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**“Doctor, please”:  
Educating nurses to speak up with interactive digital simulation tablets**

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### **Conflict of Interest**

The authors declare that they have no conflict of interest.

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### Abstract

**Background.** Courses are developed to train on open communication. This study focuses on speaking-up for scrub nurses.

**Method.** The scenario is implemented on digital tablets, with vignettes involving problematic behaviours of a colleague with the same or different status. The nurses (N = 33) were asked whether they would point out the error, whether they would be embarrassed, and how they would do it.

**Results.** Nurses expressed greater embarrassment with a colleague of a different status. This is confirmed by their phrasing and the strategies they reported when speaking to the surgeon.

**Conclusion.** The scenario was well accepted and could be used to train other health professionals.

*Keywords:* non-technical skills, speaking-up, interactive digital simulation, scrub nurse, self-debriefing.

**“Doctor, please”:****Educating nurses to speak up with interactive digital simulation tablets****Introduction**

In the operating room (OR), 43% of incidents are related to a breakdown of communication among personnel, and 23% of these are related to reluctance to share critical concerns or information (Gawande et al., 2003; Rabol et al., 2011). Furthermore, information exchanged in the OR may be inaccurate or incomplete, and shared with the wrong person or at the wrong time (Sutcliffe et al., 2004). Lack of effective communication has been identified as a major cause of incidents in the hospital environment. A strategy identified for nurses is to “speak up” to avert errors when they identify that optimal care is not being provided.

Speaking up by healthcare professionals is the explicit voicing of concerns about risky or deficient actions of others in order to improve the quality and safety of care. Speaking-up behaviours include for example reporting an asepsis error or non-compliance with safety rules (Okuyama et al., 2014). It is a very important non-technical skill, especially for surgical teams (Kolbe et al., 2012).

According to Okuyama’s model (2014), speaking up is motivated by patient safety. It is modulated by the perceived risks for the patient (level of risk) and the ambiguity of the situation (level of uncertainty). It is also influenced by factors that are contextual (e.g. hospital policy, interdisciplinary policy-making, team relationships, attitude of leaders) or individual (e.g. job satisfaction, responsibility towards the patient, professional role, confidence and previous experience, communication skills, educational background). Other factors also interact, such as the balance between feelings of perceived safety *versus* costs (e.g. fear of others’ responses/ conflict, fear of appearing incompetent) and by the balance between perceived effectiveness *versus* futility (e.g. lack of change, personal control and impact). Healthcare professionals may thus choose to remain silent, but when they do speak

28 up, they use various tactics (e.g. collecting facts, showing positive intent, choosing who to  
29 address) to overcome the barriers. Hierarchical differences, conflicting roles, concerns with  
30 upward influence, power relationships, interpersonal conflict, and organisational culture can  
31 explain communication failures and are the most frequently observed barriers to challenging  
32 authority in the OR. In order to make health professionals aware of the risks of remaining  
33 silent in the OR and to encourage them to communicate openly with their colleagues,  
34 education and training courses are being developed in different forms (Pattni et al., 2019;  
35 Sutcliffe et al., 2004). For example, simulation sessions to train nurses to speak up have  
36 already been implemented with mannequins (Kolbe et al., 2012) and virtual humans (Robb et  
37 al., 2015), but very few use digital simulation or virtual reality (VR) simulators (Bracq et al.,  
38 2019). Digital simulation or VR simulators to train healthcare professionals on non-technical  
39 skills have been developed during the last decade. They are easy to set up, and allow the  
40 replication of standardised simulation sessions (Bracq et al., 2019).

41 Using the representation of a virtual OR we created for a VR-simulation scenario for  
42 scrub nurses (Bracq et al., 2019), we created an interactive digital simulation on tablets. The  
43 scenario was created to educate scrub-nurse students to speak up in various situations and with  
44 people of different professional status, and to analyse their attitudes and their strategies. We  
45 used the paradigm of clinical vignettes (Schwappach, 2018), each one addressing three  
46 questions: the likelihood of speaking up, the level of embarrassment with speaking up, and the  
47 strategies used. To understand students' motivation and underlying processes, we used self-  
48 debriefing, which has proved efficient for non-technical skills training (Boet et al., 2011). It is  
49 defined as "an individual, written activity in which a series of questions (designed based on a  
50 theoretical debriefing framework) facilitate learners' reflection on a simulation" (Lapum et al.,  
51 2018, p. 1). This allows participants to express themselves at their own pace, free from the

52 social pressure that can be felt during collective debriefings, and to feel psychologically safe  
53 (Levett-Jones & Lapkin, 2014; Roussin et al., 2018).

#### 54 **Purpose of the present study and hypotheses**

55 The objective of this study was to assess the speaking-up behaviour of scrub-nurse  
56 students in various clinical situations and with people of different professional status, and to  
57 analyse their attitudes and strategies. Based on previous studies on speaking-up literature, we  
58 expected an effect of status on the likelihood that participants would speak up to their scrub-  
59 nurse colleague or to the surgeon, and on their feelings of embarrassment.

60 *Hypothesis 1.* The likelihood of pointing out an error would be greater when the  
61 person involved has the same professional status as the speaker. Participants would thus speak  
62 up more with the nurse (equal professional status) than with the surgeon (higher professional  
63 status).

64 *Hypothesis 2.* There would be greater feelings of embarrassment pointing out an error  
65 to someone of higher professional status. Feelings of embarrassment would thus be greater  
66 when addressing the surgeon than the nurse.

### 67 **Method**

#### 68 **Participants**

69 Thirty-three voluntary students (28 women and 5 men) from two classes (first and  
70 second year) in a French school for scrub nurses were invited to take part in the study. The  
71 average age of nurse students was 34 years. The study was approved by the Ethics Committee  
72 of the local University Hospital. Participants provided their informed consent for the study.

#### 73 **Procedure**

74 Two simulation sessions were held at the nursing school, on 13<sup>th</sup> June 2019 (n = 15  
75 students) and 24<sup>th</sup> October 2019 (n = 18 students). They were run by the first and third authors

76 simultaneously for each class, each participant working individually on their own tablet. The  
77 simulation session lasted about 90 minutes.

### 78 **Briefing**

79 In the pre-briefing, participants were told that they would experience four situations  
80 with colleagues in a virtual OR. These situations exposed problematic behaviours and errors  
81 that needed to be reported. They were asked to imagine how they would interact with these  
82 colleagues (“After finding a mistake, how do I react?”). To make them feel secure,  
83 participants’ answers were anonymous and no assessment or judgement was provided. Some  
84 explanations were given concerning the tablet interface and possibilities of interactions in the  
85 interactive digital simulation: give their answers by clicking directly on scales of responses  
86 and explain their answer by typing on a keyboard that appeared on the tablet.

### 87 **Scenario of Simulation**

88 Individual tablets without headsets were used to run the scenario (see Figure 1). It  
89 represents an interactive virtual simulation of OR created with Unity game engine (Version  
90 2018.4, Unity Technologies, San Francisco, CA). It is based on a real OR allowing immersion  
91 and interactions with the environment. The scenario was designed by VR researchers  
92 according to French national standards on simulation (HAS, 2012). It places participants in  
93 front of four clinical vignettes each involving problematic behaviour of a colleague who has  
94 either the same or a different status (see Appendix A). Nurse 1: The circulating nurse is  
95 wearing earrings. Nurse 2: The circulating nurse gets too close to the instrumentation table.  
96 Surgeon 1: The surgeon is not wearing his mask properly. Surgeon 2: A surgeon from another  
97 OR and with a dirty gown enters the OR to see his colleague and gets too close to the sterile  
98 field.

99 For each vignette, participants were asked if they would point out the error (Likelihood  
100 of speaking up), how embarrassed they would be to do so (Feelings of embarrassment), and

101 how they would do it (Strategies for speaking up). The tablet simulation scenario lasted about  
102 12 minutes.

103 **\*\*Insert Figure 1 about here\*\***

#### 104 **Debriefing**

105 Debriefing after the simulation session took the form of hand-written, anonymous self-  
106 debriefing, based on the 3D model: Defusing, Deepening and Discovering (Zigmont, Kappus,  
107 & Sudikoff, 2011). Participants were asked to express their feelings and reactions after the  
108 simulation (Defusing phase). For each vignette, they were asked to defend and explain their  
109 decision whether or not to speak up (Discovering phase). Finally, they were asked if they  
110 would speak up if they encountered similar situations and what they had learnt for their future  
111 clinical practice (Deepening phase).

112 At the end of the session, the first author distributed and read an educational sheet about  
113 speaking up: definition, how speaking up is developed and the effective communication  
114 techniques (see Appendix B).

#### 115 **Measures**

116 ***Likelihood of speaking up.*** The first question concerned the intention of speaking up:  
117 “Do you point it out (with words or gestures) to the circulating nurse/surgeon?” Participants  
118 rated each scenario using a seven-point scale ranging from 1 (*very unlikely*) to 7 (*very likely*).

119 ***Feelings of embarrassment.*** The second question asked about the embarrassment of  
120 speaking up: “Do you feel embarrassed about pointing it out to the circulating  
121 nurse/surgeon?” Participants rated each scenario using a seven-point scale ranging from 1 (*not*  
122 *embarrassed at all*) to 7 (*very embarrassed*).



123            **Strategies for speaking up.** The third question concerned the strategies for speaking  
124 up: “If you point it out, how do you do it?” To answer this open-ended question, participants  
125 were asked to write down their answer in full using the touchscreen keyboard. The answers  
126 were coded according to the coding scheme of previous studies (see Landgren et al., 2016).  
127 We coded the nature of the sentences (i.e. question only, statement only, question and  
128 statement, or no intervention), their verbal or nonverbal components (i.e. words only, actions  
129 only, words and actions), phrasing (i.e. polite formula, personalization, informal or formal  
130 tone), and explicit elements of content (i.e. humour, warning, advice or suggestion and  
131 reminder of rules). All responses were coded by one coder (first author), and 60% by two  
132 coders (first and third authors) to check the reliability of the coding. Inter-coder reliability  
133 was strong or almost perfect (Cohen  $k_{\text{Nurse1}} = 0.92$ , Cohen  $k_{\text{Nurse2}} = 0.75$ , Cohen  $k_{\text{Surgeon1}} = 0.85$ ,  
134 Cohen  $k_{\text{Surgeon2}} = 0.85$ ).

### 135 **Self-debriefing**

136            The open-ended questions in the self-debriefing were the following: (1) “For each  
137 situation, give the reasons why you chose to speak up or why you preferred not to. I spoke up  
138 because... I preferred not to because...”; (2) “If you encountered similar situations in your  
139 work, what would you do?”; (3) “What can this simulation scenario help you improve in your  
140 communication with team members in the OR?”

141            Answers to the questions were coded using an adaptation of Okuyama’s speaking-up  
142 model (Okuyama et al., 2014). The speaking-up factors identified from this model were the  
143 following: contextual factors (team relationship), individual factors (responsibility towards  
144 the patient and role as professionals), perceived safety *versus* costs (fear of the responses of  
145 others or conflict), perceived efficacy *versus* futility (personal control and impact) and the  
146 strategies used when speaking up were to show positive intent and to choose who to speak to.

147 Other strategies were also identified from participants' answers and were added in our coding  
148 scheme: choosing to use nonverbal communication, or no communication at all, deciding to  
149 raise the subject later and discreetly, finding excuses for the situation or playing down the  
150 risks, transferring the responsibility of the situation or of speaking up to others, and the  
151 deliberate use of humour. All responses were coded by one coder (first author), and 60% by  
152 two coders (first and third authors) to check the reliability of the coding. Inter-coder reliability  
153 was moderate or strong (Cohen  $k_{Nurse1} = 0.58$ , Cohen  $k_{Nurse2} = 0.75$ , Cohen  $k_{Surgeon1} = 0.80$ ,  
154 Cohen  $k_{Surgeon2} = 0.80$ ).

### 155 **Satisfaction post-simulation**

156 Participants were asked to assess their perception of the scenario with eight items rated  
157 on a seven-point scale ranging from 1 (*totally disagree*) to 7 (*totally agree*) and grouped around  
158 five dimensions of system acceptability: ease of use (2 items), immersion (2 items), efficiency  
159 (2 items), global satisfaction (1 item) and behavioural intention (1 item). They also assessed  
160 their emotional state using a classical five-point scale, each point of which was illustrated by  
161 an emoji to help them associate their emotions to a number.

### 162 **Statistical analysis**

163 Statistical analysis was performed with Jamovi (The Jamovi project, 2020).  
164 Descriptive statistics were computed, including means, maximum and minimum values, and  
165 standard deviations. To compare the means between vignettes, a repeated measures ANOVA  
166 (Greenhouse-Geisser correction) and post-hoc tests with Bonferroni corrections were made. P  
167 values  $< .05$  were considered significant. A statistical power analysis (jpower, with Jamovi)  
168 was performed for sample size estimation. The effect size (ES) in this study was 0.50,  
169 considered to be medium using Cohen's (1988) criteria. With an alpha = .05 and power =  
170 0.80, the projected sample size needed with this effect size is approximately  $N = 27$  for a

171 within group comparison. Thus, our proposed sample size of  $N = 33$  will be adequate for  
172 quantitative analysis.

### 173 **Results**

174 Participants' answers to the likelihood of speaking up and embarrassment for  
175 each vignette were compared to check any differences between 1<sup>st</sup> and 2<sup>nd</sup> year  
176 students.

177 Differences were not statistically significant, so the answers of all the participants were  
178 aggregated.

#### 178 **Effect of status on the likelihood of speaking up**

179 As shown in Table 1, the mean scores of likelihood of speaking up differed significantly  
180 according to the clinical situation,  $F(3, 96) = 9.53, p = .001, \eta^2 = .14$ . Post-hoc paired contrasts  
181 (Bonferroni) revealed that the mean scores of the likelihood of speaking up to the two nurses  
182 were significantly different from each other ( $t_{\text{Nurse1-Nurse2}} = -5.18, p < .001$ ), and from those  
183 regarding the likelihood of speaking up to the surgeons ( $t_{\text{Nurse1-Surgeon1}} = -3.55, p = .004$ ;  $t_{\text{Nurse1-}}$   
184  $\text{Surgeon2}} = -2.30, p = .10$ ;  $t_{\text{Nurse2-Surgeon2}} = 2.88, p = .03$ ), except between the Nurse 2 and the  
185 Surgeon 1 ( $t_{\text{Nurse2-Surgeon1}} = 1.63, p = .64$ ). There was no significant difference for the likelihood  
186 of speaking up to the two surgeons ( $t_{\text{Surgeon1-Surgeon2}} = 1.25, ns$ ).

187 Contrary to our expectation, the likelihood of speaking up varied according to the  
188 clinical situation more than according to status, with a limit for the first clinical situation  
189 (Nurse 1). The likelihood of speaking up to Nurse 1 was significantly lower than for the  
190 others. As expected, there was a greater likelihood of speaking up to the Nurse 2 than to both  
191 surgeons.

#### 192 **Effect of status on feelings of embarrassment**

193 As we can see in Table 1, the results showed that the mean scores of embarrassment  
194 differed significantly according to the clinical situation,  $F(3, 96) = 6.49, p < .001, \eta^2 = .09$ . As  
195 expected, post-hoc paired contrasts (Bonferroni) revealed that the means scores of  
196 embarrassment were marginally or significantly different between nurses and surgeons ( $t_{\text{Nurse1-}}$   
197  $\text{Surgeon1} = -2.43, p = .10$ ;  $t_{\text{Nurse1-Surgeon2}} = -2.51, p = .07$ ;  $t_{\text{Nurse2-Surgeon1}} = -3.53, p = .004$ ;  $t_{\text{Nurse2-}}$   
198  $\text{Surgeon2} = -3.61, p = .003$ ). Moreover, there was no significant difference between the scores of  
199 embarrassment in relation to the two nurses ( $t_{\text{Nurse1-Nurse2}} = 1.10, ns$ ) or the two surgeons  
200 ( $t_{\text{Surgeon1-Surgeon2}} = -0.08, ns$ ). Scores for the two nurses and the two surgeons were aggregated,  
201 and the results show significant differences ( $t(32) = -3.42, p = .002$ ). The mean embarrassment  
202 scores were higher for surgeons ( $M = 3.44, SD = 1.97$ ) than for nurses ( $M = 2.27, SD = 1.45$ ).

203 As expected, embarrassment in speaking up and pointing out an error was greater  
204 when the person spoken to had a higher professional status.

205 **\*\*Insert Table 1 about here \*\***

### 206 **Strategies for speaking up**

207 The strategies used to speak up are presented in Table 2. Students expressed themselves  
208 using mainly statements (75.76%), sometimes questions (16.67%), and more rarely, a  
209 statement followed by a question (3.03%). Five participants gave no answer (3.79%).  
210 Interventions were mostly verbal only (79.55%), sometimes involved words and actions  
211 (15.15%), and were rarely non-verbal (1.52%).

212 With regard to content, participants' interventions included rule reminders (55.30%),  
213 sometimes a suggestion or advice (28.03%) or a warning (23.48%), and, more rarely, humour  
214 (5.30%). Apart from warnings, which were addressed twice as often to the nurse than to the  
215 surgeon, there were no obvious differences according to the status of the person spoken to.  
216 However, there were differences in the phrasing: statements to the surgeon were formal  
217 (72.73%) and personalized (36.36%), but informal (66.67%) and almost never personalized

218 (4.55%) for the nurse. Polite formulas were sometimes used (26.52%), slightly more often  
219 with the surgeon (30.30%) than with the nurse (22.73%).

220 **\*\*Insert Table 2 about here\*\***

### 221 **Content analysis of self-debriefing**

222 Self-debriefing responses are presented in Table 3. Among the factors that encouraged  
223 speaking up, participants were most aware of individual factors, particularly their role as  
224 professionals (88.64%) and their responsibility towards the patient (25.00%). Contextual  
225 factors such as team relationship (5.30%) were mentioned less. Perceived obstacles to  
226 speaking up were cost in terms of fear of the responses of others or conflict (8.33%), and one  
227 participant mentioned lack of personal control and impact (0.76%). Fear of conflict was  
228 greater with the surgeon (13.64%) than with the nurse (3.03%), and lack of impact and  
229 personal control was only mentioned in relation to the surgeon (1.52%). Participants  
230 mentioned different strategies: positive intent (4.55%) and selecting to whom to address their  
231 concerns (3.03%).

232 Participants also mentioned other strategies that are not included in Okuyama's model:  
233 playing down the situation or making excuses to explain the behaviour (11.36%), transferring  
234 responsibility to others (8.33%), silence (7.58%), humour (1.52%), nonverbal communication  
235 (0.76%), and raising the subject later and discreetly (0.76%). Most of these strategies were  
236 more frequent with the surgeon than with the nurse: finding excuses and playing down the  
237 situation (15.15% with the surgeon, 7.58% with the nurse), transferring responsibility to  
238 others (13.64% with the surgeon, 3.03% with the nurse), remaining silent (10.61% with the  
239 surgeon, 4.55% with the nurse); humour, raising the subject later, and nonverbal  
240 communication were used only with the surgeon.

241 **\*\*Insert Table 3 about here\*\***

**242 Acceptability of the simulation and satisfaction**

243 Participants found the tablet easy to use ( $M = 4.68$ ,  $SD = 0.39$ ,  $min = 4$ ,  $max = 5$ ).  
244 They also said that they were immersed in the scenario and liked the graphics ( $M = 4.47$ ,  $SD$   
245  $= 0.58$ ,  $min = 3$ ,  $max = 5$ ). They were more reserved about its contribution for training ( $M =$   
246  $3.18$ ,  $SD = 0.76$ ,  $min = 1.5$ ,  $max = 4.5$ ). However, overall satisfaction was good ( $M = 4.39$ ,  $SD$   
247  $= 0.79$ ,  $min = 2$ ,  $max = 5$ ) and also the intention to use in the future ( $M = 3.97$ ,  $SD = 1.00$ ,  $min$   
248  $= 1$ ,  $max = 5$ ). At the end of the session, participants' emotional state was good ( $M = 4.18$ ,  $SD$   
249  $= 0.73$ ). Twenty-nine participants expressed positive emotional state, three participants  
250 expressed a neutral emotional state. Only one participant expressed a negative emotional  
251 state.

**252 Discussion**

253 The objective of this study was to assess the speaking-up behaviour of scrub nurse  
254 students in different situations and with people of different professional status, and to analyse  
255 their attitudes and strategies, through an interactive simulation on digital tablets.

256 First, the results confirm our first hypothesis concerning the effect of status on the  
257 likelihood of speaking up. Apart from the first vignette where the nurse is wearing earrings,  
258 there was a greater likelihood of speaking up with the nurse than with the surgeon. This result  
259 confirms some previous studies showing the effect of hierarchical relationships in OR on  
260 speaking up (Hémon et al., 2020; Okuyama et al., 2014; Pattni et al., 2017; Sydor et al.,  
261 2013). We also observed an unexpected difference between the two vignettes involving a  
262 nurse. It could be due to our choice of the clinical situation. Even though wearing jewellery is  
263 forbidden in the OR, there are varying degrees of tolerance about wearing earrings between  
264 regions, hospitals, and teams. This non-compliance with universal standard precautions in the  
265 OR, which is fairly common, does not trigger as much speaking up as could be expected

266 (Michinov et al., 2016). Future development of our scenario should include a less  
267 controversial clinical situation involving the nurse.

268 The results also confirm our second hypothesis, showing that participants were more  
269 embarrassed to point an error out to the surgeon (higher status) than to the circulating nurse  
270 (equal status). There was thus an effect of status on participants' embarrassment about  
271 speaking up. This is also observed by the analysis of the way the participants wrote about how  
272 they would speak up: they used a more formal tone and personalization when addressing the  
273 surgeon, which is in line with the politeness strategies described in previous studies  
274 (Morrison, 2011; Pattni et al., 2019). The participants said that it was their role as  
275 professionals and their responsibility towards the patient that motivated them to speak up. The  
276 strategies they used are in agreement with their feelings of embarrassment when addressing  
277 the surgeon: selection of who to speak to, nonverbal communication, and raising the subject  
278 later were only used in this situation. The other strategies (i.e. non-communication, playing  
279 down the situation and finding excuses, transfer of responsibility to others) were mentioned in  
280 relation to both surgeon and nurse, but particularly the surgeon (Pattni et al., 2019).

281 Regarding the simulation scenario on digital tablets, participants reported good levels of  
282 acceptability and satisfaction. As in other studies on the use of tablets for education and  
283 training, the students felt engaged and satisfied with the use of digital tablets (Verkuyl et al.,  
284 2019). Their future intention to use digital tablets for future training is good. Concerning the  
285 usefulness of the digital tablets for training, the scores are moderate. Several explanations can  
286 be proposed. First, we did not specify at the beginning of the course clear and informative  
287 curriculum guidelines for implementation of tablet technology, and some previous studies  
288 suggested that it a recommendation (Otterborn et al., 2019). Moreover, the theoretical  
289 background to the concept of speaking up was given to the students after their evaluation of

290 the scenario at the end of the session. This was done to ensure the spontaneity of the students'  
291 responses and to stay close to the natural situations of interaction.

### 292 **Limitations and future studies**

293 One of the main limitations of this study is the small number of participants, and the fact  
294 that they were all from the same school. It would be interesting to repeat this simulation  
295 session with students from other schools to see if our results are confirmed.

296 Another limitation is that the participants gave declarative answers about a situation in a  
297 nursing school. This obviously gave rise to a social desirability effect, in line with previous  
298 studies (Schwappach & Gehring, 2014). This is confirmed by the fact that five students  
299 declared that they would probably not speak up about the error, but that ten students  
300 explained why they would not do so in their self-debriefing. It would be interesting to enlarge  
301 our population and include experienced scrub nurses to see if their answers differed  
302 significantly from those of the students. Previous studies have shown that speaking-up  
303 training with real and virtual surgeons are of comparable difficulty for nurses (Robb et al.,  
304 2015). If simulation on tablets allows collective simulation sessions, it provides a lower level  
305 of immersion and self-debriefings remain individual. However, it would be interesting in  
306 future studies to measure correlations with actual behaviour in the OR.

307 Hierarchical differences were highlighted in our study, but in healthcare, gender often  
308 doubles this effect (Etherington & Boet, 2018). In our vignettes, the characters were  
309 represented according to social stereotypes, with female nurses and male surgeons. Future  
310 studies should include gender differences, with female surgeons and male scrub nurses, in  
311 order to analyse participants' reactions and the effect of gender on speaking up. Mistakes  
312 made by women in leadership positions are reported more frequently than those made by men  
313 (Pattni et al., 2017). Our study also does not take into account the type of relationship



314 between colleagues (e.g., familiarity, trust) that may also influence willingness to speak up  
315 (Milliken, Morrison, & Hewlin, 2003).

### 316 **Conclusion**

317 In this study, we analysed the speaking-up behaviour of scrub nurse students in various  
318 situations and with people of different professional status (i.e. scrub nurse and surgeon), using  
319 an interactive digital simulation on tablets. The results show that participants spoke up  
320 according to their evaluation of the situation (nature and level of risk), and not only according  
321 to the status of the person addressed. However, they expressed greater embarrassment about  
322 speaking up to a person with higher status. This is confirmed by their phrasing and strategies  
323 when addressing the surgeon. Results also show good acceptability of the simulation scenario,  
324 encouraging the development of simulation in nursing and other specialties. The scenario  
325 could be used to train surgical residents to speak up with senior surgeons and develop greater  
326 awareness of their listening skills as they climb the hierarchical ladder. Studies have shown  
327 that quality of communication is evaluated differently by surgeons and nurses (Makary et al.,  
328 2006). Training future surgeons to speak up may help cultivate a culture of open and safe  
329 communication in the OR (Pattni et al., 2019). The next step could also be the development of  
330 the scenario in an immersive virtual environment, to enhance immersion and enable  
331 participants to behave more naturally and intervene orally. Future developments of the  
332 scenario could include self-debriefing in the simulation session, with a facilitator-led virtual  
333 debriefing for example, and help contribute to the development of VR simulation debriefing  
334 standards (Verkuyl, Atack, et al., 2018; Verkuyl, Lapum, et al., 2018).

335

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447

448

**Figure Caption**

449 **Figure 1.** Photo of the virtual reality environment on tablet

450

451

452 **Table 1**

453 *Mean scores (and standard deviations) of the likelihood of speaking up and embarrassment in*  
454 *each clinical situation*

455

Clinical situation	Likelihood of speaking up	Embarrassment
Nurse 1	5.15 (2.12) <sup>a</sup>	2.48 (1.80) <sup>a</sup>
Nurse 2	6.79 (0.60) <sup>b</sup>	2.06 (1.68) <sup>a</sup>
Surgeon 1	6.27 (1.23) <sup>c</sup>	3.42 (2.24) <sup>b</sup>
Surgeon 2	5.88 (1.56) <sup>c</sup>	3.45 (2.12) <sup>b</sup>

456 *Note.* Means in the same column sharing a common superscript are not significantly different.

457 Nurse 1= Earrings; Nurse 2= Table; Surgeon 1= Mask; Surgeon 2= Sterile field.



458 **Table 2**

459 *Strategies for speaking up*

Categories	Elements	NURSE		SURGEON		TOTAL	
		/66	%	/66	%	/132	%
Nature of sentence	Question	11	16.67	11	16.67	22	16.67
	Statement	51	77.27	49	74.24	100	75.76
	Statement and question	2	3.03	2	3.03	4	3.03
	No intervention	2	3.03	3	4.55	5	3.79
Verbal and non-verbal	Words	51	77.27	54	81.82	105	79.55
	Actions	0	0	2	3.03	2	1.52
	Words and actions	12	18.18	8	12.12	20	15.15
Phrasing	Polite formula (e.g. please, excuse me)	15	22.73	20	30.30	35	26.52
	Personalization (e.g. first name, last name, Doctor)	3	4.55	24	36.36	27	20.45
	Informal	44	66.67	0	0	44	33.33
	Formal	0	0	48	72.73	48	36.36
Content	Humour	3	4.55	4	6.06	7	5.30
	Warning (e.g. Look out, Be careful)	20	30.30	11	16.67	31	23.48
	Advice or suggestion	15	22.73	22	33.33	37	28.03
	Reminder of rules	39	59.09	34	51.52	73	55.30

460

461 **Table 3**

462 *Self-debriefing: speaking-up factors adapted from Okuyama's model (2014)*

Categories	Elements	NURSE		SURGEON		TOTAL	
		/66	%	/66	%	/132	%
Contextual factors	Team relationship	5	5.58	2	3.03	7	5.30
Individual factors	Responsibility towards the patient	16	24.24	17	25.76	33	25
	Role as professionals	59	89.39	58	87.88	117	88.64
Perceived safety versus costs	Fear of the responses of others or conflict	2	3.03	9	13.64	11	8.33
Perceived efficacy versus futility	Personal control and impact	0	0	1	1.52	1	0.76
Voice: message, tactics, targets	Show positive intent	2	3.03	4	6.06	6	4.55
	Select person	0	0	4	6.06	4	3.03
Other strategies	Nonverbal communication	0	0	1	1.52	1	0.76
	No communication	3	4.55	7	10.61	10	7.58
	Raising the subject later	0	0	1	1.52	1	0.76
	Finding excuses, playing down the situation	5	7.58	10	15.15	15	11.36
	Transfer responsibility	2	3.03	9	13.64	11	8.33
	Humour	0	0	2	3.03	2	1.52

**Figure 1**

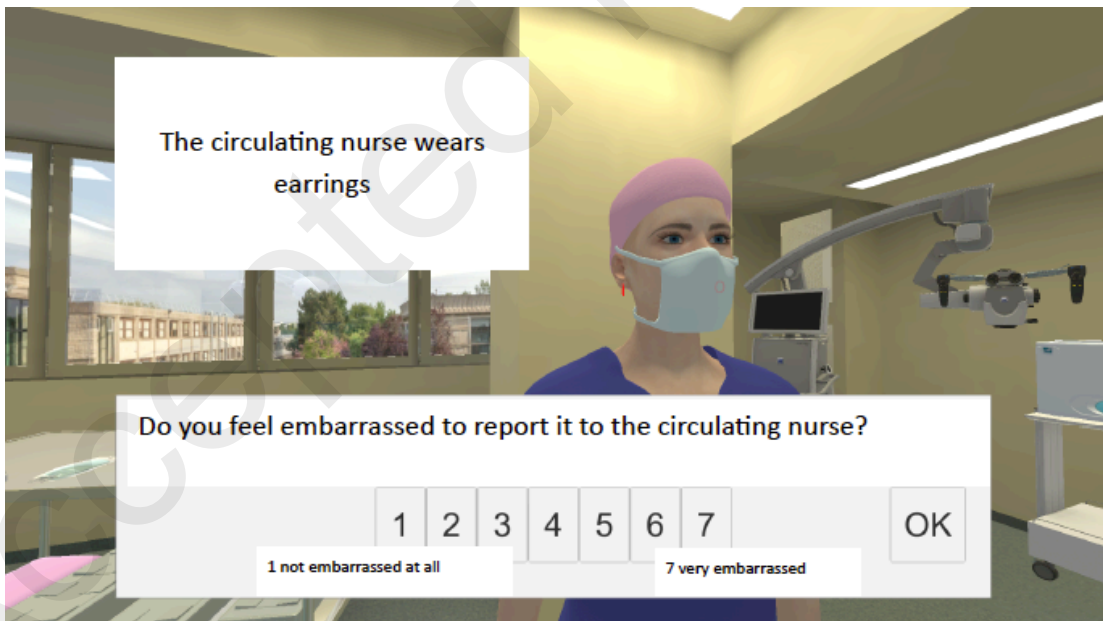
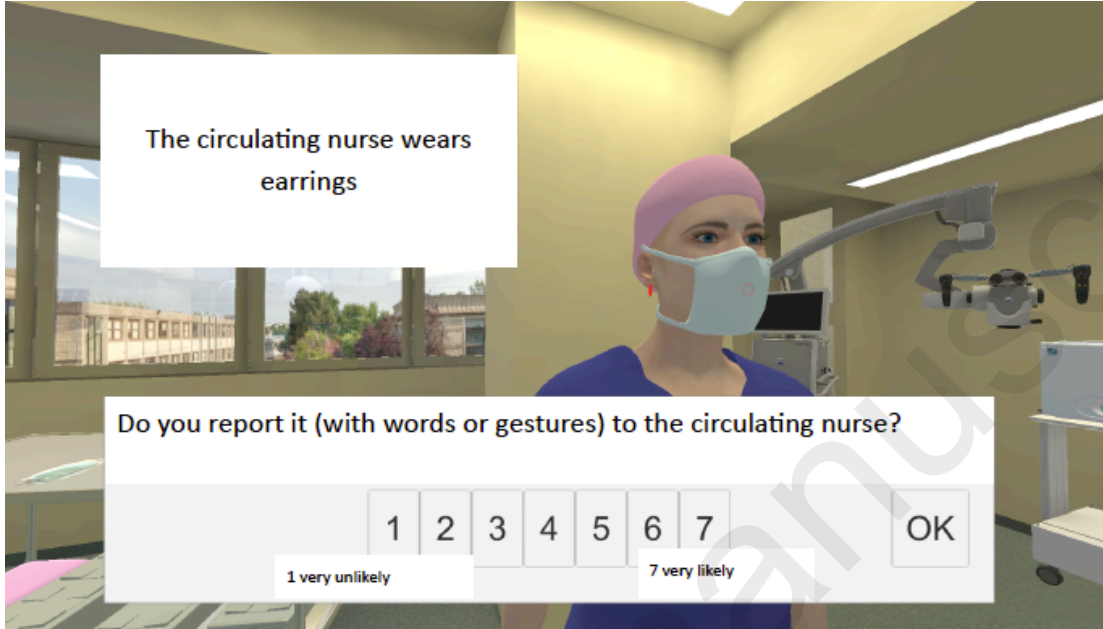
*Photo of the virtual reality environment on tablet*



## APPENDIX A

Examples of scenario with the clinical vignettes

### Nurse 1



## Surgeon 1



## SPEAKING UP

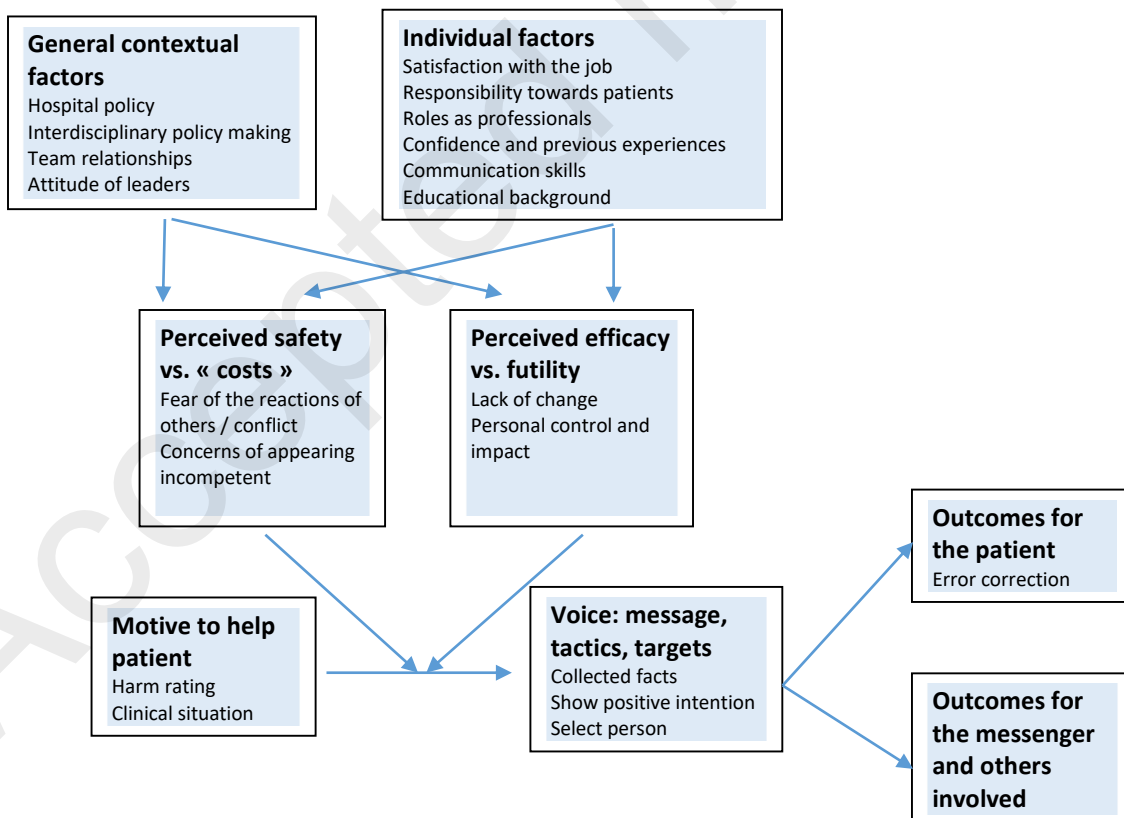
### DEFINITION

- Explicit communication of critical information related to the task (opinions, doubts, suggestions...) in order to improve the quality and safety of care. E.g.: report an asepsis error.
- Ability to make oneself heard and to present one's point of view firmly and authoritatively.
- An important non-technical skill for teamwork.

### WHY TRAIN ON THIS SKILL?

- 43% of incidents in the OR are related to communication breakdowns among personnel.
- 23% of incidents involving a communication gap are related to the reluctance to share concerns or critical information.
- Information exchanged in the OR may be inaccurate or incomplete, and shared with the wrong person or at the wrong time.

### MODEL OF HEALTHCARE PROFESSIONALS' SPEAKING UP (OKYAMA ET AL., 2014)



## APPENDIX B

- For healthcare professionals speaking up for is motivated by the desire to protect the patient and ensure safety of care. This motivation is modulated by the perceived risks to the patient and the ambiguity of the situation (uncertainty).
- Factors influencing speaking up are contextual (e.g. support from the hospital administration, safe team climate: valuing the role of each individual, encouraging questions) but also individual (e.g. positive past experiences, high sense of responsibility towards the patient, identification with the patient's professional role, communication skills and confidence in one's abilities).
- These factors interact on healthcare professionals' perception of safety or potential cost for themselves (e.g., apprehension of negative consequences: fear of repercussion on one's career, anticipation of team members' reactions, fear of appearing incompetent, fear of generating conflict) and on their perception of effectiveness (e.g. feeling of futility, feeling of being ignored or not having a word to say in the team).
- In light of all these factors, healthcare professionals may choose to express themselves orally or use strategies to overcome these perceived barriers (e.g. discreet and later resolution, call in a third party).

### HOW CAN SPEAKING UP BE DEVELOPED?

---

#### BY TRAINING (SIMULATION)

Practise with communication tools, in team, identify effective message formulations and factors that allow one to speak up or not.

---

#### BY DOING

##### *WITH STRUCTURED COMMUNICATION TOOLS*

- **SAED** by the HAS: I describe the situation, I indicate the context, I give my assessment and I formulate my request.
- From TeamSTEPPS
  - **CUS** (Concerned, Uncomfortable, Safety) examples of assertive statements: "I'm worried," "I'm uncomfortable," "it's a safety issue."
  - **DESC**: I Describe the situation, I Express my feelings, I Suggest an alternative, I Evaluate the Consequences on the objectives in order to reach consensus.

## APPENDIX B

- **TWO-CHALLENGE RULE:** after a first ineffective warning, a second assertive expression of concern. Either the target validates the reception of the message, or the problem remains unsolved: ask for help or ask the hierarchy for help.

### A FEW RECOMMANDATIONS

- Speak in the first person
- Describe rather than judge
- Propose solutions and involve people
- In the presence of patients or family members, develop coded words or gestures.
- Don't get discouraged
- It's never too late

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