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Health Care Workers' Attitudes towards Hand Hygiene Monitoring Technology.

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BACKGROUND: Automated Radio-Frequency Identification (RFID)-based hand hygiene monitoring technology has been implemented in an infectious disease department to study healthcare workers' (HCWs) practices and improve hand hygiene.

AIM: Assess HCWs' attitudes towards this innovative monitoring device in order to anticipate resistance to change and facilitate future implementation.

METHOD: In-depth interviews and an ethnographic approach.

FINDINGS: From the perspective of HCWs, while they recognise the usefulness of RFID technology to prevent the transmission of infections to patients, they expressed concerns about risks related to RFID electromagnetic waves, as well as control by their superiors. Overall, HCWs' opinions oscillate between positive feelings characterised by enthusiasm for the possibility of changing their practices using technologies and research, and negative feelings marked by strong criticisms of these technologies and research. These criticisms included blaming hand hygiene monitoring technology for decontextualising HCWs practices. They perceived the technologies through the prism of the local and national contexts in which they are embedded. From their point of view, technologies are primarily in the best interests of the project team. Thus, they affirm and maintain the different interests and objectives between themselves and the project team, crystallising a conflict of professional norms and values between these two groups. The forms of resistance taken by HCWs were practical as well as oral.

CONCLUSION: Innovative technologies should be developed to address HCWs' attitudes surrounding RFIDs. It is crucial to inform HCWs about the nature of these technologies, although some criticisms about monitoring systems are based on more structural causes.

Keywords: Healthcare workers, Hand hygiene, Monitoring technology, Implementation process, Perceptions, Resistance

Introduction

Hospital-acquired infections (HAIs) have caused the largest epidemic of infectious disease worldwide in terms of patient morbidity and mortality, as well as cost [1]. Improving the observance of hand hygiene techniques by healthcare workers (HCWs), including the use of hydro-alcoholic solutions (HAS), is one of the most effective ways to reduce these infections [2]. The establishment of regular audits of healthcare facilities through direct or indirect observation is strongly advocated [3, 4]. The former, which is considered the gold standard, has several biases, the main one being the Hawthorne Effect [5]. For this reason automated technologies are playing an increasingly important role in producing more accurate hand hygiene compliance data [6]. The infectious disease unit (IDU) of the Hôpital Nord in Marseille set up an automated RFID-based system called MediHandTrace® (MHT). This system aims to monitor HCW hand hygiene and also generates quantitative data for scientific research [6, 7]. A study using MHT data in this ward highlighted a compliance rate of 22.6% [8]. From the beginning of the research project, a team of social science researchers was involved in collecting qualitative data. One of their objectives was to investigate HCWs' opinions and attitudes toward the hand hygiene monitoring system, as well as the unforeseen consequences of its introduction. Indeed, monitoring systems can improve hand hygiene compliance [9] but human factors have an important role in this process [10]. This is why it is crucial to take into account opinions and attitudes of HCWs toward these devices and to evaluate their acceptability in order to facilitate the future implementation of such technologies in routine practice [11]. We mobilise a broad definition of the notion of attitude strongly rooted in the field of social psychology: as a more or less sustainable judgement or evaluation of an object, an individual or a situation, according to a certain degree of favour or disadvantage [12, 13]. It includes affective, cognitive and behavioural components [13, 14, 15]. The expression of an attitude can be verbal, in which case we can talk about opinion, or non-verbal [16].

72 **Context**

73 *Focus on MHT technology*

74 The MHT project is a consortium of private companies and public organisations that share a common
75 objective: to reduce the risk of HAIs by improving HCWs' practices. The MHT technology consists of a
76 combination of electronic chips (tags) inserted into HCWs' shoes and antennae which are glued to
77 the floor of the patient's room and connected to an HAS dispenser by RFID, allowing the HCW to be
78 identified when using the dispenser. A feedback screen is located in the HCWs' office and provides
79 real-time hand disinfection rates by occupational group, also known as "scores".

80 A short demo video is available at the following link:
81 https://www.youtube.com/watch?v=d1Oa7vNT_iQ

82 *Focus on the implementation process*

83 The implementation process was divided into three main phases between January 2012 and March
84 2015. Each of these phases corresponded to a particular moment in the chronology of the
85 implementation of the monitoring technology (Figure 1); and to specific modalities for managing the
86 issues related to this implementation process: nature of the meetings, actors involved and themes
87 addressed (Table I). Phase two was also a period of technological testing, which resulted in some
88 scientific publications [6].

89 **Methodology**

90 Among the professionals working in the unit, we distinguished between different groups: HCWs who
91 included the so-called paramedical staff (nurses (N), nursing assistants (NA) hospital housekeepers
92 (HHK), and students); physicians most often referred to as medical staff. This study focused on the
93 HCWs group. Indeed, these categories performed the most care paths during a shift and had the
94 lowest hand hygiene compliance rate in the unit compared to physicians [8, 17]. As a result, these
95 categories are both the most exposed to the MHT system and the most concerned with improving
96 hand hygiene. Trainee students were excluded from our surveys to limit bias.

The interview survey

This study involved 24 semi-structured face-to-face interviews with HCWs (13 N, 6 NA, 4 HHK) using a topic guide (Table II) and undertaken by CT and PP between January 2014 and January 2015. One HHK explicitly refused to be interviewed because she was “not interested in the study”. Some professionals asked to postpone their interview several times due to time constraints and were finally not interviewed.

The ethnographic survey

In order to limit social desirability bias and compare different kinds of data, an additional data collection method was added. This took the form of ethnographic fieldwork in the ward conducted by CT 2-3 days a week between July 2014 and January 2015. The purpose was to observe the professionals of the IDU unit during their work. Field observations and informal discussions related to the study objectives were recorded in a notebook. CT also attended nearly 25 meetings with the project team (steering, technical or scientific committees) from which he also drew ethnographic observations. The project team included the department head, researchers, product engineers, technicians and sales managers. In the project team, the role of interlocutor with the HCWs was usually assigned to the department head. Triangulation of data sources [18] confirmed that we had reached data saturation [19] (more details are available in Table III).

Data analysis

CT coded transcripts and ethnographic data independently using an inductive approach based on grounded theory [20] identifying recurrent and salient themes. CT then met with PB and PPW to compare, discuss and adjust the codes (for additional information on the methodology see Table III). In a second round, PB, RW, KG and PPW did critical revisions to the manuscript. We illustrated our study in quotes provided in Table IV and in the text next to the corresponding sentence using the symbol “Q” followed by quotation number.

Ethics

All potential participants were informed of the MHT implementation project, its objectives and the option of refusing to participate. All participants provided their informed consent for both the interviews and the ethnography. Students were excluded from monitoring. Participants were guaranteed anonymity and confidentiality; any information that could identify participants was deleted from the tape-recording or field notes. The research was approved by the Ethics Review Board N° 2016-018.

Results

Positive opinions towards MHT devices

A tool for improvement

Half of the HCWs interviewed (12/24) expressed an opinion on the importance of HAIS prevention and believed in the role of the MHT system in achieving this goal. For example, they considered MHT technologies as a way to acquire in-depth knowledge about hand hygiene and good practice (Q1) and/or they mentioned the positive impact of evaluation in raising awareness of their practices and trying to improve them (Q2). Three of them stated that these devices could have a lasting impact on HCWs behaviours (Q3). Nevertheless, these kind of enthusiasm were always nuanced by different kinds of critical comments.

The feedback screen, from interest to indifference

Among the half of HCWs with positive comments, four of them also expressed particularly enthusiastic remarks on the usefulness of the feedback screen to change practice and stated that they had joined the competition as a game over time(Q4). Three other HCWs stated that they were interested and stimulated by the feedback screen at the very beginning of its installation, but that they gradually became completely disinterested in this device (Q5).

144 *A risk free technology? Health risk and social control*

145 Some HCWs (5/24) had concerns regarding the possible impact of RFID waves (and their perceived
146 carcinogenic potential) on their health (Q6).

147 In addition, some HCWs (8/24) also explained that the principle of being "tagged" promoted the
148 feeling of being watched and controlled by their superiors (Q7). The project team addressed the
149 concerns of HCWs at information meetings where the harmless nature of RFID waves, anonymisation
150 of data, scientific objectives and the non-punitive nature of the project were discussed. This has had
151 a reassuring effect on health care workers and they no longer express such apprehensions.

152 *Criticisms according to HCWs*

153 <u>Indifference and inefficiency</u>

154 The other half of the caregivers (12/24) expressed their indifference to this system (Q8), considered
155 it ineffective, explaining that it did not change their behaviours (Q9), whether it was about the tags,
156 the feedback screen or both (Q10, Q11). These remarks very often went hand in hand with more
157 specific criticisms. One of these interviewees explicitly blamed the principle of competition between
158 occupational categories (Q12)

159 <u>The MHT system does not take context into account</u>

160 Just under half of the interviewees (10/24) claimed that the MHT technology and the scientific
161 research relating to it did not take into account the complex context in which they operate and the
162 reasons for their actions (Q13). For example, in discussing with these interviewees their opinion of
163 these technologies, they discussed the difficulties of matching disinfection recommendations with
164 gloves recommendations in practices (Q14), or the issue that disinfection recommendations created
165 in the relationship with the patient (Q15).

Along the same lines, twelve interviewees (12/24) explained that “scores” on the feedback screen were biased because it did not reflect the reality of work in relation to the number of staff and tasks assigned to each professional category (Q16).

MHT and the professional context

Seven of the twenty-four interviewees reported negative perceptions of MHT technologies and verbal manifestations of resistance were often associated with problematic professional contexts, such as lack of human or material resources (Q17, Q18). Indeed, phase 3 of the implementation process began at a time when health care workers felt short of staff and equipment. In this context, HCWs did not understand why such significant funding was being allocated to research when they considered that the priority was to fund jobs and equipment (Q19). Although this topic is not a majority in the interview corpus, it was also frequently mentioned in informal discussions during observations (Q20). These sentiments were still evident even after the project team had explained, at information meetings, the nature of funding and the inability to use scientific funding to create jobs or purchase equipment. This type of discourse reduced when HCWs felt less distressed about team size and workload.

Distant relationships with the goals of the project team

Finally, some interviewees (5/24) perceived MHT technologies mainly as a tool to conduct scientific research and expressed their feelings of being used by the project team for scientific research and their feeling of a lack of recognition for their work and the difficulties they face (Q21). The interview data did not reflect the reality of these remarks because the observation revealed that they were very significant in the service. These comments highlighted the divisions that HCWs perceived with the research team, blaming them for their inability to understand the HCWs' work and the difficulties they faced because they were too busy doing their research (Q22). It was the same kind of criticisms when a HCW claimed that the implementation of the MHT system was primarily a way to access professional recognition within the scientific community by publishing in scientific journals (Q23).

From speeches to acts of resistance

Rejection of automated data feedback

The ethnography also revealed that the feedback screen had been disconnected several times. The HCWs admitted that one of them was responsible for this, but never identified the culprit or prevented them from doing so. This issue was raised several times during information meetings. The project team stressed the importance and usefulness of this device in improving patient care, its costs and the potential for disciplinary action against perpetrators. This behaviour continued throughout the entire investigation. HCWs never expressed the reasons for these acts to the project team and the anthropologist.

Discussion

In order to reduce HAIs, a number of innovative technologies have been developed to promote hand hygiene [21, 22]. Few of these have been tested for accuracy or sensitivity, most are expensive, difficult to install and maintain, but their increasing use in hospitals is a key issue to improve hand hygiene [9, 23, 24]. Nevertheless, it is important to test these technologies in multiple and different settings to understand the factors that can positively or negatively influence their efficacy [25]. In the same way, it is also essential to investigate opinions and attitudes of HCWs toward these automated monitoring systems according to this variety of contexts [26]. Indeed, improving hand hygiene also requires adapting interventions, contexts and technologies for better acceptability [11, 24, 27].

Our results reveal that HCWs attitudes towards the MHT system oscillate between enthusiasm and adherence on the one hand, and strong criticism or even acts of sabotage on the other. Positive remarks are in line with results of other studies reporting tolerance of HCWs toward these technologies, their desire to improve their practices or their adherence to the competitive game [27, 28]. Nevertheless, competition is not necessarily well perceived. In this case, indifference, or at worst sabotage, may be a response to a tool considered biased or contrary to team spirit.

216 This study shows that, from the HCWs' point of view, technologies may introduce new types of
217 health and social control risks. Other studies also reported that RFID systems give the impression of
218 being controlling [29] or raise concerns about potential punitive uses of the system and its inability to
219 take into account the context and the possibilities or not in terms of hand hygiene [27]. The lack of
220 information initially given to the HCWs is likely to play a role in their acceptance of the devices,
221 especially regarding misconceptions about health effects and the fear of repressive use on HCWS.
222 Thus, our study also reveals that transparency and communication play a crucial role in acceptance
223 [26, 27, 30].

224 Another of our results is supported by qualitative studies on this subject. This is the inability to assess
225 the situational context of hand hygiene options [27]. These situations are also characterised by
226 professional dilemmas – we can talk about conflicts of professional norms – that the system cannot
227 take into account. For example, when a HCW prefers not to disinfect his or her hands to stay in
228 contact with the patient.

229 Our study also reveals some original results. Indeed, HCWs perceive the MHT system through the
230 prism of a broader and more global context, thus intertwining local and national contexts. The local
231 context corresponds to the working conditions and professional experiences in this context. The
232 system was set up at a time of difficulties that HCWs associated with a lack of human and material
233 resources. A favourable or unfavourable professional context can influence HCWs perceptions
234 toward monitoring technologies. In this perspective, the implementation of this tool is potentially a
235 tool for HCWs to advocate and negotiate regarding their working conditions. The implementation of
236 a project, that was seen to be disconnected from real care issues and mainly associated with the
237 world of research, crystallised and strengthened these claims for HCWs. These perceptions
238 correspond to the political context of national reforms of hospitals in France since the 1990s,
239 inspired by the New Public Management paradigm, which contribute to intensifying the work of
240 HCWs and have provoked protests from them, particularly in France over the past decade [31].

241 In addition, our findings show that HCWs rarely disassociate questions of monitoring technologies
242 from those of scientific research. Most importantly, HCWs expressed differences in objectives and
243 interests between their group and the project team, demonstrating that different social norms and
244 values exist between them, in a context where they consider their identity and professional
245 recognition threatened. This reflects the idea that the definition of risks and the priorities given to
246 the means of reducing them differ according to whether it is a professional in charge of daily care
247 tasks or an external actor seeking to manage patient safety through a direct approach [32].

248 *Limitations and strengths of the study*

249 While the results of this study are very similar to those of other similar studies, they may not be
250 more broadly relevant. Like all studies, the characteristics of the people interviewed also depended
251 on its specific local context and the cultural, social, political and economic characteristics.
252 Nevertheless, there are still few qualitative studies on this subject, even though the challenges of
253 hand hygiene are significant. Among these studies, few use several qualitative methods together:
254 interviews and ethnography. Nevertheless, this study also shows the importance of questioning the
255 singularities and characteristics of each context to understand caregivers' attitudes towards these
256 technologies.

257 **Conclusion**

258 Although monitoring technologies are generally tolerated, they are always perceived from the
259 context in which they are integrated.

260 Resistance and criticisms from HCWs towards MHT monitoring technologies have multiple causes.
261 Some of these are the result of a simple lack of information and communication between HCWs and
262 the project team. However, other causes are structural and depend on the coexistence of different
263 professional cultures within the working environment.

264 A social and anthropological approach helped us to understand HCWs' perceptions and behaviour
265 towards MHT. Through such an approach, resistance to these technologies can be anticipated; the
266 benefits of which have been demonstrated with hand hygiene compliance [33].

267 Finally, MHT technologies should be developed with the input of HCWs. They should be adapted to
268 their routine practices taking into account the complex care environments in which they work, as
269 well as the specific care constraints they face.

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275 Conflict of interest

276 Philippe Brouqui owns shares in the MediHandTrace® start-up.

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357

Phase 1: Development
January 2012
to
November 2012
Phase 2: Setting-up
November 2012
to
September 2013
Phase 3: Start-up
September 2013
to
March 2015

Table I.
Organisation of MHT Implementation.

	Types of meetings	Periodicity	Groups concerned	Objectives
Phase 1: ***Development***	Steering committees	Monthly	Project team	Project & product development
Phase 2: ***Setting-up***	Steering committees	Monthly	Project team	Global issues (technical, commercial, scientific)
	Technical committees	Bi-monthly	Project team	Technical adjustments
	Information meetings	*Ad Hoc*	Head of department, nursing staff and nurse managers	Informing nursing staff Responding to question and fears from nursing staff
Phase 3: ***Data Collection & Analysis***	Steering committees	Monthly	Project team	Global issues (technical, commercial, scientific)
	Bi-monthly	Project team	Technical adjustments	Technical committees
	Information meetings	*Ad Hoc*	Head of department, nursing staff and healthcare managers	Informing nursing staff Responding to question and fears from nursing staff
	Scientific committees	Weekly	Project team	Collecting data Analysis data Defining scientific orientations

Table II.
Topic Guide.

1) **What do you think about MediHandTrace and these devices implemented in the ward?**

   - What do you know about MediHandTrace?
   - Do you understand clearly the aims of this project?
   - Can you talk a little bit about that?
   - Do you give attention to these devices?

2) **What do you think about how the project and his devices have been introduced in the ward, concerning the process of implementation?**

3) **To your opinion, what should we have done differently to ensure better acceptance of devices by HCWs?**

4) **On your opinion, what are the impacts of this project on staff behaviours?**

5) **What have these devices changed in your daily work?**

6) **Do you think these technologies have an impact on your practices?**

   - On your relationship with patients?
   - On your relationship with colleagues?

7) **In general, what do you think about the implementation of new technologies, devices or tools for HCW in a hospital ward?**

8) **What do you want to add on this subject?**

   - Do you have any suggestions, ideas or comments to complete and conclude this interview?

Table III.
Methodological and Analytical Framework.

Data collection method	Semi-structured interviews	Ethnography	
Tool	Interview guide	Ethnographic fieldnotes	
Investigation period	January 2014 to July 2014	July 2014 to January 2015	
Method	Individual and Face-to-face	Observations and informal discussions	
Social groups studied	HCWs	HCWs	Project team
Setting on data collection	Workplace (convenient and private place)	Workplace	Steering committees Technical committees Information meetings Research meetings
Selected time	During the lunch break	Workdays	Steering committees Technical committees Information meetings Research meetings
Inclusion criteria	Tenured member in HCW staff	Tenured member or student in HCW staff	Member of project team
Length	25-40 minutes	400 hours	72 hours
Number of participants	24	All individual present	
Refusals	1	0	
Analytical frameworks	Grounded theory	Grounded theory	
Data analysis methods	Data coding by key themes ; Manual analysis	Content and behaviour analysis ; Comparison with interviews ; Manual analysis	