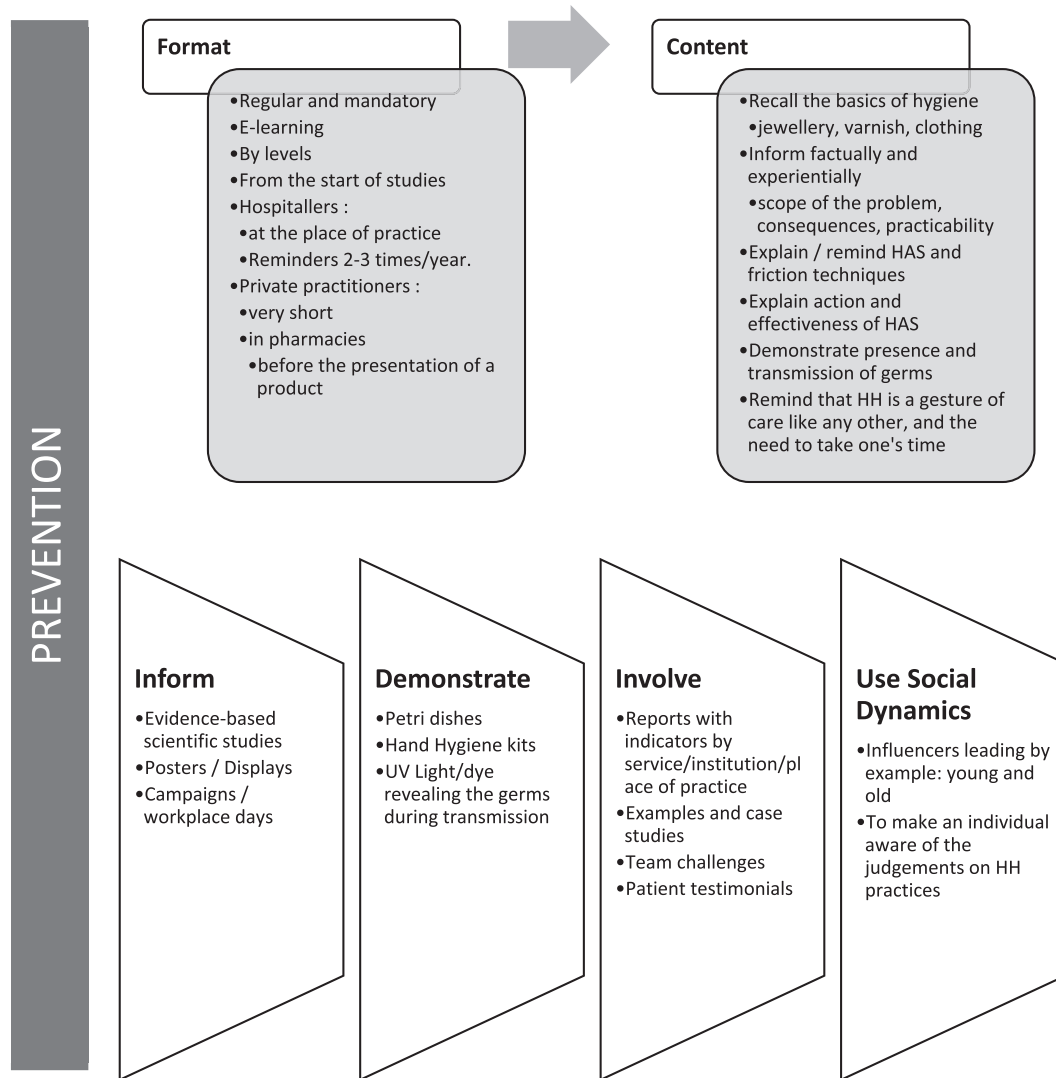


Figure 2. Prevention intervention around ABHR proposed by the study participants.

It is therefore natural that they evoke facilitators in response to these barriers that can feed into interventions function according to BCW [42]. For example, they suggest to promote access to ABHR products (BCW: environmental restructuring) by restocking them in a satisfactory manner, by highlighting them in services, by offering small, easily transportable bottles, or by highlighting their superiority over soap. Any institutional effort to facilitate access to HH products, or at least a reminder to use them, would be appreciated by health workers. Following BCW, they also suggest strengthening their automatic motivation by developing the mindset of taking one's time in hand-washing, and to develop more thoughtful and mindful habits (BCW: enablement). Some also suggest focusing the core of prevention around patients' health, threatening the patient's safety if they do not hand-wash correctly (BCW: Coercion).

Comparison to literature

It is interesting to note that in recent research, the caregivers interviewed were in favour of an electronic hand hygiene

reminder device, as they perceived a lack of feedback and support from the hospital organization about HH [43]. However, it would also be helpful to encourage people to change their professional practice by establishing more 'healthy' habits. As use of ABHR can be perceived as a 'mindless' automatism, raising awareness and encouraging caregivers to take their time could bring the gesture at a more reflexive level and prevent omission of its use. Refocusing ABHR on patient safety and well-being would also improve adherence to good hygiene protocols, as it is the main lever for motivating caregivers to reduce HCAs [31]. The effort must also be a collective one, by making available an educational arsenal (including scientific articles demonstrating the effectiveness of ABHR), tools for directly observing the transmission of germs, and preventative interventions to explain and involve healthcare workers. This would make it possible to cancel out certain irrational beliefs, according to which ABHR have no scientifically proven effectiveness. These facilitators for adherence to HH have already been identified in other studies [32,44].

Interestingly, participants indicate that informing and sensitizing patients and families about HH and ABHR would be an

important facilitator. This would empower patients and involve them in prevention. However, a study shows that most patients would be uncomfortable with the idea of questioning doctors about their HH unless they are explicitly invited to talk about it [45]. Thus, being proactive with patients and inviting them to talk about HH would encourage dialogue with them and would even prevent unwanted situations where patients directly confront caregivers on their HH [32].

Participants outlined relevant preventative measures based on the themes of informing, demonstrating, involving and using social dynamics, which can be linked to BCW [42]. Our participants suggested that prevention on HH should revolve around informing caregivers through communications, posters, prevention campaigns and scientific articles; giving them access to intellectual knowledge, enabling them to be aware of the processes of transmission and infection control (BCW: education function, to strengthen psychological capability). Also, demonstrating transmission (through Petri dishes, UV light or dyes) would allow them to experience their own individual action in the fight against infection (BCW: Persuasion, to improve reflective motivation). Involving caregivers through facility reports, team challenges, based on tangible indicators of bacterial infections or consumption of ABHR rates could strengthen their motivation and help them to visualize the impact of ABHR (BCW: Incentivisation). Finally, using social dynamics would allow the caregivers to adjust their norms to the ones of influential colleagues and to perceive the effective opinions and judgments in their environment (BCW: Modelling, to mobilize social opportunity). All these strategies would directly influence caregivers' representations of HH, integrate norms in their environment, and increase their perception of control over it. Such interventions would thus incorporate all the ingredients favourable to good health behaviour and its implementation, according to Reasoned Action Theories and Planned Behaviour Theories [46]. Moreover, perceived control and subjective norms are the most important factors contributing to higher levels of self-reported HH performance [29].

Limitations

Although the number of participants in this study is consistent, and despite data saturation being reached, there is an imbalance in the participants' profession (few clinic staff, prevalence of medical professionals in New Aquitaine and prevalence of paramedics in Guadeloupe). It is therefore possible that the identification of representations, barriers and facilitators is incomplete. Moreover, all the results have been treated from a general point of view, without comparing possible cultural and professional differences between the different professions included, or between mainlanders and islanders. It should also be highlighted that data collection happened before the start of the current COVID-19 pandemic. This can be considered strength, as we explored COVID 19-free representations, more genuine to the context of HCAs. One could argue that those results may be outdated, as it is safe to hypothesize that the pandemic impacted the representations on HH. Nevertheless, the four main barriers declared by caregivers in 2019 and 2020 via the national audit '*pulpe' friction*' in France were still the same [47]. But what would happen to those representations in a post-COVID-19 era? It might prove useful to evaluate the impact of COVID-19 on those representations once the crisis is over. Finally, our study used an

inductive approach. It yielded interesting results and identified the most immediate barriers and facilitators evoked by our participants. It is important to note that the design of this study, which aimed to keep interviews in balance with the precious time include HCPs had to share with us, may have yielded incomplete results. Further qualitative studies, based on deductive approach, may complete this point of view, and should be based on strong behaviour theories or exhaustive frameworks, such as BCW or the Theoretical Domains Framework [42,48]. Such studies would be an asset in identifying all the determinants of the use of ABHR, but would require longer and more exhaustive interviews, which can be difficult to obtain given the workload and the lack of time of HCPs.

Implication for practice

Identifying barriers and facilitators is not enough in itself, and future studies could also develop and test intervention programs based on those results. Accordingly, the CPIAS Nouvelle-Aquitaine and Guadeloupe, in the framework of MATIS, developed an intervention: the HH national toolbox. It includes an innovative tool named '*Pulpe' friction*', a web application that allows an interviewer to question in a short way (less than ten questions) HCPs on their HH practices at different key times and also on the obstacles to hydro-alcoholicsolution. This tool also provides a team diagnosis (compliance declared at different stages of care, majority of obstacles, and stage of change in the team) and proposes a personalized action plan. It allows an institution to monitor the evolution of compliance over time by repeating the audits. The toolbox includes a serious game named '*I. Control*' (existing in English version) that challenges HCPs and patients on hundreds of clinical situations involving HH and HCAI. Furthermore, several communication tools are featured (video, quiz, educational posters). All those elements and more details are available on the RéPias website [49].

Conclusion

Negative aspects and representations of ABHR, work habits as well as organizational and accessibility constraints prevent compliance with standard precautions on HH. Prevention strategies should rely on promotion of access to ABHR products by improving its accessibility to healthcare professionals, proposing diversity of textures and compositions, and by emphasizing its effectiveness and practicality. Encouraging changes in professional practices are required to focus the messages on patient safety, reminding staff on basics of HH, setting clear objectives, and developing the habit of taking the time for HH. Finally, convincing healthcare workers could be done by demonstrating direct effects of HH by the means of ludic tools, reassuring healthcare professionals with the help of scientific efficacy studies of ABHR, and even including patients and visitors in hand hygiene-related prevention.

Authors' contributions

BQ, GB, EA, 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. EA led the interviews, focus groups, and was in charge of the transcript of the verbatim and

extraction of the data. EA, AGV and NC performed qualitative analyses and interpreted the results. NC redacted the draft. BQ, AGV, RN, BJ and PP participated in the modification and correction of the draft.

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Conflict of interest statement

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

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