When Things Do Not Go as Expected: Scenario Life Savers

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In this paper we discuss scenario life savers - interventions before and during simulation scenarios that allow to create and use relevant learning opportunities, even if unexpected events happen during the conduction of the scenario. Scenario life savers are needed, when the comprehension or acceptance of the scenario by the participants is at stake, thus compromising learning opportunities. Scenario life savers can principally work by bringing participants back on track of the planned scenario or by adapting the conduction to their actions on the fly. Interventions can be within the logic of the scenario or from the "outside," not being part of the scenario itself. Scenario life savers should be anticipated during the design of scenarios and used carefully during their conduction, aiming to maximize the learning for participants.
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The value of simulation lies in creating, recognizing, and using learning opportunities.[1–3] The whole simulation setting needs to be considered when creating, recognizing, and using those learning opportunities.[1,4–7] Curriculum and course planning and management will influence whether simulation scenarios and debriefing can unfold their full potential. Instructors need to help participants to see the relevance of the course, help them into and out of the scenarios and the related role play, adapt the scenarios to the competence level of the participants, and facilitate the learning during debriefing.

In this article, we focus on a small, but important part of the simulation setting: the "scenario life savers."[8] By this, we mean plans before and interventions during scenarios that allow participants to achieve the learning goals for a specific scenario by adapting its content and form. Our aim is to describe the situations that require scenario life savers and to describe principles and methods that can be used to create and use scenario life savers. We are less concerned here with the scenario's learning goals than whether it runs as planned, the first aspect being related to the validity, the latter to the verification of a scenario.[9] These theoretical considerations will then be used to generate some practical solutions. Our discussion is grounded in our own simulation practice, spanning over ~10 years and the running of international instructor courses with ~2000 participants in the last 5 years. The article relates to mannequin-based simulation, but the principles are also likely to apply to other simulation methods, such as role play, simulated patients, and skills trainers as we will discuss in the end of this article.

THE NEED FOR SCENARIO LIFE SAVERS

The need to plan for and use scenario life savers arises from unexpected events that occur during scenarios. An important principle of simulation is that, during a scenario, the participants are free to act. This implies that they may perform actions that were not foreseen during scenario design. Previous experiences, personal values and beliefs, styles of actions, and personal preferences almost guarantee that a scenario is perceived and acted on differently by different participants. Situational factors may also contribute to unforeseen variations, arising from, for example, computer and simulation mechanism[10] problems, individual variation in role play by the instructor team, or the group dynamic of a specific group working within a scenario.

The learning effect might be compromised by such variation because of several factors:

- Comprehension of the scenario: Participants may fail to understand the scenario, when, for example, the motives and actions of a role player are unclear or inconsistent and the vital signs of the patient are difficult to interpret (eg, mechanically produced and indistinct auscultation sounds, misinterpretation of the auscultation sounds because the participant did not place the stethoscope over a breath sound speaker, and inconsistencies in the verbal information relating to clinical signs that cannot be simulated by a mannequin such as changes of skin color). The comprehension of the scenario might also be impaired due to unclear instructions before the scenario (eg, a lack of information about the resources that are available to participants during the scenario).
- Failure to accept the scenario: The simulated physiology of the patient might be perceived as unrealistic due to

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technical problems producing incompatible physiological variables or not equating with the experience of the participants with similar patients; the participants might get distracted by the interaction with other participants playing roles during the scenario or find themselves in an unsolvable situation, because those participants playing supporting roles become fixed in an uncooperative mindset.

- Mismatch between scenario difficulty and participants' competence: The scenario might become too difficult for the current participants, leading to frustration. The scenario might also be insufficiently challenging for the participants and not allow them to explore the learning opportunities.
- Unexpected actions by participants: The scenario may not run to script. For example, participants may not follow the treatment course envisaged by the scenario designer: the antibiotic that is to trigger the anaphylactic shock is not administered or the participant chooses not to intubate the patient during "the difficult intubation scenario." Even if they follow the intended course, participants may be progressing so slowly that there is not enough time to allow the scenario to run to its intended conclusion. The slowness might not be due to lacking skills but to the participants' desire to avoid missing an important piece of the scenario to create or maintain a "competent" image. Conversely, participants may proceed so quickly and take shortcuts that they bypass the planned steps that present challenges. In some scenarios, not all participants take an active role from the beginning of the scenario. Some might be outside of the simulation room being on standby to be called in for help. Sometimes the main participant or instructor team forgets that these participants are available. In the worst case that might mean that a person has traveled far to take part in a course, paid money, and invested time but is only active for a few minutes in one or more scenarios.
- Changing scenario content: The participants might use the information available to generate their own interpretation of the situation in a way that is plausible and consistent but different from that intended by the simulation team. Participants also might invent clinical situations; for example, they palpate the abdomen and the instructor describes it as tender. Participants from an urological background may first consider urological complications such as urinary retention and spend time organizing catheterization of the bladder. This is more likely to occur if the instructor is not quick enough to overrule the participant's assumptions.
- Difficulties during debriefings: The effect of the above actions may make it difficult to conduct goal-oriented debriefings because the interpretation of the scenario by the participants differs from that intended by the simulation team. This can interfere with the intended learning outcomes and, indeed, time might be needed, sometimes wasted, discussing what was supposed to happen according to the original scenario planning and why it did not. This may, in turn, have a negative impact on the running of subsequent scenarios.

Using a life saver for the scenario always requires attention and judgment from the simulation team. It is necessary to decide how much difficulty a given participant or team of participants can handle, whether the scenario is still proceeding as planned, etc. Unexpected actions by participants need not always be negative. It may be possible to use them as a focus for discussion, so that instead of trying to reorientate the group to the intended learning outcomes of the scenario, the facilitator encourages the group to explore the actions that were taken; actions that may have made the subsequent management of the patient more complicated.

PRINCIPLES OF SCENARIO LIFE SAVERS

There are two dimensions along which we can plot the scenario life savers and their use (Table 1). The first dimension, direction, has two elements—do we restore the scenario to its intended track or do we adapt the scenario to the newly created situation? The second dimension, simulation status, also has two elements—do we act within the simulated scenario itself or do we introduce changes from outside the scenario?

Note the difference between the (psychologic) simulation status and the physical location of a thing or an action. A person, for example, the laboratory assistant that is the role played by the operator in the control room, might be "within" the scenario, while he is physically located outside of the simulation room in the control room, connected by the telephone or the written report that he is providing. The vital signs of the patient are "within" the scenario; despite being manipulated outside of the simulation room. On the other hand, observers of the scenario might be in the simulation room but not "within" the scenario. Also, if the simulation operator used the intercom between control room and simulation room to warn a participant to handle the defibrillator in a safe way, this announcement would be "outside" the scenario.

Two examples of restoring the scenario from within the scenario are the request for an antibiotic by someone playing

Table 1. Overview of Scenario Life Saver Principles With Examples

	Direction	
	Restore	**Adapt**
Simulation status		
Within	Role player provides hints about clinical signs (in role)	Change of originally planned scenario to the one that would match participants' actions
	Manipulation of vital signs (slow down, make more obvious, etc.)	Include the aspects that come up into the originally planned scenario
Outside	Using the directors voice to describe the vital signs in the originally intended version	Describing that the scenario is now changed by the directors voice
	Stopping the scenario and restarting in the intended direction	

a supporting role (eg, a role played surgeon) during an anaphylaxis scenario or the control room operator may lower the oxygen saturation of the patient more quickly than originally planned to provoke the participant into securing the airway during the difficult airway scenario.

Two examples of changing the planned scenario into a new situation are to convert an anaphylaxis scenario into a case of major hemorrhage. If the intended learning outcomes relate to principles of crisis resource management then the new scenario should allow these goals to be achieved equally well. In a scenario where the clinical challenge is too easy for the participants, the situation could be changed by introducing an additional complication such as a power failure or a blood transfusion error.

Also the combination of both approaches, restoring and changing the scenario, is possible. The simulation team might bring an "out of bounds" role player back on track by sign language or verbal instruction, while at the same time shifting the scenario from one medical problem to another.

When implementing life savers from within the scenario they should follow the logic of the simulated scenario and need to be explicable and believable to the participant(s) based on this logic. New information may be made available, for example, by a supporting role player commenting on some new physical sign such as a rash on the patient's chest. This should be consistent with any changes in the patient's physiology and with what would be perceivable in a situation (eg, no visible cues should be described that are covered under a blanket, such as a rash on the chest).

In contrast, life savers implemented from the outside of the scenario do not (and need not) follow the logic of the scenario itself. Participants may have to step out of role to prevent undesired consequences. This may range from damage to the mannequin (inserting a drain where a drain should not go) or potential harm to a participant (inappropriate handling of a live defibrillator). The scenario may be resumed or started from the very beginning, if the participants had gone down a completely inappropriate track because of an error from the control room team, which misled the participants. As an example, if the control room operator entered the wrong dose of drug during induction of anesthesia and the patient's blood pressure fell severely, accompanied by a tachycardia, the active participants in the simulation area may think that this is an anaphylactic reaction to an anesthetic drug and proceed down that path. If the intended learning goal was the recognition and management of malignant hyperthermia then it would be very difficult to restore the scenario to its intended course, and the best option would be to admit the error, stop the scenario, apologize to the simulation group, and begin the scenario again.

However, as long as the value of creating, recognizing, and using relevant learning opportunities is not compromised, all (or at least many) changes are possible. The simulation team can create and influence the situation in many ways. In this way, it is possible to go beyond the mere reconstruction of clinical reality and use the unique potentials of simulation reality for learning.[1]

PRACTICAL IMPLICATIONS

Scenario life savers can be designed into a scenario or created on an ad hoc basis. They are typically implemented during the scenario.

Before the scenario takes place, the use of scenario life savers can be primed. Participants should know the different communication channels between the control room (or the control area) into the simulation room—from within and outside the scenario. They should also be informed as to which of the persons playing supporting roles will provide what kind of reliable information (eg, describing clinical signs or clarifying confusing elements during the simulation). Such communication about which communication channels are to be used and for what purposes each channel is to be used can be called "metacommunication" (Table 2). During metacommunication, the basis on which the different communication channels will be used to convey the different kinds of information is established and agreed on.

Table 2 describes the different opportunities in time and space to implement scenario life savers and the different communication channels for doing so, with the persons involved.

During the design of scenarios, the simulation team should try to anticipate where participants are more likely to do something unexpected, such as when they have more than one option for action. The application of principles of failure modes and effects analysis[11] might be helpful when working through the scenario. This means that the simulation team works mentally through the scenario, trying to identify where participants could do something unexpected, how an unexpected action would be recognized, and how the simulation team could react in such a case. A set of relevant and preprepared scenario life savers could thus be assembled. Careful consideration should be given when designing scenarios in which the only logical consequence of an unresolved clinical situation would be the death of a patient (eg, a scenario that involved the patient developing a tension pneumothorax).

Having identified those stages where potential problems may arise during the running of the scenario, the simulation team should be especially vigilant for actions and elements in the scenario that would:

- lead to unwanted consequences for the simulated patient, such as immediate resolution of the clinical challenge or, even worse, an undesired deterioration or even death.
- change the basic scenario completely (eg, the difficult airway scenario cannot be implemented, if the participants do not at some point start intubation of the patient).
- cause the participant team to have big problems or commit major errors during the treatment of the patient (for example, a lack of breath sounds on one lung after intubation may be perceived as a tension pneumothorax if associated with a fall in blood pressure and oxygen saturation).
- place the participants in danger (eg, unsafe practice while using a defibrillator) or put the simulator at risk for damage (eg, administration of endotracheal epinephrine solution).

Table 2. Communication Interfaces Between Control Room and Scenario With Examples of Life Savers

Course Phase	Communication Channel	Simulation Status	Content	Example
Setting Introduction/ Beginning of course	Face-to-face, verbal	Outside	Explain the possibility of using life savers	"[...] We might stop the scenario, if we see you handling the defibrillator in an unsafe way. We will address you via the loudspeaker in the corner of the room in this case. [...]"
Simulator briefing in the simulation room	Face-to-face, verbal and visual by pointing	Outside	Explain the difference of "within" and "outside" the scenario	"[...] We have different ways of communication between the simulation room and the control room. The patient will speak to you via *this* loudspeaker in the mannequin. The scenario director might tell you something about vital signs that you cannot see directly in the mannequin, like skin colour–you will hear him via the loudspeaker *up there*.
			Explain the different interfaces between the simulation room and the control room • patient voice • role players (part of the simulation team) • role player (part of the participants' group) • director's voice • physiology and clinical signs by monitor and/or by verbal prompts	There will be a nurse with you in each scenario. He is a member of our simulation team and will not trick you but also not help you too much. If you have questions for him, he will answer to the best of his knowledge. If he tells you something about the patient, it will be correct. He has a walky-talky with him, that we can use to communicate - for example, if we in the control room cannot see which medication you administered. Maybe, we will also ask some of you to play a role and will then tell you what you should do in that role.
			Clarify both the method of providing the information (eg, from a person involved in the scenario or using the telephone) and the nature of the information in terms of its reliability (eg, a role player will not "lie").	The vital signs that you see *here* on the monitor will be controlled from the control room. Rarely, we do have problems with the simulation–but we would let you know, if it that occurs."
Scenario briefing	Face-to-face	Outside/possibly inside	Outside: Explain any specifics of the scenario that are relevant for the conduction of the scenario Inside: Role play a hand-over situation, creating time pressure from the beginning	"The next scenario will take place in an emergency room of a large hospital. You will have the role of the receiving nurse and doctor on call in the emergency room. The patient is a 62-yr old male, who was brought in by his wife, complaining of chest pain. Please go in and find out, what his problem is."
Scenario	Patient voice over loudspeaker	Within	Provide information about patient's history and state, guiding questions and hints	"[...] Oh doc, it really hurts in my chest. It started three hours ago. [...]"
Scenario	Role players from the simulation team	Within	Help the participants by questions or remarks that focus their attention on specific aspects Patient history information, clinical impression, guiding questions and hints, results from diagnostic measures, and finding and using additional information (eg, a diabetic clinic card in the wallet) Where possible, use a hidden radio connection to those role players to adjust their actions during the scenario	" [...] Mrs. Smith came in yesterday and was really complaining about the pain in her foot. This morning, she [...]"

(*Continued*)

Table 2. (*Continued*)

Course Phase	Communication Channel	Simulation Status	Content	Example
Scenario	Role player from the participants' group	Within	Interaction-based on knowledge of clinical work setting and idea about role play and simulation–often tendency to go into conflict or for over- or underacting	Role explanation: "We want you to play an upset parent of the small patient. Your main concern is that you have no clue what is happening to your little girl.
			Where possible, help role players with the basic motives that they should follow during the scenario and agree on metacommunicative elements that help in fine tuning their actions (eg, being more or less disturbing or cooperative during a scenario)	It would be good if you could look at me from time to time and I will signal you with my hands up to go more intense and with hands down to ease a bit. OK?"
			You might give them written "role cards" to which they can refer during the scenario	Role implementation: "Doc, doc, please, do something, quickly, DO something, now. Look, she is really not well, please [...]"
Scenario	Directors voice	Within	Provide clinical and vital signs, clarifying information about scenario situation and resources available, results of diagnostic measures	"You see a rash on the thorax of the patient" "The patient's lips are cyanotic" "The patient's skin feels very hot"
Scenario	Directors voice	Outside	Provide information to clarify the simulation setting (eg, how to use a piece of equipment), safety warnings for participants or about material, start and end of scenario, instruction about elements of the fiction contracts (eg, consider the arterial line as placed, even, if it is not placed due to lack of physical resources)	"You find a smaller tube in the drawer below the one you are looking in" "Please put the paddles back onto the defibrillator immediately." "Please assume that you get CO_2 back now after the intubation. Our sensor just broke."
Scenario	Monitor	Within	Provide physiology by monitor Explain, which physiological and clinical data should be obtained visually from the mannequin and monitoring and which will be provided verbally (eg, skin color)	Scenario relevant changes of physiology and vital signs provided via the monitor (exhaled CO_2) the mannequin (eg, pupil dilation) or both (eg, blood pressure and heart rate)

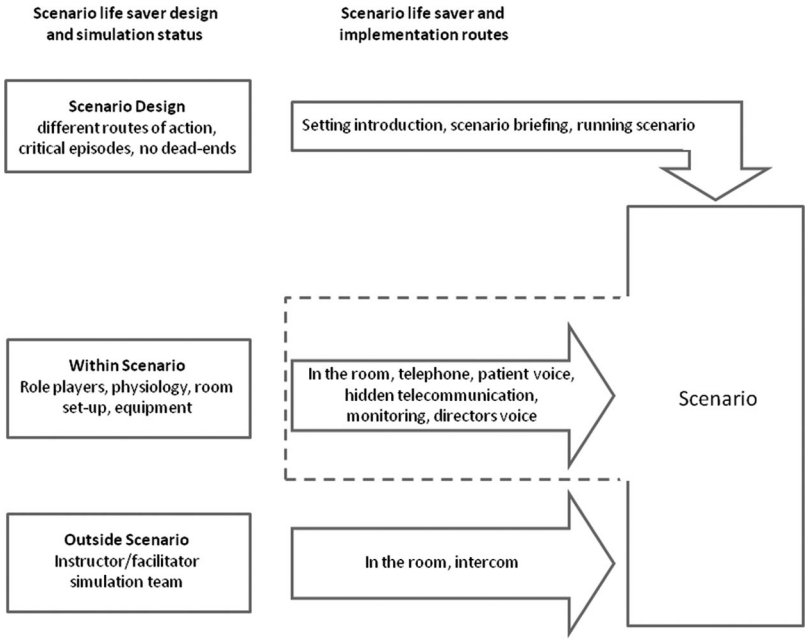

Figure 1. Life saver design and implementation by different routes and in different phases of a simulation-based course. The dotted area in the scenario border represents the different interfaces between the simulation room and control room or control area.

Some scenario life savers are generic and can be used in many if not all scenarios, whereas others are specific for a particular scenario. The generic life savers are those that give the simulation team more time to decide and control the scenario (eg, the patient asks the participant to repeat a question if the simulation team missed the question or did not understand it). Another generic life saver is the "deus ex machina (the 'god' who saves the hero)" by sending in a "senior colleague" for help, who just "happened to be passing" and who heard a "commotion" and wanted to check what is going on (good role play is needed here to enter and impact on the scenario). Those role players need to introduce themselves (and thus get a good briefing) not to become the flying Dutchman appearing from nowhere—their story needs to be explainable within the logic of the scenario, their appearance must fit into the "fiction contract."[1,12]

Specific life savers are closely related to the story of and the resources within the scenario. For example, a participant role playing a young resident may attempt to point the development of the actual scenario participants away from the misplaced endotracheal tube during a difficult airway scenario trying to avoid the too early solution of the scenario. Another example could be predefined limits for changes in physiological parameters that would trigger interventions by role players: the role played nurse in the scenario might suggest specific medication, if the systolic blood pressure drops below 80 mm Hg.

MEANS FOR USING SCENARIO LIFE SAVERS

There are many different means and routes for using and implementing scenario life savers (Fig. 1 and Table 2). Sorting them conceptually will help the team to use the most appropriate scenario life saver in the most appropriate mode, when it is needed. A key issue is to understand the interfaces and routes of communication between the control room or the control area of a scenario and those participating in the scenario itself.

Figure 1 depicts on the left side the phase and simulation status of a scenario life saver and its implementation. This can happen before the scenario (eg, the simulation setting introduction or the scenario briefing) or during the scenario. During the scenario, life savers can be implemented from within or from outside the simulation, differentiating their simulation status. They either belong to the scenario and evolve from its logic (within simulation status) or have their roots outside of the scenario (outside simulation status) and can be seen as a kind of metacommunication.

The right side of the figure shows the implementation routes for life savers. Before the scenario, the relevant information is typically provided by a member of the simulation team (topmost arrow). The middle arrow depicts communication channels that connect the control room (or control area) during the scenario to the actual scenario action. The lowest arrow shows different channels for "outside" life savers. Consider that the simulation operator uses the route depicted in the middle to speak as the patient providing relevant diagnostic information through a loudspeaker in the mannequin. The same operator might later in the scenario use a different loudspeaker to describe symptoms that the simulator cannot simulate directly (eg, the already mentioned skin rash).

Table 2 describes the different interfaces that might be used to implement life savers in more detail.

It is advisable to make note of the possible scenario life savers in any script[8] that is used to plan the scenario. This script now becomes a living document that is updated as new or unexpected turns of the scenario are encountered. Furthermore, this document will record the life savers that were applied and the impact, successful or unsuccessful, of these new life savers.

SUMMARY

In this article, we have described the principles of scenario life savers and how they can be designed and implemented. The principles underlying this article are applicable also to other

forms and uses of simulation. Whatever simulation form is used in whatever setting, unexpected events might occur—whether due to technical challenges, misunderstandings, user errors, different interpretations, and many other possible reasons. The principle methods of restoring the originally planned scenario or of adapting the scenario on the fly can be applied in different simulation settings and with various simulation methods. The differences lie in the details of implementing life savers. The simulation team should prepare that which can be prepared and adapt to that which cannot be prepared by using the tools that are feasible in the given context. This may be role players, technical equipment, or many other items. The concepts described earlier in the text are meant to help simulation teams identify the available possibilities.

The process of identifying and using scenario life savers begins well before the scenario itself and needs not only preparation but also skillful implementation by the simulation team. Using scenario life savers can maximize the learning by ensuring that the scenario is relevant for the intended learning goals, the current participants, and the clinical situation. Although the scenarios may not necessarily unfold in a standardized manner, the use of scenario life savers is one way to facilitate the standardized (or at least harmonized) understanding and educational content of a scenario with different participants. Some groups might need stronger hints to actually engage with the specific (eg, difficult intubation) scenario than others. Using scenario life savers can help to achieve the maximum learning potential of the scenario while also affording protection to participants and equipment.

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