

Scenario Design for Healthcare Collaboration Training under Suboptimal Conditions

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Abstract. Health care today usually consists of various services covering various parts of the total health care of a region or country. These services are required to coordinate and collaborate, often using procedures and IT collaboration tools that may not be designed for interoperating across the evolving wider landscape of health care services. We posit that it is necessary to train personnel in collaboration skills using whatever infrastructure is in place. To this end, we present design principles for simulation-based collaboration training scenarios that emphasizes the inclusion of suboptimal infrastructure elements. We applied the principles in a co-creational workshop with healthcare stakeholders from a hospital and surrounding municipalities in Norway where we discussed cases where collaboration training is perceived as critical. We elicited five training vignettes concerning the general case of detecting, and following up on, clinical deterioration in a patient at home or in a nursing home. We found that the design principles spurred highly relevant discussions among participants and that novel ideas for collaboration training were brought forth on the basis of these principles. We conclude that there is a potential in using these principles for eliciting training vignettes that address the actual situation more accurately.

Keywords: Scenario Design · Healthcare Collaboration · Procedures · IT Services · Simulation-Based Training · Stakeholder Journey Analysis

1 Motivation

A patient's total health care is commonly provided by a number of different services across various parts of the public and private sectors. A seamless journey through these services is far from obvious. Collaboration and communication issues due to different fields of expertise, different work cultures, non-interoperable processes [13,14,4] and suboptimal, non-interoperable collaboration IT services [21,2,20] regularly lead to frustration for all involved, and may even cause health- and life-threatening situations.

It is common when collaboration problems arise in the public sector to launch large IT initiatives to develop common platforms for digitalized collaboration; several of which never get deployed, e.g., [32], or somehow get out of control in other ways, e.g., [33]. A uniform electronic patient record (EPR) system is often a central component of such systems. While we await the coming of future, successful collaborative IT platforms, healthcare must function in the present. We therefore argue that it is necessary to train personnel in the use of of suboptimal IT services.

A number of procedural tools, such as checklists and protocols, have been developed for guiding and standardizing the work of health care professionals. Successful collaboration often hinges on the joint use and understanding of these tools. There are also procedural tools for collaboration itself which can be used over various media, including the collaborative IT platforms mentioned above. In the particular case we are studying, the procedural tools are not uniformly in place and not jointly used and understood [34]. To address this situation, a model was introduced in the National health care sector for building procedural skills systematically and for training collaboration over those skills within and across health care services [3]. However, it is evident that even disseminating such procedural tools and building skills at the desired level across services will take time, and, again, health care collaboration must happen in the mean time.

We therefore present principles for designing simulation-based training for health care collaboration, in the face of (1) existing suboptimal IT services and (2) suboptimal levels and proliferation of procedural skills. We apply these design principles in scenario design in a co-creation workshop.

Beyond architectural guidelines for scenario design, e.g., [29], there is little information about how simulation-based training is actually developed in systematic reviews of the effects of simulation-based training [30,10]. However, it has been pointed out that it is important to develop training programs that are based on, and aligned with, the current needs of trainees, and the Delphi process has been suggested for selecting and prioritising what training to be included in a curriculum [22]. Others suggest that participatory approaches and co-creation is particularly well suited for design in health care, since the sharing of knowledge by all parties involved is regarded as a prerequisite for a good result [1,26].

The term co-creation is defined ambiguously in the existing literature on design and innovation [37,5,12]. We follow the definition that describes co-creation as an activity where actors jointly produce a mutually valued outcome, based on assessments of the risks and benefits of proposed courses of action and decisions based on dialogue, access to information and transparency [7].

Existing frameworks for co-creation stress that participation must happen at the same time and in the same context [1]. Thus, the most common activity for co-creation is a workshop. Workshops provide opportunities for using different methods to create and share ideas and foster joint solutions. Some possible methods that can be employed include role-playing, mixed-group teamwork, prototyping, creating personas, and creating stakeholder journeys. Co-creation can be a relevant way to create high-quality health care services since actors in health-

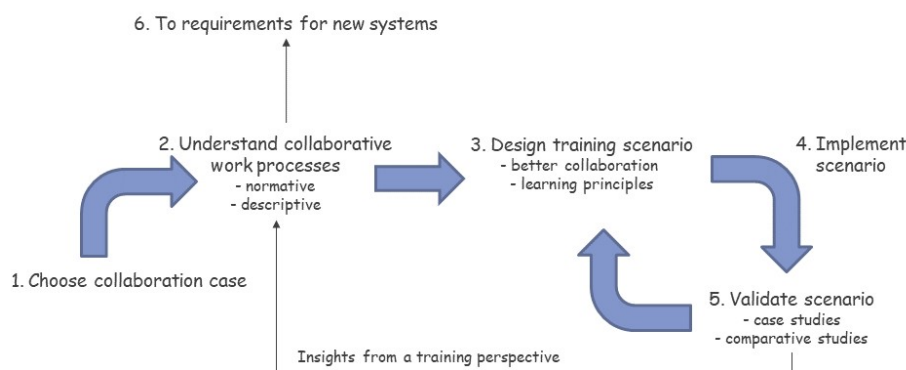


Fig. 1. Scenario design stages

care must have a heightened understanding of each other’s roles, motivations, knowledge and goals to collaborate and make decisions, but it is important that existing workshop methods be adapted to the specific settings under study [1].

2 Design Challenge

A scenario is a “description of the hypothetical or real area, environment, means, objectives, and events during a specified time frame related to events of interest” [29]. Scenario design for simulation-based training is non-trivial in the outset [28,29] and even more so for higher-level skills such as decision-making and collaboration; see pointers in [17]. To get to grips with this in our setting, we follow the six high-level scenario design steps in Fig. 1. Together with healthcare stakeholders, we choose a collaboration case that is perceived to be of particular interest for improvement. For that case, we must then understand what should happen versus what actually happens. From this understanding, we design training scenarios aimed at training health personnel to collaborate better within and across healthcare services, all according to learning principles such as deliberate practice and adaptive thinking [9,27]. Scenarios are then implemented in mixed reality and validated using stakeholder groups. Insights from the validations are also fed back to work process elicitation with the intent to provide input to requirements engineering for new collaborative systems.

Several collaboration cases will be studied, and therefore, Fig. 1 shows one increment or iteration of a concerted effort toward simulation-based training [25,16] for collaboration within and between healthcare services.

The rigorous way to design scenarios would be to (1) determine the normative work process, (2) determine the actual work process, and (3) work out the difference and design training with the aim to achieve the normative situation. The first two of those three steps are extensive fields of research conducted else-

where by healthcare researchers. Our program of work is dedicated to describing work processes in only *sufficient* detail to design efficient training scenarios. To that end, we will in the following arrive at four scenario design principles.

Fig. 2 shows a sketch of a work process for the case *clinical deterioration – home care service*. This case was elicited together with a healthcare consultant who is involved in the education of procedural skills and in training collaboration using those skills. The notation is a mix of the *Business Process Model and Notation* (BPMN) [23] and a stakeholder journey analysis notation [15,18]. In our example, each actor has a separate *swimlane*, and orange circles denote technology touchpoints. Starting from the top, a patient experiences a clinical deterioration, whereupon a home healthcare service worker should detect the deterioration and initiate structured observations using the *Airway, Breathing, Circulation, Disability, Exposure* (ABCDE) approach [19]. Based on these observations, the worker should calculate the *National Early Warning Score* (NEWS) [24] and use that score and other observations to assess and decide further action. In Fig. 2, the further action involves communication with a general practitioner, emergency room or emergency response unit. During this communication information is to be exchanged using the *Identify, Situation, Background, Assessment and Recommendation* (ISBAR) format [31] and entered into the electronic

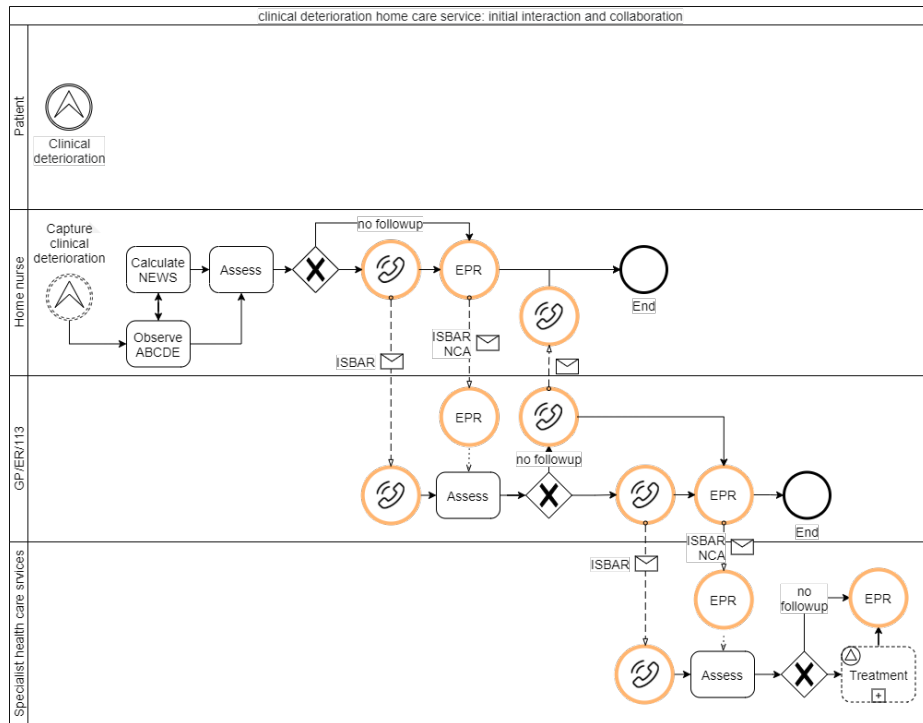


Fig. 2. Work process for a clinical deterioration collaboration case

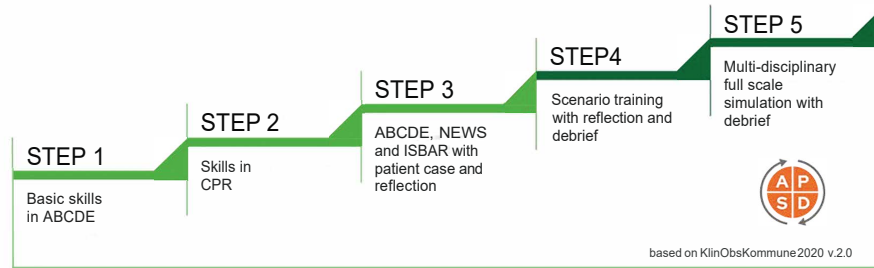


Fig. 3. Steps of the KlinObsKommune framework

patient record (EPR) system using *Nursing and Care* (NCA) messages [6]. Further collaboration with specialist healthcare services is illustrated in the bottom swimlane.

Recent research has uncovered that personnel with municipal healthcare services might not have the required skills regarding emergencies and general observation abilities [35]. Likewise, specialist staff at hospitals do not have sufficient knowledge about the skills of municipal healthcare personnel. The KlinObsKommune model [3] addresses the education of municipal and specialist healthcare personnel in a five-step model, shown in Fig. 3. In Steps 1 and 2, personnel train their skills in systematic patient observation (ABCDE) and cardiopulmonary resuscitation (CPR). In Step 3, the integration of ABCDE with NEWS for further clinical observation and decision-making is trained, together with the communication format ISBAR. Step 4 concerns training the ensuing collaboration within the municipal healthcare system to handle clinical patient deterioration, and Step 5 concerns training the ensuing collaboration between municipal and specialist healthcare systems. Steps 4 and 5 are the focus of our work.

A major challenge when designing training scenarios for higher-level skills such as collaboration, judgement and decision-making is that the number of conceivable situations that ostensibly need training is enormous. This contrasts with training procedural skills such as operating a medical instrument, assembling equipment, or performing ABCDE, NEWS and ISBAR correctly. While the work process in Fig. 2 appear structured and systematic, actual work processes are fraught with difficulties in practice. Various EPR systems may not always interoperate well, and even if the EPR systems worked well together, other challenges based on other variables (e.g., unable to contact the person with whom to collaborate, not knowing the patient’s previous status, inconsistent medicine lists, etc.) entail a combinatorics explosion of different sequences of events. Structured training often cannot be designed to cater for each specific contingency. This situation is exasperated for simulation-based training that relies on synthetic (virtual reality) elements that require software development because simulation systems development is time-consuming and traditionally does not cater well for the flexibility required in training [8,36].

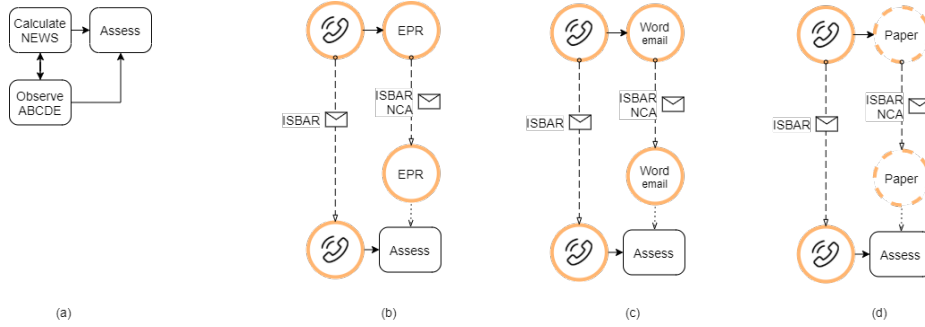


Fig. 4. Patterns of action and interaction that can be implemented as reusable modular vignettes. Each actor has a separate *swimlane*, and orange circles denote technology touchpoints.

To create simulation-based training that can be flexible and useful in the multitude of real-world situations that health-care workers will find themselves in, we start by positing the following design principles (DPs). Training scenarios should be

- composed of generic, reusable vignettes (DP1) and
- skills centered (DP2).

Vignettes can be described as small, reusable, temporarily ordered set of events that are ideally self-contained so that they can be reused in multiple scenarios [29]. When understanding the work processes in Stage 2 of our scenario design model (see Fig. 1), we have an explicit focus on identifying *action* and *interaction patterns* that form the basis for designing training vignettes. Further, these patterns should pertain to specific skills, so that vignettes can be designed with metrics to measure skill acquisition and improvement [17]. Fig. 4 shows examples of an action pattern (a) and an interaction pattern (b) identified in Fig. 2. Working at identifying such patterns that target specific skills, rather than mapping out entire work processes, delineates our work against the more general task of defining normative and descriptive work processes as such.

Second, to ensure that training is performed on platforms that actually are in use, we state the principle that vignettes should

- include events that require the use of state-of-practice IT services (DP3).

This may seem trivial, but it is quite common that simulation-based training presents systems as they *are intended to be*, instead of *as they actually are*. Thus, vignettes must be designed so that practitioners can become better at using whatever suboptimal systems that are in place. For instance, practitioners might use *improvised* solutions such as using Microsoft Word or paper notes when cross-platform EPR systems are not functioning [11], as outlined in Fig. 4 (c) and (d).

Third, to ensure that training reflects actual levels and proliferation of procedural skills, we state the principle that vignettes should

- include events that require the use of state-of-practice procedures (DP4).

The KlinObsKommune model in Fig. 3 may lead one to think that everything has to be in place at the lower steps before one can start training on higher steps. Whether such a view is intended or, perhaps rather an artifact of the model graphics, we interpret the model as stating the structure of competence, rather than the order in which skills should be trained.

In sum, design principles DP3 and DP4 insist that trainees must collaborate in vignettes even under suboptimal circumstances caused by the present state of affairs of IT platforms, tools and procedural skills.

With the design principles spelled out, we can refine the high-level view of Fig. 1. To that effect, Fig. 5 shows the refined view, where Stage 2 is narrowed to understand collaborative work processes sufficiently for designing vignettes based on critical collaboration patterns. Further, the reusable vignettes are stored in a repository in various formats. The basic textual description of a vignette can be implemented in various materials, from simple scripts for discussion exercises and role playing to advanced software intended for mixed reality games. Implementing scenarios then involves using vignettes to compose larger scenarios.

3 Workshop for eliciting vignettes

In late autumn 2021, we conducted a co-creative workshop with the intent to elicit vignettes according to principles DP1–DP4 above. As we worked on the

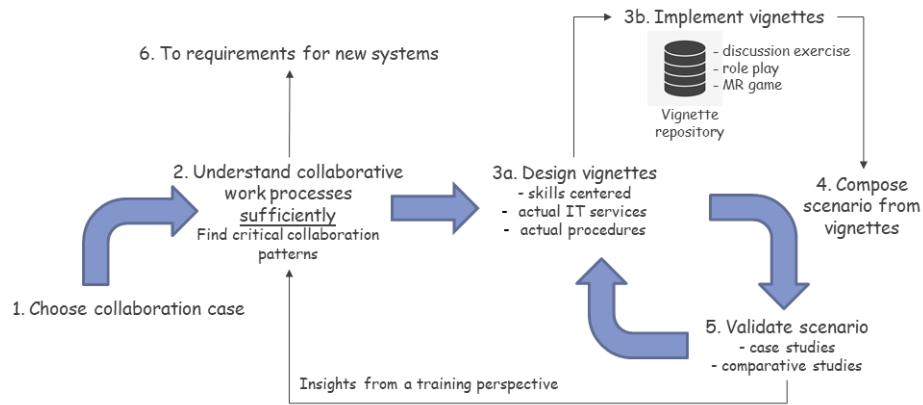


Fig. 5. Scenario design stages according to design principles

design principles and on planning the workshop, we were concerned that practitioners within each healthcare service did not necessarily have an overview of the overall collaborative process, and that there was large variation in which procedures and formats were familiar to everyone. Therefore, the workshop participants consisted of hand-picked practitioners with overall knowledge of the work processes and methods, rather than representatives for each actor in the work process diagrams. Some participants also had experience from training practitioners in KlinObsKommune. The participants other than the researchers were general practitioners, nurses, and advisors in the municipalities' development centers for nursing homes and home health care. In total, nine participants and five researchers participated.

At the beginning of the workshop, the participants were familiarized with the notion of simulation-based training for healthcare collaboration and our ideas embedded in the four design principles. They received a walkthrough of an extended version of the stakeholder journey chart for the case discussed in Section 2 (see Fig. 2). We extended this to the general case of detecting, and following up on, clinical deterioration in a patient at home or in a nursing home. During this walkthrough, researchers pointed out repeating patterns of action and interaction. The researchers also emphasized that the chart was to be considered an example, since there are many variations of this case in practice.

The participants were then divided into three groups: one group of six (four participants and two researchers), one of five (three participants and two researchers), and one of three (two participants and one researcher). Each group was tasked with finding concrete instances of that case. For example, participants might visualize a patient with a specific condition and use this specific situation to discuss and identify the most crucial action and interaction patterns that need improvement.

The discussions were not recorded to avoid collecting personal data, but researchers took notes of issues that were raised underway. As discussions progressed, the groups were asked to suggest concrete training vignettes satisfying the design principles. This was facilitated by an online template prompting for relevant aspects of such vignettes. The template was prepared as an online spreadsheet that could be edited jointly. This was based on previous experience of performing co-creation workshops during Covid-19 lockdown based on video conferencing tools. The template was inspired by the customer journey method, with focus on how the various stakeholders collaborate around a particular patient case. In the current workshop, we planned for a physical workshop, with a virtual workshop as a possible backup-plan. The template was shared on a screen, and participants also brought their own laptops. The template prompted participants to enter the following information:

- Roles involved
- Situation
- Skills to be trained
- Relevant prerequisite skills
- Events and contextual elements trainees are faced with

- Tasks to perform
- Metrics to measure task performance
- How to measure metrics
- Hints for trainees (*optional*)
- Physical items present
- Other (*optional*)

The template was designed so that the participants could contribute by writing directly into the template, but in practice, the researchers wrote most of the entries in collaboration with the other participants. The introduction and walkthrough took 15 minutes. Several of the workshop participants had also participated in a full-day seminar the day before on the same topics. The groups were given one hour and 45 minutes to discuss and discover vignettes. After this, all the groups assembled again for a 30-minute summary where each group presented their vignettes.

4 The vignettes

A total of five vignettes were elicited using the above-mentioned case of detecting, and following up on, clinical deterioration in a patient at home or in a nursing home. The vignette descriptions below constitute the raw structured output from the workshop cosmetically edited for presentation. The purpose of presenting them in this discussion is to illustrate the first stages of the scenario design model (Fig. 5) and any effects of the design principles.

4.1 Vignette 1

Vignette 1 is about building trust and confidence between health services in a municipality on the one hand and the services run at the county or national level on the other hand. This was illustrated by a case where a municipality health care practitioner (e.g., a home care nurse or auxiliary nurse) visits the home of a patient with deteriorating health. After observing this, the health care practitioner is supposed to contact a doctor.

Roles involved: Two roles in the municipal health care system: 1) a municipal health care worker and 2) a municipal doctor (a general practitioner, an emergency room doctor, a doctor at the municipal emergency day care unit).

Situation: Clinical deterioration, not acute.

Skills to be trained: To structure communication in ISBAR and find common terminology during the initial phone call and to find empowerment to communicate lack of understanding to the other party. To structure information in ISBAR and use clear language When entering information in the EPR. In general, knowing when to place phone calls and when to send NCA messages.

Relevant prerequisite skills: Knowledge of ABCDE and ISBAR, but not necessarily NEWS.

Events and contextual elements trainees are faced with: Trainees experience that they do not share a common terminology with which to communicate with one another.

Tasks to perform: To find a common frame of reference for communication.

Metrics to measure task performance: The degree to which the severity of the situation is communicated successfully. The degree of mutual trust.

How to measure metrics: Self-assessment, mutual reflection, pre- and post-tests to measure changes in trust.

Physical items present: EPR system (either on PC, phone, or tablet)

Other. Use of VR for distributed training could support outcome.

4.2 Vignette 2

Vignette 2 builds upon the previous situation. The vignette's purpose is to ensure that the municipality health care practitioner has good decision-making skills and takes appropriate action when the municipal doctor does not respond.

Roles involved: Two roles in the municipal health care system: 1) A municipal health care worker and 2) a person other than a doctor.

Situation: Clinical deterioration, not acute.

Skills to be trained: Adaptive thinking.

Relevant prerequisite skills: Trainees are aware of the various channels for contact in the municipal health care system.

Events and contextual elements trainees are faced with: The doctor does not respond.

Tasks to perform: 1) Decide if further clinical assessment is called for. 2) Re-initiate contact with doctor. 3) Call other health care personnel that are available. 4) Use NEWS-determined response. 5) Retain responsibility or transfer that responsibility explicitly to someone else when necessary. 6) Systematically follow up the situation. 7) Report to EPR.

Metrics to measure task performance: 1) How well did the health care worker follow up on the patient (retaining responsibility)? Was the responsibility transferred to different personnel? 2) Completeness of EPR routine. 3) Across all trainees and training sessions: the number of patients who receive documented follow-ups or clarification.

How to measure metrics: (1) and (2) could possibly be assessed automatically in a decision-tree-based game, (3) is still to be decided.

Physical items present: EPR system (either on PC, phone, or tablet)

Other. Use VR for distributed training.

4.3 Vignette 3

In Vignette 3, more context is given to the deterioration. The patient's medication list has not been updated after the patient has been dismissed from the hospital. The goal for the trainees is to understand each other's daily routines and systems, and how to spot an out-of-date medical list.

Roles involved: Two roles: 1) municipal health care personnel, including doctors on the one hand and 2) doctors in specialist roles on the other hand.

Situation: Clinical deterioration, not acute, with suspicion of the patients medication list not being up to date.

Skills to be trained: Structured communication with specialist doctor.

Relevant prerequisite skills: ABCDE

Events and contextual elements trainees are faced with: Clinical deterioration (breathing difficulty) triggered by inconsistent medication list after dismissal from the hospital.

Tasks to perform: 1) detect that the deterioration is caused by using the wrong medication. 2a) If available, locate the medication list; notice the list is not up-to-date and contact the hospital. 2b) If the list is not available, communicate suspicion via NCA message according to how acute the situation is. 3) Contact emergency room during vacations. 4) Report in EPR.

Metrics to measure task performance: 1) the degree of taking action. 2) Time until the medication list is updated. 3) Across trainees and training: the number of patient casualties caused by wrong medication.

How to measure metrics: (1) and (2) could possibly be assessed automatically in a decision-tree-based game. (3) is still to be decided.

Physical items present: EPR system (either on PC, phone, or tablet)

Other: Use VR for distributed training.

4.4 Vignette 4

The purpose of Vignette 4 is to improve skills among municipality health care workers without a nursing certificate in potentially acute situations and to give them confidence to communicate directly to the emergency room on their own, especially in situations where the responsible nurse might be physically distant or busy with other urgent tasks. This vignette starts with a patient at home with a potentially life-threatening deterioration. Sepsis was chosen as a case because it is a common condition that might be difficult to detect. As for Vignette 1, this vignette will require the trainees to decide when to contact the emergency room and how to communicate essential information efficiently.

Roles involved: Two roles: 1) Municipality home healthcare workers and 2) nurses who take calls in the emergency room. Only the first role is under training.

Situation: Clinical deterioration, potentially acute. Specifically, the home healthcare worker visits a female patient in her eighties at home, who has symptoms of a urinary tract infection and seems disoriented. The documented patient status states that the patient is lucid, but suffers from heart disease. The municipality health care workers have not seen to the patient lately.

Skills to be trained: 1) Build empowerment to request necessary information and to contribute to information quality in the user status. 2) Raise awareness and reflect on what information home healthcare workers, versus the emergency room nurses, have access to.

Relevant prerequisite skills: Trainees know Level 1 of KlinObsKommune (i.e., ABCDE), but do not necessarily have much practice in it.

Events and contextual elements trainees are faced with: 1) The patient emits a strong odour, probably from the urinary tract. 2) The trainee may not have all necessary medical equipment for ABCDE observations. 3) It might not be possible to send messages between systems, because these systems do not communicate.

Tasks to perform: 1) perform some clinical observations The possible observations are: check that airways are free, count respiration, observe heart rate (not possible), observe mental state (patient is disoriented), observe skin and lip colour (does not have blue lips). 2) Call the emergency room and communicate in ISBAR the results of ABCDE observations. During the phone call, the home healthcare worker is guided by the emergency room nurse to communicate on ISBAR and to perform the ABCDE observations correctly. 3) Obtain the medication list and information about relevant diagnoses.

Metrics to measure task performance: 1) The degree to which the gravity of the situation is communicated successfully. 2) The degree of mutual trust.

How to measure metrics: Self-assessment, mutual reflection, debriefing with facilitator. Check whether they perceive a tentative sepsis situation when guided. Trainee's assessment of the seriousness of the situation; in particular, whether they perceive that this is a serious situation with a potentially seriously ill patient, in which case they should call an ambulance without delay.

Hints for trainees: Pocket card with guidance on ISBAR, ABCDE and NEWS.

Physical items present: Access to a PC and a mobile phone with a clock that displays seconds. Access to user status in the mobile care solution, with the following information: Name and personal information, that she has a heart condition and is lucid. There are also some checklists in the mobile solution.

Other: Possible extension to this situation for calling an ambulance and communicating with the specialist health care.

4.5 Vignette 5

Vignette 5 addresses the emergency room aspect of the situation described in Vignette 4. The purpose of this vignette is for emergency room nurses to be trained on how to guide home health care workers in communication on ISBAR and on how to perform correct observations according to ABCDE.

Roles involved: Two roles: 1) Emergency room nurses and possibly emergency room doctors, 2) municipality home health care workers. Only the first role is under training.

Situation: Clinical deterioration, potentially acute. The emergency room nurse receives a call from a municipal home healthcare worker with a female patient in her eighties who has symptoms of a urinary tract infection and seems disoriented.

- Skills to be trained:** To guide a home healthcare worker during a phone call to communicate using ISBAR and to do correct ABCDE observations.
- Relevant prerequisite skills:** Trainees should know Level 1-3 of KlinObsKom-mune; i.e., they are familiar with ABCDE, NEWS and ISBAR.
- Events and contextual elements trainees are faced with:** 1) The ERP systems of the home healthcare worker and the emergency room ERP system do not communicate. 2) The home healthcare worker may not have all necessary medical equipment for the ABCDE observations.
- Tasks to perform:** The emergency room nurse shall guide the home healthcare worker in communication in ISBAR, and on observation according to ABCDE observations.
- Metrics to measure task performance:** 1) The extent to which the emergency room nurse uses the situation to explicitly guide the home healthcare worker in observation and communication according to ISBAR and NEWS, 2) the nurse's ability to detect possible sepsis without stressing the home healthcare worker.
- How to measure metrics:** Self-assessment, mutual reflection, debriefing with facilitator.
- Physical items present:** Access to a PC, a phone

Vignette 4 and 5 are the two opposing sides of a joint vignette. The fact that they are specified separately suggests that the role not under training can be simulated. Simulating one part of an interaction is sometimes desirable for added control over the learning situation.

5 Discussion

The design principles DP1 to DP4 were topics of discussion during the group work, often prompted by the researchers raising awareness of the principles. While DP1 to DP3 were generally accepted at face value, DP4 gave rise to two valuable discussion points that we emphasize here.

First, relating to the stepwise skills model in Fig. 3, DP4 states that it is important to train collaboration skills at Step 4 and 5, even when Steps 1–3 are not completed. This triggered conceptual discussions about the model itself, and in our opinion, these discussions heightened participants' awareness of DP4. The proposed vignettes rely on the presence of suboptimal procedural deployment and skills in several places.

Second, it was necessary to remind the participants of the fact that we were discussing vignettes for collaboration, *not* designing training for collaboration procedures. That is, although ISBAR is a protocol for communication and therefore collaboration (as are also ABCDE and NEWS in essence), we were not designing procedural training for ISBAR (nor for NEWS or ABCDE). Rather, we were designing training for interpersonal collaboration when these procedures are possibly lacking. Understanding this fact resulted in a relevant and innovative insight: Participants were concerned with how skilled personnel must guide

less skilled personnel in using ISBAR and NEWS in a reassuring way to elicit the necessary information to evaluate the situation. This amounts to *in situ* training of procedural skills, within the training of interpersonal collaboration under suboptimal circumstances. This brings the idea of *just-in-time learning* to the knife's edge in that the procedural skill of Steps 1–3 in Fig. 3 are trained by necessity to ensure patient safety in a potentially critical situation. This idea is evident in Vignettes 4 and 5. If this is possible in practice, it may be a very good supplement to a more formalised learning of Steps 1–3 in the model in Fig. 3.

A third topic that arose more loosely from the discussions during the group work, was the participants' concern about the importance of training healthcare personnel so that they become aware of each other's different roles and access to information. This was perceived as an important step in developing mutual trust and building confidence to reveal personal short-comings and ask for information. A related topic that emerged was the need to train *systemic awareness*; that is, each individual's awareness of their significance and responsibility for the whole system to work better, both in a specific situation, but also by looking for ways to improve the quality of systemic artefacts (procedures, documentation, etc.).

We found that using an online and jointly shared spreadsheet to be an easy and effective way to structure the discussion and to gather information from the participants. Although devised for a virtual workshop in case of a Covid-19 lockdown, we ended up using this digital solution, after abandoning the white board, when we were, in fact, able to conduct the workshop physically. We found that it is important that the topics asked for in the (the column names) are tailored to the goal and participants of the workshop. Although carefully designed by the researchers, some participants found that columns were overlapping in topic and asking for similar information. Better explanations before or joining or deleting some columns might have made the data collection even easier and faster. While we have not been able to compare this workshop method with, e.g., using storyboards as outlined by Schiza et al. [26], it seems that the threshold for engaging participants in the discussion using the spreadsheet was low. Quick and easy co-creation is an imperative when working with busy health personnel.

The outcomes of our workshop were likely dependent on our selection of participants and that these participants understood the motivation for the workshop and the salience of the presented case. This resulted in effective participant dialogue and output, although we had limited time with the participants. The flipside of this has two issues: First, the results from this particular study may be replicable and generalizable only to groups consisting of individuals with similar backgrounds and experience. This is a threat to validity unless we are careful when applying our findings from this and ensuing similar studies. Second, although the case and its challenges resonated well with our particular participants, it is not given that healthcare personnel for which we are designing the vignettes will have the same degree of recognition of the importance of the case or its challenges. Indeed, they might perceive that the main issues are something else entirely. We picked the workshop participants precisely for the purpose of eliciting vignettes that address pressing needs and that are relevant for health-

care personnel, and we do have confidence that this is the case. Nevertheless, for the next steps of development, it is vital that representatives for the various roles under training are involved.

6 Final Remarks

The vignettes elicited in this study suggests training for specific healthcare roles. These vignettes will be presented to a stakeholder group that includes these roles. This second workshop will focus on validating the vignettes with these stakeholders and on distilling out a first validated vignette for further development in Stage 3 of our scenario design model, as outlined in Fig. 5. In Stage 3, the manner in which suboptimal procedures and IT services will be represented and implemented must be determined. Moreover, the details of embedding the just-in-time learning elements for *in situ* procedural training will have to be discussed, represented and implemented.

The vignette will be specified using a generic textual and graphical format. Then, this specification will initially be implemented as a role playing exercise, which we will run with relevant stakeholders to adjust and refine the vignette. It is our aim to incorporate synthetic elements via virtual reality where this can enhance learning. There already exists virtual reality solutions for procedural training of basic skills (ABCDE and ISBAR), and one interesting way forward would be to see whether these solutions can help us to embed the just-in-time learning of procedural skills mentioned above.

This first vignette will be the start of several iterations comprising of design, implementation and validation of vignettes that will span incrementally more of the desired training space.

We found that the design principles and vignette format helped us to address suboptimal healthcare procedures and IT services and that the creation of the vignettes engaged the participants. We observed that the focus extended from suboptimal IT services to the lack of training in procedures and communication in general. By listening carefully to the workshop participants, we were able to instantiate the design principles so that the vignettes would be suited to address the complexity of the healthcare work processes, as well as focusing on the municipal healthcare workers' skills.

The workshop method we used turned out to be a suitable technique for coming up with scenarios that are detailed enough to form a basis for further use. We plan on refining our workshop technique further in other projects where detailed and structured scenarios are needed.

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