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# BMJ Open

## Using In situ simulation when preparing for COVID-19: Health care professional's point of view.

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6 1 **Title page**

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8 3 Using In situ simulation when preparing for COVID-19: Health care professional's point of view.

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For peer review only

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4 54 **Abstract**

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7 55 **Objectives:** The COVID-19 pandemic has forced hospital organization and health care professionals to prepare for large  
8 56 quantities of patients in isolation rooms. In situ simulation may seem promising in order to manage the organizational  
9 57 changes that the pandemic require. This study aims to investigate in situ simulations influence on healthcare professional's  
10 58 preparedness to face the pandemic.

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12 59 **Setting:** We conducted full-scale in situ simulations over a 3-week period at a Danish University Hospital

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14 60 **Participants:** 277 health care professionals

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17 61 **Interventions:** The simulations consisted of a briefing, two scenarios focusing on acute respiratory insufficiency and  
18 62 correct use of personal protective equipment (PPE), and a debriefing. We conducted eight focus group using comparable  
19 63 semi-structured interview guides on the organizational restructuring of the departments and the outcomes of the needs-  
20 64 driven simulation-based program.

21  
22 65 **Results:** The informants perceived that the simulations resulted in positive experiences for the healthcare professionals  
23 66 and perceived the organizational changes as effective. They highlighted that simulation enhanced teamwork, demystified  
24 67 the COVID-19 disease, and improved skills, in correct use of PPE and acute treatment of COVID-19 patients. Data  
25 68 revealed that a pre-defined simulation task force including both experienced simulators and medical experts for facilitation  
26 69 of in situ simulation would be beneficial.

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29 70 **Conclusion:** In situ simulation may be useful to enhance learning on organization- and individual level during a  
30 71 pandemic. This educational activity could serve an important role in facilitating hospital preparation and education of  
31 72 large numbers of healthcare professionals during a health care crisis. The establishment of a simulation task force is,  
32 73 suggested to handle coordination and rapid enrolment across the hospital.

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36 75 **Strengths and limitations of this study**

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39 76 **Strengths:**

- 40 77
- 41 78 • Study focusing on health care professional's perception of in-situ simulation
  - 42 79 • Large population of participants in the early stage of the COVID-19 pandemic

43 80 **Limitations:**

- 44 81 • No pre-intervention interviews were performed
- 45 82 • Most of the COVID-19 Clusters were never activated, thus what was leaned never came into  
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## 88 **Introduction**

89 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been spreading worldwide since its occurrence by  
90 the end of 2019, causing the COVID-19 pandemic. The World Health Organization (WHO) estimated a global mortality  
91 at 3.4% in the initial phase of the pandemic [1]. These numbers pressured the existing workforce, and called for an increase  
92 in numbers of healthcare professionals, who could act as frontline staff during the pandemic [2]. Vagni and colleagues  
93 (2020) found that healthcare professionals involved in the treatment of COVID-19 were exposed to a large degree of  
94 stress, especially if they lack adequate knowledge about the disease [3].

95 Training and correct use of personal protection equipment (PPE) in the care of all patients with respiratory symptoms was  
96 essential due to contamination risks [4,5]. Hence, the immense pressure on the healthcare system called for immediate  
97 development of just-in-time preparedness strategies in order to meet the challenges of new healthcare professionals not  
98 familiar with the disease, risk of contamination, and risk of mental health issues among the professionals [6].

99 Simulation has a potential to help managing the global COVID-19 crisis and in potentially similar future pandemics [2,7–  
100 9]. It is however, not known how the use of in situ simulations affected the healthcare professionals, due to the rare  
101 occurrence of pandemics. Thus, the present study aims to investigate how healthcare professionals, educational experts,  
102 and leaders at department levels at a University Hospital perceived their involvement in an in situ simulation program.

### 104 ***Reorganization of the hospital and design of COVID-19 clusters***

105 Aarhus University Hospital, which contains above 1200 bedsides, established a COVID-19 clinic focused on COVID-19  
106 testing, identification, and triaging.

107 In addition, the capacity at the Department of Intensive Care were increased and four COVID-19 clusters were established,  
108 with a total capacity of 134 isolation rooms. See figure 1 for details.

109 *Please insert figure 1; COVID-19 Clusters, Aarhus University Hospital. March 2020 – isolationrooms*

110 A stepwise approach was used in order to convert four in-patient departments to COVID-19 patient treatment clusters.  
111 The clusters should admit COVID-19 patients sequentially when 50% of the capacity of the previous cluster were in use,

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4 112 however only COVID-19 cluster 1 and 2 were activated during the study period. The allocated healthcare professionals  
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6 113 had their daily work in a variety of clinical departments and faced unfamiliar working routines, with in respect to  
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8 114 colleagues, teams, and working locations within the COVID-19 clusters.  
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### 11 115 12 13 14 116 *Educational activities in the COVID-19 clusters*

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17 117 In order to prepare personnel, a steering committee in each cluster was established. Co-author LE was part of the  
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19 118 educational team in cluster 1 and co-author BL was part of the educational team in cluster 2. As part of the educational  
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21 119 activities an in situ simulation programme was developed. The programme had an agile structure making it adjustable in  
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23 120 regards to the continuous development of new guidelines about triaging, resuscitation, and treatment of COVID-19  
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25 121 patients.

26 122 Experiences and insights from the simulation was shared with the hospital administration on a daily basis, in order to  
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28 123 ensure that gained knowledge and points of attention could benefit the entire hospital. In this way, there was a close  
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30 124 relation between the different levels of management at the hospital.  
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## 32 125 33 34 126 **Materials and Methods**

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37 127 The simulations at Aarhus University Hospital included a total of 277 healthcare professionals (doctors, nurses, and  
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40 128 physiotherapists) and were conducted during a three-week period in April 2020. The simulations lasted between 60-90  
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43 129 minutes and consisted of two scenarios focusing on acute respiratory insufficiency and correct use of personal protective  
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45 130 equipment (PPE).  
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48 131 *Please insert Figure 2; Description of simulated cases*  
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51 132 The simulations did not include formal assessments of the learning due to the time-sensitive nature of the training. Instead,  
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54 133 the simulations included all healthcare professions that treated covid-19 patients and all participants were asked to actively  
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57 134 participate in the simulation and in giving and receiving feedback. The scenarios in the simulation sessions required  
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135 collaborative and active learning. The simulations were conducted as rapid cycle deliberate practice, consisting of average  
136 20-minutes briefing, 20-minutes scenario, and 20-minutes debriefings[10].

137 We conducted eight focus group interviews lasting between 35 minutes and 63 minutes per interview using comparable  
138 semi-structured interview guides [11]. The interview guides comprised thematically structured open-ended questions with  
139 respect to themes as uncertainty, fear of contamination, and lack of preparedness among healthcare professionals during  
140 the pandemic, which is known from the educational literature [2,7,12]. Furthermore, informants were asked to reflect on  
141 how the COVID-19 pandemic affected their daily work routines. The semi-structured interview guide allowed the  
142 interviewer to probe for additional insight and to dig deeper into the pros and cons of the simulations. The interviewers  
143 were trained qualitative researchers who also facilitated the simulations, however the interviewers did not interview  
144 participants they had trained. This was done in order to decrease the power relation between interviewer and interviewee.  
145 All interviews were transcribed verbatim and narrative coded [11]. The informants in the present study were included  
146 based on their experience with being either participants in simulations, facilitators of the simulations, members of the  
147 educational committee, or consultants responsible for the included departments. We included doctors, nurses, and other  
148 healthcare professionals in order to embrace the voice of all professions. Each focus group had a strategic composition of  
149 informants in order to decrease the power differential among the informants according to the methodological  
150 recommendations from Stalmeijer and colleagues [13].

151 We applied a qualitative methodology that relates to the social constructionist understanding of storytelling as being  
152 integral to the analysis of healthcare professionals' perspectives and personal experiences when dealing with the pandemic  
153 [14].

#### 154 ***Patient and public involvement statement***

155 It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination  
156 plans of our research

#### 157 ***Ethics***

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158 Participation in the interviews was voluntary and participants' quotes were made anonymous. No ethical approval or trial  
159 registration was required for this study according to Danish legislation. All participants provided informed consent and  
160 gave permission to recording of the interviews.

## 161 **Results**

162 In total 24 informants were included in the present study (12 healthcare professionals, 7 medical experts, and 5 consultants  
163 responsible for the clusters). The informants perceived that the simulations resulted in positive experiences for the  
164 healthcare professionals and experienced the organizational changes as positive (i.e. increase in interdisciplinary actions,  
165 decrease of bureaucracy, and a stronger sense of community). The following sections elaborate on these findings.

### 166 *Anxious concerns and demystification of the COVID-19*

167 The healthcare professionals in the interviews reported a feeling of uncertainty, partly due to being put in a stand-by  
168 position for emergency preparedness, and partly due to the severity of the disease combined with an overwhelming  
169 amount of information. This is exemplified by a physiotherapist who participated in the simulation:

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171 *"I feel like we have been caught in some kind of limbo or 'silence before the storm'..."* (Physiotherapist).

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173 Here, in situ simulation was perceived as crucial in preparing for the COVID-19 disease by demystifying the disease and  
174 providing hands-on experiences with the patient category, effectively improving a sense of self-efficacy [15].

175 Especially stress management was experienced as helpful in reducing potential stressors and increasing a sense of comfort  
176 in handling the COVID-19 patients, as also noted by the physiotherapist and a registered nurse:

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178 *"...we were on such uncertain ground in the beginning. I also think [the simulation training] gave me some sense of  
179 security."* (Physiotherapist)

180 *"Yes, in that sense it [COVID-19] was demystified."* (Registered nurse)

181 The medical experts that facilitated the simulations highlighted the use of in situ simulations in order to enhance  
182 organizational learning and individual learning. Organizational changes, such as an increase in multidisciplinary  
183 cooperation and a stronger sense of community, prepared the clusters to the COVID-19 pandemic. The medical experts

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184 highlighted the need for individual learning of the healthcare professionals and perceived the simulation training as key  
185 in preparing oneself and the department for the COVID-19 pandemic:

186 *"In our cluster the simulations had a really good effect in order to demystify the disease and decrease fear among the  
187 healthcare professionals. The professionals had a lot of uncertainty in regards to what the pandemic would bring.  
188 Furthermore, the simulations raised a lot of questions that we, as heads of the cluster could answer in the daily meetings"*  
(Medical expert).

### ***Importance of multidisciplinary team training***

191 Another theme was the importance of interdisciplinary simulation sessions. The sessions highlighted each healthcare  
192 professional's value and role when handling COVID-19 patients. This was especially noted by the physiotherapist in the  
193 quote below, who experienced a stronger sense of professional identity, as well as an increased sense of comfort in  
194 teamwork:

195 *"[...] there has been a great experience of interdisciplinarity and an awesome feeling that we will handle it [COVID-19]  
196 together..."* (Physiotherapist).

197 In continuation, teamwork was enhanced during the simulations, according to a managing consultant:

198 *"The fact that experienced and un-experienced healthcare professionals were teamed up in the simulations really help in  
199 order to create insight into the value of each team-member. It also helped the new professionals to be integrated in  
200 departments, where they never had worked before."* (Managing consultant)

201 In continuation, consultants responsible for departments highlighted how the simulations helped ensuring a professional  
202 and calm working environment at the clusters. This is exemplified in the following quote by a head of a department who  
203 stressed how the simulations improved the working environment:

204 *"When we started the in situ simulation the atmosphere in the department became calmer. The treatment of COVID-19  
205 patients is actually fairly simple, and the simulations helped the healthcare professionals to realize that. The simulations  
206 help them practice the COVID-19 treatment and do some mistakes without jeopardizing patient-safety. It surely helps in  
207 order to calm the healthcare professionals and establish a very well-functioning department"* (Managing consultant)

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208 The positive gains of in situ simulation were also emphasized in the following quote by another head of department that  
209 didn't received any COVID-19 patients, but still valued the simulations.

210 *"This is surely something that we are going to use in the future (...) It has provided us with so much knowledge and  
211 teamwork. The content can be anything. It helped all of us because it is interdisciplinary and include experienced and  
212 unexperienced healthcare professionals."* (Managing consultant)

### 214 ***Design and facilitation of the simulations***

215 The healthcare professionals highlighted the simulation facilitator as a key factor by being engaged in the scenario,  
216 ensuring fidelity, and securing a safety net by debriefing the simulations. The medical experts that facilitated the  
217 simulations also highlighted the collaboration with in situ simulation experts in order to establish psychological safety  
218 [16] and an optimal learning environment.

219 *"It makes it a lot easier for me as a facilitator, when there is an experienced in situ simulation instructor conducting the  
220 scenarios together with me. In this way, I know that the educational elements are being taken care of in a professional  
221 manner"* (Medical expert).

222 The presence of a medical expert and an educated simulation facilitator in each simulation secured the consistency among  
223 the facilitators. This is exemplified by one of the medical experts in the following quote:

224 *"The fact that we were two medical experts and one simulation expert to conduct all the in situ simulations in our  
225 department helped ensure consistency in the scenarios. A lot of the questions from the participants were the same and  
226 because we had daily meetings with the heads of the department, we knew what to answer. During the two weeks we  
227 spend all our working time conducting these simulations, which made us confident in reaching the learning goals and  
228 establishing a smooth facilitation of the simulations."* (Medical expert)

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4 229 The informants in the present study called for the establishment of a simulation task force across the hospital in order to  
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6 230 share knowledge between departments and develop expertise in designing, implementing, and facilitating the simulations.  
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10 232 *"I would have benefited by ending each day with an afternoon meeting with all the simulation facilitators from the*  
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12 233 *COVID-clusters across the hospital. The pandemic caused a lot of questions in addition to facilitating the simulations.*  
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14 234 *For example, what happens if a COVID-patient with comorbidity needs to be transferred to another department? If all*  
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16 235 *simulation facilitators made a small daily report and shared this with the other facilitators, we could ensure knowledge*  
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18 236 *sharing across the hospital."* (Medical expert)  
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21 237 Due to a lack of PPE, some simulations were conducted without the correct equipment in the initial phase of the simulation  
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23 238 program. During the simulation programme the heads of departments realized the value of using the correct PPE, as  
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25 239 explained in the quote below.

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28 240 *"The outcome of simulation went from good to better, when we started to use the correct PPE, as this required that the*  
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30 241 *healthcare team worked fully together."* (Consultant responsible of department)  
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## 33 242 **Discussion**

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36 243 The interviews in the present study suggest that in situ simulation enhanced teamwork, helped demystify the COVID-19  
37 244 disease, and provided the healthcare professionals with competences within correct use of PPE and acute treatment of  
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39 245 COVID-19 patients.  
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43 247 Healthcare professionals previously exhibit concern about family transmission of infectious diseases, thus it seems  
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45 248 reasonable if the COVID-19 pandemic had a negative impact on the healthcare professionals' perceived quality of work  
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47 249 [17]. Based on the findings in the present study, it seems that in situ simulation can be a useful tool, when facing such a  
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49 250 decrease in the perceived quality of work.

50 251 In medical education, Weller and colleagues (2014) investigated effective healthcare teams and found an unacceptable  
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52 252 rate of errors due to lack of teamwork between healthcare professionals [18]. Consequently, they put forward seven  
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54 253 interventions to overcome barriers to teamwork and team communication, including the use of simulation. Our study  
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56 254 indicates that the informants experienced anxiety regarding the rapid spread of the COVID-19 virus. Furthermore,  
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4 255 informants stated that in situ simulation made them feel more comfortable facing the task at hand i.e. by demystifying the  
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6 256 treatment of the COVID-19 disease and enhancing teamwork, all in a safe educational environment.

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8 257 The uncertainty due to COVID-19 is likely to add complexity to the clinical work. Thus, training of healthcare  
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10 258 professionals seems key in order to reduce stress and form coping strategies. Our findings align well with the stress model  
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12 259 by Palmer and colleagues from 2003, as their model highlight professionals' training in order to face an increased  
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14 260 complexity of work and decrease stress [19].

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18 262 The hospital infrastructure seems influential when supporting the fundamental aim of wellbeing for all patients and  
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20 263 delivering high standards of care [20]. This is supported by our findings, suggesting that learning occurred on an  
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22 264 organization level as well as the individual level, as stated above. Similar findings are emphasized by Brydges and  
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24 265 colleagues (2020), who advocate for the use of simulation when preparing for and responding to the early stages of the  
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26 266 COVID-19 pandemic [12].

27 267 Simulation seems to have a potential in managing the global COVID-19 pandemic by rapidly facilitating hospital  
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29 268 preparation and education of large numbers of healthcare professionals [7,21,22]. Wong and colleagues (2020) advocated  
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31 269 for the use of in situ simulation in the beginning of the pandemic in order to test the preparedness of isolation rooms,  
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33 270 however, they do not specifically highlight using a coordinated and centralized simulation team to ensure the development  
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35 271 of a robust curriculum development, as Dubé et al. (2020) explicitly emphasize [6,23]. While the present study supports  
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37 272 the use of simulation in a pandemic, the findings also reveal the need of coordinated planning across the hospital in order  
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39 273 to secure that the learning goals of the simulation is reached. The coordination of simulation is highlighted by Brazil and  
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41 274 colleagues (2020), who conducted an intervention similar to the one in the present study, orchestrated by a Simulation  
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43 275 Service formally established across the hospital [24]. The setting in the present study would have benefitted from the  
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45 276 establishment of a simulation task force including educated simulators and medical expert, in order to ensure that the  
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47 277 pedagogical, didactical, and medical elements in the simulations where at the highest possible level.

## 48 278 49 279 **Limitation**

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51 280 Due to the rapid development of the COVID-19 pandemic it was not possible to conduct a study with objective assessment  
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53 281 of skills learned e.g. an examination or practical test of what was learned. Nonetheless, the in situ simulations are  
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55 282 suggested to decrease stress and improve teamwork among the healthcare professionals. Similar, the simulations may  
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57 283 have improved the clinical skills of the participating staff. It has not been possible to conduct a follow-up data collection  
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285 in order to establish if demystification of the disease and decrease in stress still is present or new educational activities is  
286 needed.

## 287 **Conclusion**

288  
289 In situ simulation may be useful to enhance learning on an organization level as well as the individual level during a  
290 pandemic. This educational activity could serve an important role in facilitating hospital preparation and education of  
291 large numbers of healthcare professionals during a pandemic. The establishment of a simulation task force is, however,  
292 suggested as in situ simulation across a hospital requires coordination and rapid enrolment in health care crises.

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## 298 **Contributorship statement:**

299  
300 JJ and RDJ contributed with the idea of the study, collecting of data and the writing of the manuscript. BL, NT and LE  
301 contributed with collecting of data. GVE contributed with the idea of the study.

302 All authors read and approved the manuscript before submission.

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## 305 **Competing interests:**

306 There are no competing interests for any author

## 307 **Data sharing statement**

308 Data was shared between the authors only before anonymization.

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**Figures:**

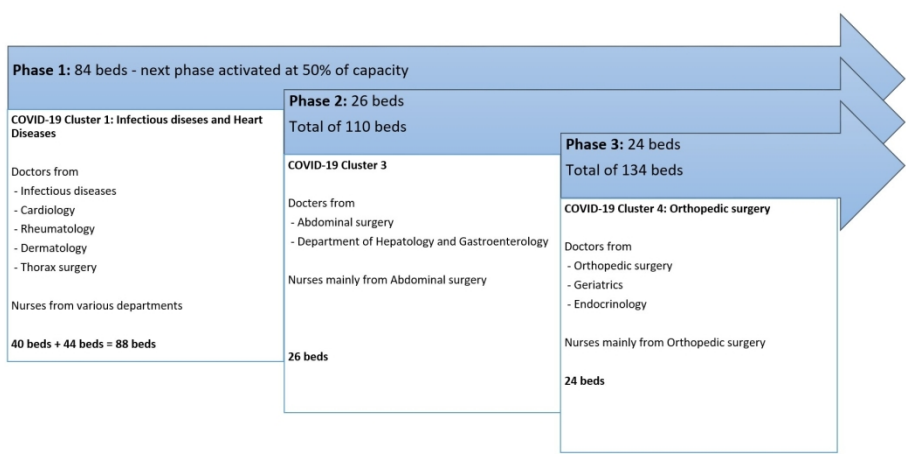
Figure 1: COVID-19 Clusters, Aarhus University Hospital, March 2020 – isolationrooms

Figure 2: Description of simulated cases

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Figure 1

COVID-19 Clusters, Aarhus University Hospital. March 2020 – isolation rooms



523x308mm (96 x 96 DPI)

Figure 2: Description of simulated cases

Cases	Background information	Case description	Clinical outcome	Learning objectives
Patient 1	75 years. Known well regulated arterial hypertension High level of function.	Respiratory insufficient Covid-19 infected patient. Dependence on oxygen supplement and elevated bed rail. Mono-organ failure	Patient stabilization on COVID-19 medical ward (non-ICU)	<ol style="list-style-type: none"> <li>1. Terms of ABCDE approach</li> <li>2. appropriate use of PPE and medical equipment</li> <li>3. transportation of equipment to/from isolated patients</li> </ol>
Patient 2	64 years. Known dysregulated diabetes II and adipositas. High level of function.	Severe respiratory insufficient Covid-19 patient. ABCD-unstable. Septic shock/central pulmonary embolism and multi organ failure  (occasionally extended with adjacent cardiac arrest)	Medical emergency call/acute transfer to ICU and mechanic ventilation (Advanced CPR if cardiac arrest)	<ol style="list-style-type: none"> <li>4. Advanced ABCDE-approach to critically ill patient.</li> <li>5. Acute communication strategy and early call for assistance</li> <li>6. Use of PPE when performing aerosol generating interventions</li> <li>7. Reflection on indication for intensive care and resurreccion</li> </ol>

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# BMJ Open

## Healthcare professionals' experience of using in situ simulation training in preparation for the COVID-19 pandemic: a qualitative focus group study from a Danish hospital.

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<b>Primary Subject Heading</b>:	Medical education and training
Secondary Subject Heading:	Anaesthesia, Infectious diseases, Qualitative research, Respiratory medicine
Keywords:	Adult anaesthesia < ANAESTHETICS, MEDICAL EDUCATION & TRAINING, RESPIRATORY MEDICINE (see Thoracic Medicine), COVID-19

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7 2 **Title of the article:**

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9 3 Healthcare professionals' experience of using in situ simulation training in preparation for the COVID-19 pandemic: a  
10 4 qualitative focus group study from a Danish hospital.

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42 Simulation-Based Medical Education

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45 COVID-19

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## 55 Abstract

56 **Objectives:** The COVID-19 pandemic forced hospital organization and healthcare professionals to prepare for large  
57 quantities of patients in isolation rooms. In situ simulation may seem promising in order to manage the organizational  
58 changes that the pandemic require. This study aims to investigate in situ simulations influence on healthcare professional's  
59 self-perceived preparedness to face the pandemic.

60 **Design:** A qualitative focus group study

61 **Setting:** We conducted full-scale in situ simulations over a 3-week period in April 2020, including 277 healthcare  
62 professionals, at a Danish University Hospital. Subsequently, six semi-structured focus group interviews, including 22  
63 participants from the simulations, were conducted in May 2020.

64 **Participants:** 22 healthcare professionals participated in the focus group interviews

65 **Methods:** The simulations consisted of a briefing, two scenarios focusing on acute respiratory insufficiency and correct  
66 use of personal protective equipment (PPE), and a debriefing. We conducted six focus group interviews using comparable  
67 semi-structured interview guides focusing on the organizational restructuring of the departments and outcomes of the  
68 needs-driven simulation-based program. We used thematic analysis to identify main themes.

69 **Results:** The informants perceived that the simulations resulted in positive experiences for the healthcare professionals  
70 and perceived the organizational changes as effective. They highlighted that simulation enhanced teamwork, demystified  
71 the COVID-19 disease, and improved skills, in correct use of PPE and acute treatment of COVID-19 patients. Data  
72 revealed that a pre-defined simulation task force including both experienced simulators and medical experts for facilitation  
73 of in situ simulation would be beneficial.

74 **Conclusion:** In situ simulation may be useful to enhance learning on organization- and individual level during a  
75 pandemic. This educational activity could serve an important role in facilitating hospital preparation and education of  
76 large numbers of healthcare professionals during a health care crisis. Introduction of a simulation task force is, suggested  
77 to handle coordination and rapid enrolment across the hospital.

- 78
- 79 • The study presents insights based on healthcare professionals' experiences with participating in
- 80 COVID-19 in situ simulations in a university hospital
- 81 • A focus group interview intervention of involved health care professionals was performed in
- 82 close timely relation to the simulations.
- 83 • In situ simulation facilitated learning both at the individual and organization levels
- 84 • Due to the pandemic a limited number of informants are included in the present study

## 85 Introduction

86 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been spreading worldwide since its occurrence by  
87 the end of 2019, causing the COVID-19 pandemic. The World Health Organization (WHO) estimated a global mortality  
88 at 3.4% in the initial phase of the pandemic [1]. These numbers pressured the existing workforce, and called for an increase  
89 in numbers of healthcare professionals, who could act as frontline staff during the pandemic [2]. Vagni and colleagues

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4 90 (2020) found that healthcare professionals involved in the treatment of COVID-19 were exposed to a large degree of  
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7 91 stress, especially if they lack adequate knowledge about the disease [3].  
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10 92 Training and correct use of personal protection equipment (PPE) in the care of all patients with respiratory symptoms was  
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13 93 essential due to contamination risks [4,5]. Hence, the immense pressure on the healthcare system called for immediate  
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16 94 development of just-in-time preparedness strategies in order to meet the challenges of new healthcare professionals not  
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19 95 familiar with the disease, risk of contamination, and risk of mental health issues among the professionals [6].  
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21 96 In situ simulation has a potential to help managing the global COVID-19 crisis and in potentially similar future pandemics  
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24 97 [2,7–9]. It is however, not known how the use of in situ simulations affected the healthcare professionals, due to the rare  
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26 98 occurrence of pandemics. Thus, the present study aims to investigate how healthcare professionals, educational experts,  
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28 99 and leaders at department levels at a University Hospital perceived their involvement in an in situ simulation programme.  
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### 31 32 33 101 ***Reorganization of the hospital and design of COVID-19 clusters***

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35 102 Aarhus University Hospital, which contains above 1200 bedsides, established a COVID-19 clinic focused on COVID-19  
36  
37 103 testing, identification, and triaging.  
38

39 104 In addition, the capacity at the Department of Intensive Care were increased and four COVID-19 clusters were established,  
40  
41 105 with a total capacity of 134 isolation rooms. The term COVID-19 clusters refers to the fact that several medical specialties  
42  
43 106 worked together at one isolation ward. See figure 1 for details.  
44

45 107 *Please insert figure 1; COVID-19 Clusters, Aarhus University Hospital. March 2020 – isolation rooms*

46  
47 108 A stepwise approach was used in order to convert four in-patient departments to COVID-19 patient treatment clusters.  
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49 109 The clusters should admit COVID-19 patients sequentially when 50% of the capacity of the previous cluster were in use,  
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51 110 however only COVID-19 cluster 1 and 2 were activated during the study period. The allocated healthcare professionals  
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53 111 had their daily work in a variety of clinical departments and faced unfamiliar working routines, with respect to colleagues,  
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55 112 teams, and working locations within the COVID-19 clusters.  
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### 57 58 113 ***Educational activities in the COVID-19 clusters***

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4 114 In order to prepare personnel, a steering committee in each cluster was established. As a part of the steering committee,  
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6 115 educational teams were established in order to prepare the healthcare professionals to face the pandemic. Co-author LE  
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8 116 was part of the educational team in cluster 1 and co-author BL was part of the educational team in cluster 2. As part of  
9  
10 117 the educational activities an in situ simulation programme was developed. In situ simulation was used as a method due to  
11  
12 118 an educational focus on individual and organizational learning[2]. The programme had an agile structure making it  
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14 119 adjustable in regards to the continuous development of new guidelines about triaging, resuscitation, and treatment of  
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16 120 COVID-19 patients.

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18 121 Experiences and insights from the simulation was shared with the hospital administration on a daily basis, in order to  
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20 122 ensure that gained knowledge and points of attention could benefit the entire hospital. Hence, the understanding of  
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22 123 COVID-19 disease and how to improve the organization of isolation rooms and clinical teams were shared based on  
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24 124 insights from the simulations. In this way, there was a close relation between the different levels of management at the  
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26 125 hospital.

## 27 126

### 29 127 **Methods**

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32 128 We conducted 6 qualitative focus group interviews including a total of 22 healthcare professionals. The focus group  
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34 129 method and a narrative research approach can be used to investigate meanings and beliefs that influence the informants'  
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36 130 attitudes toward in situ simulation as an educational tool[10]. The informants were participants from a simulation based  
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38 131 educational initiative focusing handling and treatment of COVID-19 patients. These simulations took place at Aarhus  
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40 132 University Hospital and included a total of 277 healthcare professionals (doctors, nurses, and physiotherapists) and were  
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43 133 conducted during a three-week period in April 2020. The team based in situ simulations lasted between 60-90 minutes  
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45 134 and consisted of two scenarios focusing on acute respiratory insufficiency, correct use of personal protective equipment  
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48 135 (PPE), team communication and transportation of unstable patients, please see figure 2. The participants all simulated  
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51 136 both scenarios. All simulations were facilitated by a medical expert and an educated simulation instructor, both present  
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54 137 during briefing, conduction, and debriefing of the scenarios. The participants were organized in groups of 4-6 individuals  
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57 138 in a team composition that corresponded to the clinical teams in the newly established COVID-19 clusters (1-2 doctors,  
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139 2-4 nurses and 1-2 other healthcare professionals). A manikin deputised as patient and all equipment from a basic medical  
140 ward was available. Measured vitals was presented on a monitor and operated by the facilitators during the scenarios.

141 *Please insert Figure 2; Description of simulated cases*

142 The simulations did not include formal assessments of the learning due to the time-sensitive nature of the training. Instead,  
143 the simulations included all healthcare professions that treated covid-19 patients and all participants were asked to actively  
144 participate in the simulation and in giving and receiving feedback. The scenarios in the simulation sessions required  
145 collaborative and active learning. The simulations were conducted as rapid cycle deliberate practice, consisting of average  
146 20-minutes briefing, 20-minutes scenario, and 20-minutes debriefings[11]. Rapid cycle deliberate practice was selected  
147 as Hunt and colleagues showed that this approach is associated with improvement in performance of key measures and  
148 progressive acquisition of trained skills during simulation [11]. Sessions were debriefed using teamGAINS [12] as  
149 technical and non-technical leaning objectives were essential for the outcome.

#### 150 **Data collection**

151 The qualitative focus group interviews lasted between 35 minutes and 63 minutes per interview using comparable semi-  
152 structured interview guides [13]. The interview (*see full interview topic guide in supplementary material*) guides  
153 comprised thematically structured open-ended questions with respect to themes as uncertainty, fear of contamination, and  
154 lack of preparedness among healthcare professionals during the pandemic, which is known from the educational literature  
155 [2,7,10]. Furthermore, informants were asked to reflect on how the COVID-19 pandemic affected their daily work  
156 routines. The themes of the interviews can be seen in the Interview topic guide. The semi-structured interview guide  
157 allowed the interviewer to probe for additional insight and to dig deeper into the pros and cons of the simulations. The  
158 interviewers were trained qualitative researchers who also facilitated the simulations. However each cluster had it's own  
159 facilitators thus, the interviewers did not interview participants they had trained. This was done in order to decrease the  
160 power relation between interviewer and interviewee. The informants in the present study were included based on their  
161 experience with being either participants in simulations, facilitators of the simulations, members of the educational

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4 162 committee, or consultants responsible for the included departments. We included doctors, nurses, and other healthcare  
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6 163 professionals in order to embrace the voice of all professions. More nurses than doctors were included in order to reflect  
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8 164 the composition of the clinical teams from the simulations. We planned for 4-7 informants in each group. However, in  
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10 165 the focus group consisting of the consultants responsible for the clusters only 3 informants participated. Each focus group  
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12 166 had a strategic composition of informants in order to decrease the power differential among the informants according to  
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14 167 the methodological recommendations from Stalmeijer and colleagues [14]. All informants were recruited as volunteers.  
15  
16  
17 168 We applied a qualitative methodology that relates to the social constructionist and narrative understanding of storytelling  
18  
19 169 as being integral to the analysis of health care professionals' perspectives and personal experiences when dealing with  
20  
21 170 the pandemic [15]. All interviews were transcribed verbatim and reviewed by the investigators (both medical experts and  
22  
23 171 educated simulators). Subsequently, the interviews were analysed thematically by 3 qualitative researcher who created  
24  
25 172 common themes across the transcripts [13]. The generated main themes were reviewed and discussed among investigators  
26  
27 173 in order enhance trustworthiness. The themes are presented in the result section.  
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#### 30 174 *Patient and public involvement statement*

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34 175 It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination  
35  
36 176 plans of our research  
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#### 38 39 177 *Ethics approval statement*

40  
41 178 Participation in the focus group interviews was voluntary and participants' quotes were made anonymous. No ethical  
42  
43 179 approval or trial registration was required for this study according to Danish legislation. All participants provided  
44  
45 180 informed consent and gave permission to recording of the interviews.  
46  
47

## 48 49 181 **Results**

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51 182 In total 22 informants were included in the present study (12 healthcare professionals, 7 medical experts, and 3 consultants  
52  
53 183 responsible for the clusters). The informants perceived that the simulations resulted in positive experiences for the  
54  
55 184 healthcare professionals and experienced the organizational changes as positive (i.e. increase in interdisciplinary actions,  
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57 185 decrease of bureaucracy, and a stronger sense of community). The following sections elaborate on these findings.  
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#### 186 *Anxious concerns and demystification of the COVID-19*

187 The healthcare professionals in the interviews reported a feeling of uncertainty, partly due to being put in a stand-by  
188 position for emergency preparedness, and partly due to the severity of the disease combined with an overwhelming  
189 amount of information. This is exemplified by a physiotherapist who participated in the simulation:

190  
191 *"I feel like we have been caught in some kind of limbo or 'silence before the storm'..."* (Physiotherapist).

192  
193 Here, in situ simulation was perceived as crucial in preparing for the COVID-19 disease by demystifying the disease and  
194 providing hands-on experiences with the patient category, effectively improving a sense of self-efficacy [16].

195 Especially stress management was experienced as helpful in reducing potential stressors and increasing a sense of comfort  
196 in handling the COVID-19 patients, as also noted by the physiotherapist and a registered nurse:

197  
198 *"...we were on such uncertain ground in the beginning. I also think [the simulation training] gave me some sense of*  
199 *security."* (Physiotherapist)

200 *"Yes, in that sense it [COVID-19] was demystified."* (Registered nurse)

201 The medical experts that facilitated the simulations highlighted the use of in situ simulations in order to enhance  
202 organizational learning and individual learning. Organizational changes, such as an increase in multidisciplinary  
203 cooperation and a stronger sense of community, prepared the clusters to the COVID-19 pandemic. Based on the  
204 simulations several changes were made, e.g. how medical equipment was pre-packed in the COVID-19 clusters, how we  
205 organized the isolation rooms, the design of clinical teams as well as how to communicate in and out of quarantine areas.  
206 A medical expert pointed out such a specific change in organization that was based directly on experience from the  
207 simulation:

208 *"During the simulations, we learned that it is a good idea to start each shift with a 1min meeting in order to clarify roles*  
209 *if an acute situation in an isolation room should occur"* (Medical expert)

210 The medical experts also highlighted the need for individual learning of the healthcare professionals and perceived the  
211 simulation training as key in preparing oneself and the department for the COVID-19 pandemic:

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212 *"In our cluster the simulations had a really good effect in order to demystify the disease and decrease fear among the*  
213 *healthcare professionals. The professionals had a lot of uncertainty in regards to what the pandemic would bring.*  
214 *Furthermore, the simulations raised a lot of questions that we, as heads of the cluster could answer in the daily meetings"*  
215 (Medical expert).

### ***Importance of multidisciplinary team training***

217 Another theme was the importance of interdisciplinary simulation sessions. The sessions highlighted each healthcare  
218 professional's value and role when handling COVID-19 patients. This was especially noted by the physiotherapist in the  
219 quote below, who experienced a stronger sense of professional identity, as well as an increased sense of comfort in  
220 teamwork:

221 *"[...] there has been a great experience of interdisciplinarity and an awesome feeling that we will handle it [COVID-19]*  
222 *together..." (Physiotherapist).*

223 In continuation, teamwork was enhanced during the simulations, according to a managing consultant:

224 *"The fact that experienced and un-experienced healthcare professionals were teamed up in the simulations really help in*  
225 *order to create insight into the value of each team-member. It also helped the new professionals to be integrated in*  
226 *departments, where they never had worked before."* (Consultant responsible for department)

227 In continuation, consultants responsible for departments highlighted how the simulations helped ensuring a professional  
228 and calm working environment at the clusters. This is exemplified in the following quote by a consultant responsible of  
229 department who stressed how the simulations improved the working environment:

230 *"When we started the in situ simulation the atmosphere in the department became calmer. The treatment of COVID-19*  
231 *patients is actually fairly simple, and the simulations helped the healthcare professionals to realize that. The simulations*  
232 *help them practice the COVID-19 treatment and do some mistakes without jeopardizing patient-safety. It surely helps in*  
233 *order to calm the healthcare professionals and establish a very well-functioning department"* (Consultant responsible for  
234 department)

235 The positive gains of in situ simulation were also emphasized in the following quote by another head of department that  
236 didn't received any COVID-19 patients, but still valued the simulations.



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4 237 *“This is surely something that we are going to use in the future (...) It has provided us with so much knowledge and*  
5  
6 238 *teamwork. The content can be anything. It helped all of us because it is interdisciplinary and include experienced and*  
7  
8 239 *unexperienced healthcare professionals.”* (Consultant responsible for department )  
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11 240 ***Design and facilitation of the simulations***  
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14 241 The healthcare professionals highlighted the simulation facilitator as a key factor by being engaged in the scenario,  
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16 242 ensuring fidelity, and securing a safety net by debriefing the simulations. The medical experts that facilitated the  
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18 243 simulations also highlighted the collaboration with in situ simulation experts in order to establish psychological safety  
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20 244 [17] and an optimal learning environment.  
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23 245 *“It makes it a lot easier for me as a facilitator, when there is an experienced in situ simulation instructor conducting the*  
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26 246 *scenarios together with me. In this way, I know that the educational elements are being taken care of in a professional*  
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29 247 *manner”*(Medical expert).  
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33 248 The presence of a medical expert and an educated simulation facilitator in each simulation secured the consistency among  
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36 249 the facilitators. This is exemplified by one of the medical experts in the following quote:  
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40 250 *“The fact that we were two medical experts and one simulation expert to conduct all the in situ simulations in our*  
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42 251 *department helped ensure consistency in the scenarios. A lot of the questions from the participants were the same and*  
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45 252 *because we had daily meetings with the heads of the department, we knew what to answer. During the two weeks we*  
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48 253 *spend all our working time conducting these simulations, which made us confident in reaching the learning goals and*  
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51 254 *establishing a smooth facilitation of the simulations.”*(Medical expert)  
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54 255 The informants in the present study called for the establishment of a simulation task force across the hospital in order to  
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56 256 share knowledge between departments and develop expertise in designing, implementing, and facilitating the simulations.  
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258 *“I would have benefited by ending each day with an afternoon meeting with all the simulation facilitators from the*  
259 *COVID-clusters across the hospital. The pandemic caused a lot of questions in addition to facilitating the simulations.*  
260 *For example, what happens if a COVID-patient with comorbidity needs to be transferred to another department? If all*  
261 *simulation facilitators made a small daily report and shared this with the other facilitators, we could ensure knowledge*  
262 *sharing across the hospital.”* (Medical expert)

263 Due to a lack of PPE, some simulations were conducted without the correct equipment in the initial phase of the simulation  
264 program. During the simulation programme the heads of departments realized the value of using the correct PPE, as  
265 explained in the quote below.

266 *“The outcome of simulation went from good to better, when we started to use the correct PPE, as this required that the*  
267 *healthcare team worked fully together.”* (Consultant responsible for department)

## 268 Discussion

269 The interviews in the present study suggest that in situ simulation enhanced teamwork, helped demystify the COVID-19  
270 disease, and provided the healthcare professionals with competences within correct use of PPE and acute treatment of  
271 COVID-19 patients.

272 Healthcare professionals previously exhibit concern about family transmission of infectious diseases, thus it seems  
273 reasonable if the COVID-19 pandemic had a negative impact on the healthcare professionals' perceived quality of work  
274 [18]. Based on the findings in the present study, it seems that in situ simulation can be a useful tool, when facing such a  
275 decrease in the perceived quality of work.

276 In medical education, Weller and colleagues (2014) investigated effective healthcare teams and found an unacceptable  
277 rate of errors due to lack of teamwork between healthcare professionals [19]. Consequently, they put forward seven  
278 interventions to overcome barriers to teamwork and team communication, including the use of simulation. Our study  
279 indicates that the informants experienced anxiety regarding the rapid spread of the COVID-19 virus. Furthermore,  
280 informants stated that in situ simulation made them feel more comfortable facing the task at hand i.e. by demystifying the  
281 treatment of the COVID-19 disease and enhancing teamwork, all in a safe educational environment.

282 The uncertainty due to COVID-19 is likely to add complexity to the clinical work. Thus, training of healthcare  
283 professionals seems key in order to reduce stress and form coping strategies. Our findings align well with the stress model

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4 285 by Palmer and colleagues from 2003, as their model highlight professionals' training in order to face an increased  
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6 286 complexity of work and decrease stress [20].  
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10 288 The hospital infrastructure seems influential when supporting the fundamental aim of wellbeing for all patients and  
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12 289 delivering high standards of care [21]. This is supported by our findings, suggesting that learning occurred on an  
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14 290 organization level as well as the individual level, as stated above. Systematic sharing of the insights, gained from the  
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16 291 simulation, lead to changes in approaching COVID-19 patients in the isolation rooms, which reflects the organizational  
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18 292 impact of the simulations. Similar findings are emphasized by Brydges and colleagues (2020), who advocate for the use  
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20 293 of simulation when preparing for and responding to the early stages of the COVID-19 pandemic [10].

21 294 Simulation seems to have a potential in managing the global COVID-19 pandemic by rapidly facilitating hospital  
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23 295 preparation and education of large numbers of healthcare professionals [7,22,23]. Wong and colleagues (2020) advocated  
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25 296 for the use of in situ simulation in the beginning of the pandemic in order to test the preparedness of isolation rooms,  
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27 297 however, they do not specifically highlight using a coordinated and centralized simulation team to ensure the development  
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29 298 of a robust curriculum development, as Dubé et al. (2020) explicitly emphasize [6,24]. While the present study supports  
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31 299 the use of simulation in a pandemic, the findings also reveal the need of coordinated planning across the hospital in order  
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33 300 to secure that the learning goals of the simulation is reached. The coordination of simulation is highlighted by Brazil and  
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35 301 colleagues (2020), who conducted an intervention similar to the one in the present study, orchestrated by a Simulation  
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37 302 Service formally established across the hospital [25]. The setting in the present study would have benefitted from the  
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39 303 establishment of a simulation task force including educated simulating and medical experts, in order to ensure that the  
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41 304 pedagogical, didactical, and medical elements in the simulations where at the highest possible level. The main themes  
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43 305 derived from the focus group interviews describe perception of in situ simulations from a variety of health care workers  
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45 306 in an early stage of the pandemic. This timing seems important in understanding the need for simulation based educational  
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47 307 activities prior to a health care crisis. However, due to the rapid development of the COVID-19 pandemic it was not  
48  
49 308 possible to plan and organize the interviews in detail. Relatively few informants (n=3 in one group and n=4 in another)  
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51 309 reduce the generalizability of the results in the present study. Furthermore, the circumstances did not allow us to conduct  
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53 310 a study with objective assessment of skills learned e.g. an examination or practical test of what was learned. Nonetheless,  
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55 311 the in situ simulations are suggested to decrease stress and improve teamwork among the healthcare professionals.  
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57 312 Similar, the simulations may have improved the clinical skills of the participating staff. It has not been possible to conduct  
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4 313 a follow-up data collection in order to establish if demystification of the disease and decrease in stress still is present or  
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6 314 new educational activities is needed.  
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## 8 315 **Conclusion**

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11 318 In situ simulation may be useful to enhance learning on an organization level as well as the individual level during a  
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13 319 pandemic. This educational activity could serve an important role in facilitating hospital preparation and education of  
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15 320 large numbers of healthcare professionals during a pandemic. The establishment of a simulation task force is, however,  
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17 321 suggested as in situ simulation across a hospital requires coordination and rapid enrolment in health care crises.  
18

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20 323  
21  
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23  
24 325 simulations; the involved steering committees in the COVID-19 clusters for supporting the in situ simulations; Lone Dich  
25  
26 326 and Thea Isaksen for transcription of data.  
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31  
32 328 JJ and RDJ contributed with the idea of the study, collecting of data and the writing of the manuscript. BL, NT and LE  
33 329 contributed with collecting of data. GVE contributed with the idea of the study.  
34

35  
36 330 All authors read and approved the manuscript before submission.  
37

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40  
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42

## 43 333 **Competing interests:**

44  
45 334 There are no competing interests for any author  
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47

## 48 335 **Data availability statement**

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50 336 No additional data are available.  
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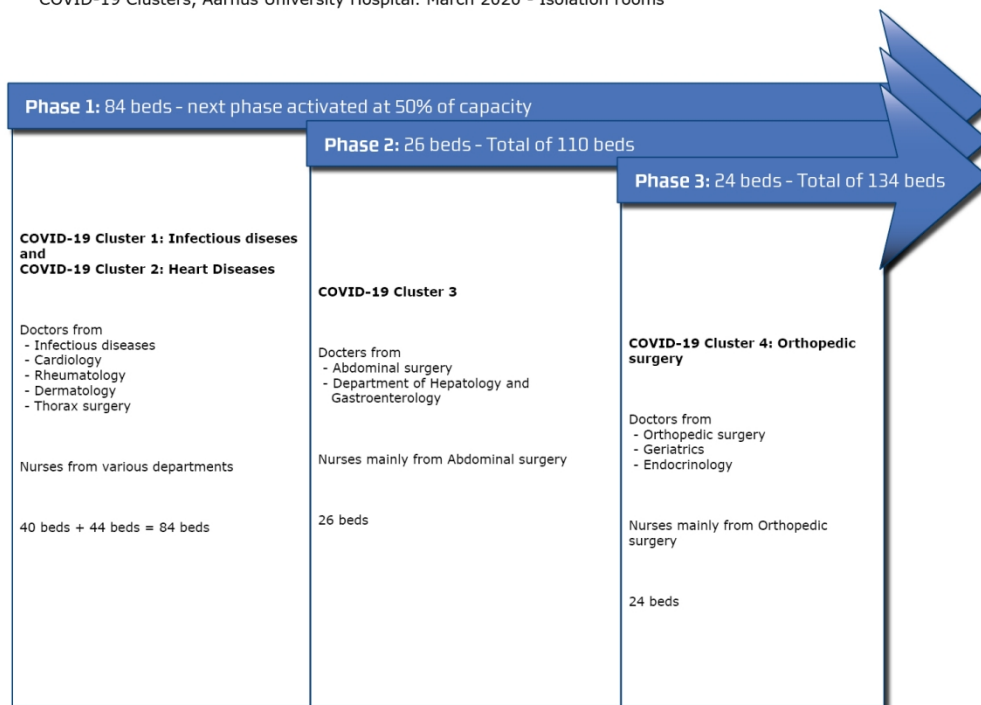
**Figures:**

Figure 1: COVID-19 Clusters, Aarhus University Hospital. March 2020 – isolationrooms

Figure 2: Description of simulated cases

Figure 1

COVID-19 Clusters, Aarhus University Hospital. March 2020 - Isolation rooms



529x529mm (72 x 72 DPI)

Figure 2

Description of simulated cases

Cases	Background information	Case description	Clinical outcome	Learning objectives
<b>Patient 1</b>	75 years Known well-regulated arterial hypertension High level of function	Respiratory insufficient Covid-19 infected patient. Dependence on oxygen supplement and upright positioning of bed rail. Single-organ failure	Patient stabilization on COVID-19 medical ward (non-ICU)	<ol style="list-style-type: none"> <li>1. Terms of ABCDE approach</li> <li>2. appropriate use of PPE and medical equipment</li> <li>3. transportation of equipment to/from isolated patients</li> </ol>
<b>Patient 2</b>	64 years Known dysregulated diabetes II and adipositas. High level of function	Severe respiratory insufficient Covid-19 patient. ABCD-unstable. Septic shock/central pulmonary embolism and multi-organ failure  (occasionally extended with adjacent cardiac arrest)	Medical emergency call/acute transfer to ICU and mechanic ventilation (Advanced CPR if cardiac arrest)	<ol style="list-style-type: none"> <li>1. Advanced ABCDE-approach to critically ill patient</li> <li>2. Acute communication strategy and early call for assistance</li> <li>3. Use of PPE when performing aerosol generating interventions</li> <li>4. Reflection on indication for intensive care and resuscitation</li> </ol>

529x529mm (72 x 72 DPI)



## Interview topic guide

Timeframe	Topic	Examples of questions
<b>0-15min</b>	Being a health care professional during a pandemic	<p>Please describe how it is to be a healthcare professional during COVID-19</p> <p>How has COVID-19 affected your work life?</p>
<b>15-30min</b>	In situ simulation as an educational tool when facing a pandemic	<p>Please describe your experience of participating in the simulation?</p> <p>How has the simulations influenced your daily work?</p>
<b>30min-45min</b>	Content of the specific simulated scenarios	<p>What do you think of the contents of the simulation scenarios?</p> <p>If you were to adjust something in the simulations, please describe such adjustments.</p> <p>Also, would you like to add something to the simulations, if you were in charge?</p> <p>To what extent has the content in the simulation been relevant to your daily work in the department and the treatment of COVID-19 patients?</p>
<b>45min-60min</b>	Outcome of the simulation	<p>What is the outcome of the simulations?</p> <p>What did you learn from the simulations?</p>
<b>60min-75min</b>		

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<p>The educational impact of simulation during a pandemic</p>	<p>If you were in charge of the educational initiatives during a pandemic, what activities would you include?</p> <p>How would you prioritize these activities?</p> <p>Would you recommend your colleagues to engage in simulation activities during a pandemic?</p>
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## Standards for Reporting Qualitative Research (SRQR)\*

<http://www.equator-network.org/reporting-guidelines/srqr/>

Page/line no(s).

### Title and abstract

<p><b>Title</b> - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended</p>	L3
<p><b>Abstract</b> - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions</p>	L55

### Introduction

<p><b>Problem formulation</b> - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement</p>	L86-99
<p><b>Purpose or research question</b> - Purpose of the study and specific objectives or questions</p>	L98

### Methods

<p><b>Qualitative approach and research paradigm</b> - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**</p>	L168
<p><b>Researcher characteristics and reflexivity</b> - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability</p>	L154/170
<p><b>Context</b> - Setting/site and salient contextual factors; rationale**</p>	L151
<p><b>Sampling strategy</b> - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**</p>	L154
<p><b>Ethical issues pertaining to human subjects</b> - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues</p>	L178
<p><b>Data collection methods</b> - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**</p>	L165

1 2 3 4 5	<b>Data collection instruments and technologies</b> - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	L151
6 7 8	<b>Units of study</b> - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	L161
9 10 11 12	<b>Data processing</b> - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	L170
13 14 15 16	<b>Data analysis</b> - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	L168-173
17 18 19 20	<b>Techniques to enhance trustworthiness</b> - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	L173

### Results/findings

23 24 25 26	<b>Synthesis and interpretation</b> - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	L182-185
27 28 29	<b>Links to empirical data</b> - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	L191-267

### Discussion

32 33 34 35 36 37 38	<b>Integration with prior work, implications, transferability, and contribution(s) to the field</b> - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	L270-302
39	<b>Limitations</b> - Trustworthiness and limitations of findings	L302-314

### Other

42 43 44	<b>Conflicts of interest</b> - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	L334
45 46	<b>Funding</b> - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	L332

\*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

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\*\*The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

**Reference:**

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014  
DOI: [10.1097/ACM.0000000000000388](https://doi.org/10.1097/ACM.0000000000000388)

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