



Review

Sepsis and Clinical Simulation: What Is New? (and Old)

Pablo Cuesta-Montero ¹, Jose Navarro-Martínez ^{1,*} , Melina Yedro ¹ and María Galiana-Ivars ² 

¹ Department of Clinical Simulation (SimIA Lab), Dr. Balmis General University Hospital, Alicante Institute for Health and Biomedical Research (ISABIAL), 03010 Alicante, Spain; pablocuesta@yahoo.es (P.C.-M.); simia@isabial.es (M.Y.)

² Department of Anesthesiology and Surgical Critical Care, Dr. Balmis General University Hospital, Alicante Institute for Health and Biomedical Research (ISABIAL), 03010 Alicante, Spain; mgivars@gmail.com

* Correspondence: jnavarro.martinez@gmail.com

Abstract: Background: Sepsis is a critical and potentially fatal condition affecting millions worldwide, necessitating early intervention for improved patient outcomes. In recent years, clinical simulation has emerged as a valuable tool for healthcare professionals to learn sepsis management skills and enhance them. Methods: This review aims to explore the use of clinical simulation in sepsis education and training, as well as its impact on how healthcare professionals acquire knowledge and skills. We conducted a thorough literature review to identify relevant studies, analyzing them to assess the effectiveness of simulation-based training, types of simulation methods employed, and their influence on patient outcomes. Results: Simulation-based training has proven effective in enhancing sepsis knowledge, skills, and confidence. Simulation modalities vary from low-fidelity exercises to high-fidelity patient simulations, conducted in diverse settings, including simulation centers, hospitals, and field environments. Importantly, simulation-based training has shown to improve patient outcomes, reducing mortality rates and hospital stays. Conclusion: In summary, clinical simulation is a powerful tool used for improving sepsis education and training, significantly impacting patient outcomes. This article emphasizes the importance of ongoing research in this field to further enhance patient care. The shift toward simulation-based training in healthcare provides a safe, controlled environment for professionals to acquire critical skills, fostering confidence and proficiency when caring for real sepsis patients.



Citation: Cuesta-Montero, P.; Navarro-Martínez, J.; Yedro, M.; Galiana-Ivars, M. Sepsis and Clinical Simulation: What Is New? (and Old). *J. Pers. Med.* **2023**, *13*, 1475. <https://doi.org/10.3390/jpm13101475>

Academic Editor: Nikoletta K. Rovina

Received: 6 September 2023

Revised: 22 September 2023

Accepted: 6 October 2023

Published: 8 October 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords: sepsis; clinical simulation; medical education

1. Introduction

Sepsis stands out as a major public health threat, affecting millions of people worldwide and representing one of the leading causes of morbidity and mortality worldwide [1,2]. It is not a simple clinical condition; its complexity and severity make it a condition that requires immediate recognition and intervention to increase the patient's chances of survival [3]. However, effectively addressing this challenge requires not only a theoretical understanding of the problem, but also specialized practical skills and abilities [4]. In recent decades, the use of simulation as a learning tool in healthcare education has boomed. It offers healthcare professionals a unique opportunity to hone their skills in managing clinical situations in a structured and controlled learning context [5,6]. This shift in medical pedagogy has changed the traditional dynamics of healthcare education and training, often based on the 'see one, do one, teach one' approach [7,8]. However, in today's world, where patient safety is paramount and margins for error are increasingly narrow, the need for a risk-free learning environment for both patients and practitioners is increasingly evident and necessary [9,10]. As technology and educational methods continue to evolve, clinical simulation is no longer confined to simulation centers [11]; it is being integrated into hospitals and clinics during specific processes and situations, becoming 'in situ' and thus expanding its scope and relevance [12,13]. In the context of sepsis, this approach becomes

even more important as it allows for the identification of problems in the workplace and the implementation of real changes [14–17]. Clinical simulation is a toolbox that ranges from simple exercises to very complex simulations, creating scenarios that aim to hone not only individual skills, but also communication and teamwork skills, with a common goal centered around preparing healthcare professionals for the real world [18,19]. This article aims to highlight the relevance of clinical simulation as a pedagogical innovation to address the medical challenges posed by sepsis, as well as the ability of this tool to generate change in healthcare professionals and improve adherence to clinical guidelines.

2. Sepsis, a Global Education Issue

Approximately 48.9 million cases of sepsis and 11 million sepsis-related deaths were reported worldwide in 2017, with mortality rates steadily increasing and an estimated annual cost of more than USD 24 billion in the US [20].

Of the global initiatives to address this major problem, the Surviving Sepsis Campaign (SSC) is undoubtedly the best known. The initial objectives of the campaign were to increase health, social, and political awareness of the disease; to improve early diagnosis through a clear definition of sepsis; to improve treatment; to promote education; to improve post-ICU care; and to implement global guidelines [21].

From the first edition in 2004 [22] to the latest edition in 2021 [3], these guidelines have had a global scientific impact with more than 20,000 citations and have been translated into more than 25 languages [23]. These guidelines revolve around essential care packages or bundles for sepsis management that aim to improve care, reduce mortality, and improve outcomes [24–26]. A bundle is a set of diagnostic and therapeutic interventions, based on clinical guidelines and supported by current evidence, that, when used together in an orderly fashion and over a period of time, have a greater benefit on the patient than when used in isolation [27].

Despite the proven effectiveness of these sepsis care bundles, adherence is suboptimal and sepsis is often under-diagnosed [28]. Educational interventions have been shown to improve bundle adherence in many studies, but are not always associated with improved patient management [29].

Most educational efforts have focused on ICU professionals, leaving a gap for other professionals who are critical in the early recognition of sepsis [30–32]. Preparing all healthcare professionals and students by improving understanding and knowledge of sepsis [2], as well as informing the general population and patients in particular, remains an unmet need [33].

Medical education interventions can be analyzed in different ways and with different tools [34], although the most interesting are those that measure their acceptability, the learning they provide, the impact they generate, and the duration of the change they produce [35,36]. Those related to sepsis are very diverse, with a structure and results that are difficult to extrapolate [37].

A recent review [32] found that the vast majority of educational initiatives were based on SCC bundles and their usefulness in early diagnosis and treatment algorithms, with less emphasis on other aspects (such as teamwork and communication).

Of the most commonly used educational strategies in medicine [38], traditional didactic teaching, e-learning, gamification, multimodal training, and clinical simulation appear in the literature [32,37].

Traditional didactic teaching is the oldest and most common method of approaching sepsis in the literature [39]. In this category, we find everything from seminars and sessions with slide presentations to articles and bibliographic material. This method is the simplest to organize and implement and is widely accepted as it follows the classical lines of education [38]. It has the disadvantage that knowledge retention can be limited compared to other methods that use active learning [40] and require physical spaces [41].

E-learning is one of the fastest growing forms of teaching at the moment, due to the advantage of being able to learn anywhere and anytime [42,43]. In recent years, and for

obvious reasons, it has become one of the most widely used methods [41]. One of the evolutions of this system is blended learning, which combines face-to-face learning with e-learning and is gaining followers by combining the advantages of both systems. So much so that, in terms of educational benefits, it is an educational method in itself [44].

Gamification, or game-based learning, uses the attributes and dynamics of games to enhance the learning experience. These strategies are better accepted by professionals, especially younger ones, and show higher knowledge retention [45]. This methodology has been applied in various ways, from the realization of platforms similar to classic score-based video games [46] and simulation games [47] to the realization of escape rooms [48].

Multimodal training aims to cover all training spectrums, combining the best of each. Although some studies have demonstrated their impact on training, they remain a minority training modality [49,50].

Although many studies report improvements in patient care and outcomes following the implementation of a sepsis education intervention, regardless of the type of intervention, it is important to recognize that there are other variables that influence outcomes [29]. Hospital protocols, the internal workings of a hospital, the prior training of professionals, interprofessional relationships, and the culture of safety and teamwork are key elements in implementing any change [51–53].

Clinical simulation has been identified in the literature as one of the learning modalities with the greatest impact on professionals and the highest retention of knowledge when conducted in an appropriate manner [54]. Despite its benefits, it is by far the most underutilized educational intervention.

In order to improve sepsis education, and in order for this education to have an impact on clinical outcomes, it is necessary to (a) make the general population aware that it is a public health problem, (b) use educational interventions that are integrated with health policies and that create synergies with hospital protocols with current scientific recommendations as a central working axis, (c) ensure that these interventions must be based on active learning with a focus on simulation techniques, (d) involve all actors involved in patient care, and (e) provide care in multidisciplinary teams to centralize sepsis care in a multidisciplinary and multiprofessional approach.

Addressing the global educational challenge that sepsis represents necessitates the deployment of impactful and encompassing educational interventions aimed at enhancing its early recognition and management. A spectra of educational strategies, ranging from traditional didactic teachings to clinical simulation, are pivotal to counteract this medical condition; however, adherence and implementation are still found lacking in several instances. The educational endeavors should be holistic and multifaceted, and must promote active learner engagement, with an emphasis on clinical simulation, to ensure optimal knowledge retention and clinical application. Moreover, sepsis education should not only target healthcare professionals but also the general populace, raising awareness about this severe public health issue. Ultimately, the realization of educational interventions should align seamlessly with health policies and hospital protocols, ensuring a maximized impact on the clinical outcomes of sepsis patients

3. Clinical Simulation: A Toolbox

In order for an initiative such as the SSC to achieve the objectives for which it was created, it is essential to understand the barriers to its implementation [37,55]. It is logical to think that in order to tackle such a broad problem, it is necessary to use versatile, dynamic tools that can be integrated into all the processes and structures of healthcare systems, such as clinical simulation [56].

Clinical simulation is a technique, not a technology [56], that provides professionals with a set of tools through the use of controlled and safe practical experiences [57]. The methodology offers healthcare professionals, students, and participants the opportunity to acquire and refine clinical skills [6], make decisions [18] and experience complex situations without compromising their own safety or that of the patient [58].

As well as being used to improve practitioners' skills and knowledge, clinical simulation provides an environment conducive to the study of various aspects of medical care, from the effectiveness of new interventions to human factors in healthcare [59,60]. By enabling data collection in a controlled environment, simulation becomes a valuable tool for clinical research that can lead to improvements in healthcare practice and policy [10].

Clinical simulation is particularly useful for training multidisciplinary teams to manage complex situations [19]. By simulating a clinical environment, critical elements of communication, teamwork, and decision making can be addressed, as well as aspects that are fundamental to patient care but often overlooked in other educational approaches [61].

This educational methodology has the capacity to adapt to different levels, healthcare disciplines, and healthcare settings, as well as to the different skills, technical or non-technical, that need to be taught [56]. This adaptability allows resources to be managed according to educational needs in order to optimize time and resources [62,63].

The development of educational activity through clinical simulation usually follows a structured educational model that at least includes the following phases [64–66] (Figure 1):

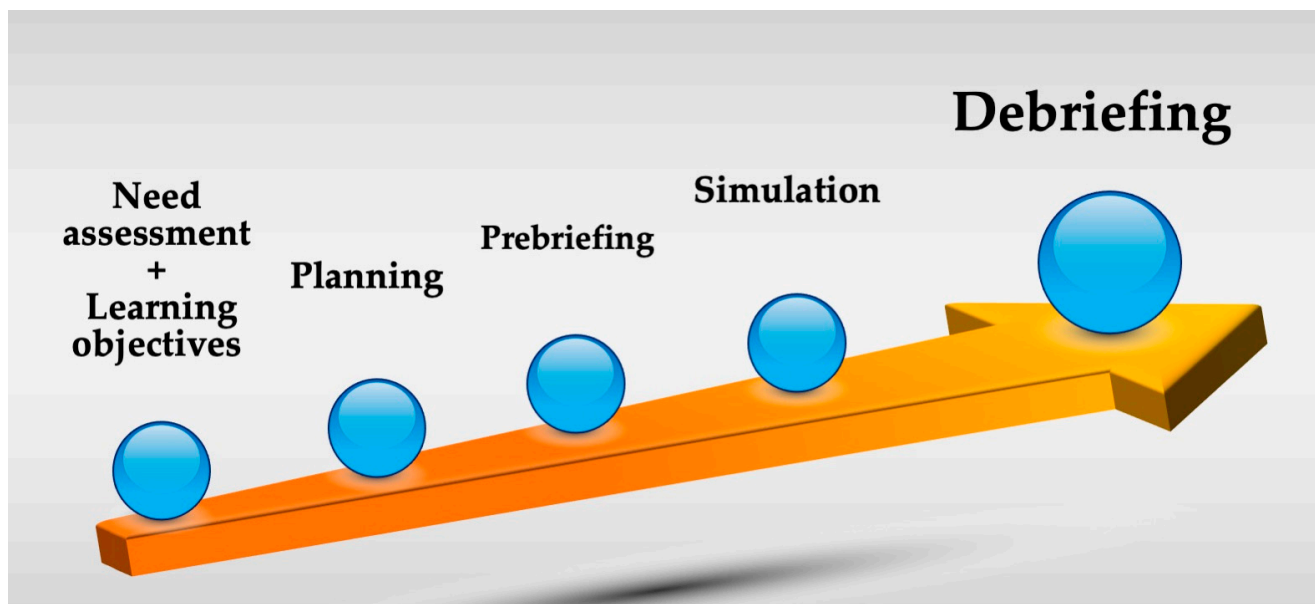


Figure 1. Phases of a structured educational model in clinical simulation.

-The identification of learning needs and the development of learning objectives. Needs are defined as the actual gap between an individual's practical performance and the health system's intended performance for that position. This process can be as simple as reviewing the curriculum needs for a particular specialty or process across specialties [67], or it can be quite complex, involving in-depth analysis and more specific methodologies [68]. Sometimes, it is the simulation itself that is used to identify needs that cannot be diagnosed by other methods [69].

-Planning. The organization of available resources by teachers and learners. In this part, it is necessary to be very realistic about the objectives and the resources available. All the details of the organization of this type of event must be taken into account, from the timetable to the physical facilities to the teacher–student ratio (depending on the activity to be carried out) [70].

-Prebriefing. This refers to the information and orientation provided to participants before a simulation activity is carried out based on its scenario, objectives, and development [71]. This information mainly includes the following points [72,73]: the psychological safety of the environment, the learning expectations of the trainer, the time available for the activity, the simulation scenario, the working environment and logistics, and the description of the debriefing afterwards. It should be noted that the most important point is

that of psychological safety, where rules of communication, confidentiality, and respect are established, as well as a fictional contract to accept the simulation as real [59].

-Simulation. A scenario should create the context in which the simulation is carried out according to the objectives that are to be achieved. In the field of clinical simulation, the structure of this scenario and the resources used, together with the experience of the facilitators, favor the realism of the simulation and improve the acquisition of knowledge and skills. Given that several elements interact during clinical simulation, it is advisable to use checklists or templates that improve and standardize the simulation and allow for subsequent evaluation [74–76].

-Debriefing. This last point could be defined as a learning conversation between several people to review a real or simulated event, analyzing their actions and emotions. During this process, guided reflection takes place in order to improve or maintain their performance in the future. This process aims to promote the development of clinical judgement and critical thinking skills [71,77]. Debriefing is recognized as the most important point within a clinical simulation activity [64,78–80]. Multiple structures and forms of debriefing exist in the literature [80,81], and although debriefing with good judgement is currently preferred [77], it is essential to adapt it to a specific educational process [63], and, above all, to conduct it [82]. One of the benefits of debriefing is its use in clinical practice, with the aim of reflecting on, and learning from, a real clinical situation [83–85]. This tool allows us to identify opportunities for improvement through direct observation, identify team needs, and create safe learning environments in the workplace [86].

Like clinical debriefing, clinical simulation should be integrated into the day-to-day running of care systems to compensate for the lack of real experience or to improve skills that are now fundamental to human treatment [56]. The translation of simulation into real life has benefits beyond those associated with learning alone, which are difficult to assess in the short term [87].

In situ simulation is an activity that takes place in the normal workplace rather than in simulation centers. It is a strategy based on creating scenarios, that are safe for the practitioner and the patient, in the real clinical environment, and it is used to identify the skills, knowledge, and teamwork required to develop appropriate clinical care. The applications of in situ simulation are very diverse, both clinical and educational, as well as assessment and quality [13,88].

New technologies, such as virtual reality, have been integrated into clinical simulation to improve participant acceptance and outcomes [89]. However, the most important role in clinical simulation is not played by the technology, but rather by the instructor/facilitator who is responsible for developing the simulation activity [90].

Far from the horizon described by David Gaba in 2004, simulation has spread, albeit unevenly, across the medical education landscape. The cost of implementing simulation clinically depends on the target population, the purpose of the simulation, and the technology required to implement it. It also depends on how educational and clinical organizations manage to reorganize their working structures in order to incorporate simulation.

Quantifying the benefits of simulation is much more difficult than assessing the costs. Most of the benefits, in terms of patient safety, error reduction, and improved performance and quality of care, are long-term and can only be realized through the consistent and prolonged use of simulation [56].

Despite the costs, the versatility of this “educational toolbox” makes it an essential strategy for preparing future health professionals, although, as with any educational method, its effectiveness depends on its correct use [65].

As healthcare continually evolves, the role of clinical simulation becomes even more pivotal in bridging the gap between theoretical knowledge and real-world applications. The dynamic nature of simulation ensures that healthcare professionals are not only equipped with knowledge, but also with the adaptability to navigate unforeseen challenges. Future projections suggest an increased reliance on simulation to address emerging health threats and to prepare for scenarios that traditional training cannot replicate. The investment in

simulation, both in terms of time and resources, is an investment in patient safety, care quality, and overall healthcare advancement. With technology integrating further into healthcare, the fusion of advanced tech and simulation promises a transformative era of medical training and patient care.

4. From Theory to Practice

A recent systematic review of sepsis education [32] found that simulation-based learning models improved knowledge acquisition and retention and teamwork skills compared to standard teaching methods, developing fundamental skills for the early management of sepsis such as critical thinking. One of the findings of this study is that clinical simulation represented the minority of educational practices used for teaching sepsis.

Despite the importance of the sepsis problem and the benefits of clinical simulation, there are few high-quality studies in the literature that reflect its use [32,91]. However, as with evidence-based medicine, it is necessary to integrate individual practical experiences with the best available evidence to provide the best possible care [92], or, in this case, the best possible education.

Changes in aviation safety or in the practice of anesthesiology were not based on evidence that certain practices reduced the incidence of complications, but on the widespread implementation of small changes, of which few were subjected to controlled experiments [93]. As in these disciplines, the benefits of simulation cannot always be measured by controlled experiments [94], nor can they be measured with the usual tools in terms of educational impact [35] or quality [95].

However, the current system of education, training, and competence maintenance has not been subjected to rigorous testing to determine whether it actually meets its stated objectives [56].

The most frequent purpose for which this tool is used is the assessment of knowledge and competencies [14,96], most often within multi-modal training [32]. There are many advantages of this tool, as it allows for the assessment of knowledge between different specialties [97] and competences within the same specialty with different degrees of experience [98]. Another purpose for which it has been used is for training in an initial approach to recognize the septic patient [99].

One of the most important issues worked on through simulation is the effect of interprofessional working relationships during the treatment of sepsis [51,100,101]. Despite appearing as a fundamental point in the treatment of time-dependent pathologies [102,103], and in particular in sepsis [3], it is one of the points to be improved in simulation training [32,91].

Simulation can be used as a tool to train all healthcare professionals who are in contact with the patient, regardless of their specialty and category. Nursing plays a key role in this [32,37] and simulation can provide a safe environment to improve skills, knowledge, and care [104].

Knowledge of and training in sepsis should not be limited to healthcare professionals [33]. Staff-in-training programs have been shown to be feasible and effective [105] in improving diagnostic skills in multiple clinical settings and across multiple specialties [101,106–110].

The incorporation of simulation into the training curricula of medical and nursing students has produced very good results in terms of both knowledge and skills in the diagnosis and deterioration of patients with sepsis [111,112].

Outside the hospital, and for less skilled and less experienced healthcare workers, simulation is of considerable benefit in managing rare events and identifying sepsis-related problems [113].

Beyond recreating complex scenarios in intensive care units, simulation can be applied at all points of care of the septic patient. From diagnosis in long-term care homes [113], admission to the emergency department, passage through intermediate care units [114], the hospital ward [115], or the operating theatre [109], clinical simulation can replicate the situations in which patient care takes place. The development of in situ simulation enables

training in complex settings where the early diagnosis and treatment of sepsis is critical, such as emergency departments [16] and rural hospitals and health services [115,116].

Sepsis management requires both technical and non-technical skills, all of which benefit from simulation, not only for the learning itself but also for patient safety. The most common example is central line cannulation [117]. Non-technical skills, probably more important and less studied, comprise another fundamental area in sepsis management, allowing for improved functioning and workload during teamwork [118].

The type of skills to be trained in sepsis management will determine the technology required for simulations, bearing in mind that technology and fidelity are not the most important elements in a simulation [119,120]. Virtual simulation, telesimulation, and augmented reality are very new tools that can help improve learning experiences in sepsis, although they are currently underdeveloped in the field [121–123].

Post-simulation debriefing aims to promote change in clinical practice through reflection [78]. Although reflective debriefing is probably the most widely used to reinforce knowledge in sepsis simulation scenarios [124], other more recent simulation methods, such as Deliberate Rapid Cycling Practice [125], have been shown to be equally effective and even superior in the post-training period for the management of septic shock [54].

Clinical debriefing following the clinical deterioration of patients has been shown to be a powerful educational tool [126], especially when used in a multidisciplinary manner [127], with multiple benefits for healthcare workers [128].

In some of the studies mentioned above, the underlying evidence provided strong support for the benefits of simulation. In many cases, however, both the authors and the institutions involved in these studies proceeded with a limited evidence base because of the superficial consistency of the simulation approaches employed. The difficulty of conducting definitive research on their success, together with continuing dissatisfaction with traditional methods, also influenced this decision.

Simulation is thus not merely a replicative tool but a transformative approach to medical education and patient care, necessitating a paradigm shift in our perception and utilization of educational methodologies in healthcare. The multifaceted applications of simulation underscore its instrumental role in enhancing interdisciplinary collaboration and optimizing patient outcomes in sepsis management. As we navigate the complexities of healthcare, the incorporation of innovative simulation techniques will be pivotal in fostering an environment of continuous learning and improvement. The progressive integration of simulation in medical education heralds a new era in healthcare, characterized by enhanced clinical proficiency and improved patient care paradigms.

5. Conclusions

Clinical simulation has transformed the way professionals prepare for clinical situations, replacing the traditional approach with a structured and controlled methodology. This technique allows skills and competencies to be honed in a safe environment, prioritizing patient safety and minimizing medical errors. Its accessibility has expanded beyond simulation centers into real clinical settings, broadening its scope and relevance.

In the context of sepsis, clinical simulation becomes even more important as it allows for problem identification and resolution in real working environments. In addition to improving individual skills, it promotes teamwork and communication skills, preparing professionals to face real-world challenges. Adherence to key clinical guidelines and care bundles is critical in the management of sepsis, and education plays a critical role in improving this adherence.

Simulation is adaptable to a variety of educational strategies, from traditional teaching to gamification and multimodal training. Gamification, for example, has been shown to be particularly effective with young professionals, increasing knowledge retention. However, factors such as hospital protocols, the prior training of professionals, and the culture of safety and teamwork also influence outcomes.

In conclusion, clinical simulation is an essential tool in addressing the challenges of sepsis. Its ability to enhance skills, promote collaboration, and improve adherence to clinical guidelines makes it a valuable strategy in the training of healthcare professionals. The pedagogical innovation that it represents has the power to bring about real change in professionals, thereby improving care and patient safety in the fight against sepsis. Clinical simulation can be adapted to different stages of patient care, in different clinical settings and for different levels of experience, demonstrating its versatility and effectiveness in sepsis management training.

Author Contributions: Conceptualization: P.C.-M. and J.N.-M.; methodology: P.C.-M. and M.Y.; writing—review and editing: P.C.-M. and M.G.-I. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Acknowledgments: We would like to thank D. Gaba and Winston Churchill for their contribution to making the world a better (safer) place: “*Now this is not the end. It is not even the beginning of the end. But it is, perhaps the end of the beginning*” of medical education (and peace).

Conflicts of Interest: The authors declare no conflict of interest.

References

- Rudd, K.E.; Johnson, S.C.; Agesa, K.M.; Shackelford, K.A.; Tsoi, D.; Kievlan, D.R.; Colombara, D.V.; Ikuta, K.S.; Kissoon, N.; Finfer, S.; et al. Global, regional, and national sepsis incidence and mortality, 1990–2017: Analysis for the Global Burden of Disease Study. *Lancet* **2020**, *395*, 200–211. [\[CrossRef\]](#) [\[PubMed\]](#)
- Reinhart, K.; Daniels, R.; Kissoon, N.; Machado, F.R.; Schachter, R.D.; Finfer, S. Recognizing Sepsis as a Global Health Priority —A WHO Resolution. *N. Engl. J. Med.* **2017**, *377*, 414–417. [\[CrossRef\]](#) [\[PubMed\]](#)
- Evans, L.; Rhodes, A.; Alhazzani, W.; Antonelli, M.; Coopersmith, C.M.; French, C.; Machado, F.R.; McIntyre, L.; Ostermann, M.; Prescott, H.C.; et al. Surviving sepsis campaign: International guidelines for management of sepsis and septic shock 2021. *Intensiv. Care Med.* **2021**, *47*, 1181–1247. [\[CrossRef\]](#)
- Trovato, G. SEPSIS. Educational and Best Practice Frontiers. Beyond the Boundaries of Fatality, Enhancing Clinical Skills and Precision Medicine. *Ther. Clin. Risk Manag.* **2020**, *16*, 87–93. [\[CrossRef\]](#)
- Okuda, Y.; Bryson, E.O.; DeMaria, S.; Jacobson, L.; Quinones, J.; Shen, B.; Levine, A.I. The Utility of Simulation in Medical Education: What Is the Evidence? Utility of simulation in medical education. *Mt. Sinai J. Med. J. Transl. Pers. Med.* **2009**, *76*, 330–343. [\[CrossRef\]](#) [\[PubMed\]](#)
- Nestel, D.; Groom, J.; Eikeland-Husebø, S.; O'Donnell, J.M. Simulation for Learning and Teaching Procedural Skills: The State of the Science. *Simul. Healthc. J. Soc. Simul. Healthc.* **2011**, *6*, S10–S13. [\[CrossRef\]](#) [\[PubMed\]](#)
- Vozenilek, J. See One, Do One, Teach One: Advanced Technology in Medical Education. *Acad. Emerg. Med.* **2004**, *11*, 1149–1154. [\[CrossRef\]](#) [\[PubMed\]](#)
- Rodriguez-Paz, J.M.; Kennedy, M.; Salas, E.; Wu, A.W.; Sexton, J.B.; Hunt, E.A.; Pronovost, P.J. Beyond “see one, do one, teach one”: Toward a different training paradigm. *Postgrad. Med. J.* **2009**, *85*, 244–249. [\[CrossRef\]](#)
- Aggarwal, R.; Mytton, O.T.; Derbrew, M.; Hananel, D.; Heydenburg, M.; Issenberg, B.; MacAulay, C.; Mancini, M.E.; Morimoto, T.; Soper, N.; et al. Training and simulation for patient safety. *Heart* **2010**, *19*, i34–i43. [\[CrossRef\]](#)
- Phrampus, P.E. Simulation and Integration into Patient Safety Systems. *Simul. Healthc. J. Soc. Simul. Healthc.* **2018**, *13*, 225–226. [\[CrossRef\]](#)
- Bienstock, J.; Heuer, A.P. A review on the evolution of simulation-based training to help build a safer future. *Medicine* **2022**, *101*, e29503. [\[CrossRef\]](#) [\[PubMed\]](#)
- Goldshtein, D.; Krensky, C.; Doshi, S.; Perelman, V.S. In situ simulation and its effects on patient outcomes: A systematic review. *BMJ Simul. Technol. Enhanc. Learn.* **2019**, *6*, 3–9. [\[CrossRef\]](#) [\[PubMed\]](#)
- Martin, A.; Cross, S.; Attoe, C. The Use of in situ Simulation in Healthcare Education: Current Perspectives. *Adv. Med. Educ. Pr.* **2020**, *11*, 893–903. [\[CrossRef\]](#) [\[PubMed\]](#)
- Qian, J.; Wang, Y.; Zhang, Y.; Zhu, X.; Rong, Q.; Wei, H. A Survey of the First-Hour Basic Care Tasks of Severe Sepsis and Septic Shock in Pediatric Patients and an Evaluation of Medical Simulation on Improving the Compliance of the Tasks. *J. Emerg. Med.* **2016**, *50*, 239–245. [\[CrossRef\]](#) [\[PubMed\]](#)
- Kessler, D.O.; Walsh, B.; Whitfill, T.; Gangadharan, S.; Gawel, M.; Brown, L.; Auerbach, M. Disparities in Adherence to Pediatric Sepsis Guidelines across a Spectrum of Emergency Departments: A Multicenter, Cross-Sectional Observational In Situ Simulation Study. *J. Emerg. Med.* **2015**, *50*, 403–415.e3. [\[CrossRef\]](#) [\[PubMed\]](#)

16. Leng, O.M.; Rothwell, C.; Buckton, A.; Elmer, C.; Illing, J.; Metcalf, J. Effect of In Situ High-Fidelity Simulation Training on the Emergency management of Pneumonia (INSTEP): A mixed-methods study. *BMJ Simul. Technol. Enhanc. Learn.* **2018**, *4*, 190–195. [[CrossRef](#)] [[PubMed](#)]
17. Sharara-Chami, R.; Sabounieh, R.; Zeineddine, R.; Banat, R.; Fayad, J.; Lakissian, Z. In Situ Simulation: An Essential Tool for Safe Preparedness for the COVID-19 Pandemic. *Simul. Healthc. J. Soc. Simul. Healthc.* **2020**, *15*, 303–309. [[CrossRef](#)]
18. Gordon, M.; Box, H.; Farrell, M.; Stewart, A. Non-technical skills learning in healthcare through simulation education: Integrating the SECTORS learning model and complexity theory. *BMJ Simul. Technol. Enhanc. Learn.* **2015**, *1*, 67–70. [[CrossRef](#)]
19. Fung, L.; Boet, S.; Bould, M.D.; Qosa, H.; Perrier, L.; Tricco, A.; Tavares, W.; Reeves, S. Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: A systematic review. *J. Interprofessional Care* **2015**, *29*, 433–444. [[CrossRef](#)]
20. Fleischmann-Struzek, C.; Mellhammar, L.; Rose, N.; Cassini, A.; Rudd, K.E.; Schlattmann, P.; Allegranzi, B.; Reinhart, K. Incidence and mortality of hospital- and ICU-treated sepsis: Results from an updated and expanded systematic review and meta-analysis. *Intensiv. Care Med.* **2020**, *46*, 1552–1562. [[CrossRef](#)]
21. Slade, E.; Tamber, P.S.; Vincent, J.L. The Surviving Sepsis Campaign: Raising awareness to reduce mortality. *Crit. Care* **2003**, *7*, 1–2. [[CrossRef](#)] [[PubMed](#)]
22. Dellinger, R.P.; Carlet, J.M.; Masur, H.; Gerlach, H.; Calandra, T.; Cohen, J.; Gea-Banacloche, J.; Keh, D.; Marshall, J.C.; Parker, M.M.; et al. Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock. *Crit. Care Med.* **2004**, *32*, 858–873. [[CrossRef](#)]
23. Dellinger, R.P.; Rhodes, A.; Evans, L.; Alhazzani, W.; Beale, R.; Jaeschke, R.; Machado, F.R.; Masur, H.; Osborn, T.; Parker, M.M.; et al. Surviving Sepsis Campaign. *Crit. Care Med.* **2023**, *51*, 431–444. [[CrossRef](#)] [[PubMed](#)]
24. Levy, M.M.; Dellinger, R.P.; Townsend, S.R.; Linde-Zwirble, W.T.; Marshall, J.C.; Bion, J.; Schorr, C.; Artigas, A.; Ramsay, G.; Beale, R.; et al. The Surviving Sepsis Campaign: Results of an international guideline-based performance improvement program targeting severe sepsis. *Intensive Care Med.* **2010**, *36*, 222–231. [[CrossRef](#)] [[PubMed](#)]
25. Jozwiak, M.; Monnet, X.; Teboul, J.-L. Implementing sepsis bundles. *Ann. Transl. Med.* **2016**, *4*, 332. [[CrossRef](#)] [[PubMed](#)]
26. Baghdadi, J.D.; Brook, R.H.; Uslan, D.Z.; Needleman, J.; Bell, D.S.; Cunningham, W.E.; Wong, M.D. Association of a Care Bundle for Early Sepsis Management with Mortality Among Patients With Hospital-Onset or Community-Onset Sepsis. *JAMA Intern. Med.* **2020**, *180*, 707–716. [[CrossRef](#)] [[PubMed](#)]
27. Levy, M.M.; Pronovost, P.J.; Dellinger, R.P.; Townsend, S.; Resar, R.K.; Clemmer, T.P.; Ramsay, G. Sepsis change bundles: Converting guidelines into meaningful change in behavior and clinical outcome. *Crit. Care Med.* **2004**, *32* (Suppl. S11), S595–S597. [[CrossRef](#)]
28. Deis, A.S.; Whiles, B.B.; Brown, A.R.; Satterwhite, C.L.; Simpson, S.Q. Three-Hour Bundle Compliance and Outcomes in Patients with Undiagnosed Severe Sepsis. *Chest* **2018**, *153*, 39–45. [[CrossRef](#)]
29. Damiani, E.; Donati, A.; Serafini, G.; Rinaldi, L.; Adrario, E.; Pelaia, P.; Busani, S.; Girardis, M. Effect of Performance Improvement Programs on Compliance with Sepsis Bundles and Mortality: A Systematic Review and Meta-Analysis of Observational Studies. *PLoS ONE* **2015**, *10*, e0125827. [[CrossRef](#)]
30. Cowan, S.; Holland, J.; Kane, A.; Frost, I. What are the barriers to improving care for patients with sepsis? *Clin. Med.* **2015**, *15* (Suppl. S3), S24. [[CrossRef](#)]
31. Watkins, R.R.; Haller, N.; Wayde, M.; Armitage, K.B. A Multicenter Survey of House Staff Knowledge About Sepsis and the “Surviving Sepsis Campaign Guidelines for Management of Severe Sepsis and Septic Shock”. *J. Intensiv. Care Med.* **2017**, *35*, 187–190. [[CrossRef](#)]
32. Choy, C.; Liaw, S.; Goh, E.; See, K.; Chua, W. Impact of sepsis education for healthcare professionals and students on learning and patient outcomes: A systematic review. *J. Hosp. Infect.* **2022**, *122*, 84–95. [[CrossRef](#)] [[PubMed](#)]
33. Fiest, K.M.; Krewulak, K.D.; Brundin-Mather, R.; Leia, M.P.; Fox-Robichaud, A.; Lamontagne, F.; Leigh, J.P.; Canada, F.S. Patient, Public, and Healthcare Professionals’ Sepsis Awareness, Knowledge, and Information Seeking Behaviors: A Scoping Review*. *Crit. Care Med.* **2022**, *50*, 1187–1197. [[CrossRef](#)] [[PubMed](#)]
34. Domínguez-Torres, L.C.; Vega-Peña, N.V. Las pirámides de la educación médica: Una síntesis sobre su conceptualización y utilidad. *Rev. Colomb. Obstet. Ginecol.* **2023**, *74*, 163–174. [[CrossRef](#)] [[PubMed](#)]
35. Falletta, S. *Evaluating Training Programs*; Kirkpatrick, D.L., Kirkpatrick, J.D., Eds.; Berrett-Koehler Publishers: San Francisco, CA, USA, 2009.
36. Frye, A.W.; Hemmer, P.A. Program evaluation models and related theories: AMEE Guide No. 67. *Med. Teach.* **2012**, *34*, e288–e299. [[CrossRef](#)] [[PubMed](#)]
37. Rababa, M.; Hamad, D.B.; Hayajneh, A.A. Sepsis assessment and management in critically ill adults: A systematic review. *PLoS ONE* **2022**, *17*, e0270711. [[CrossRef](#)] [[PubMed](#)]
38. Swanwick, T. Understanding Medical Education. In *Understanding Medical Education: Evidence, Theory, and Practice*, 2nd ed.; Wiley Blackwell: Hoboken, NJ, USA, 2014.
39. Ferrer, R. Improvement in Process of Care and Outcome After a Multicenter Severe Sepsis Educational Program in Spain. *JAMA.* **2008**, *299*, 2294. [[CrossRef](#)] [[PubMed](#)]

40. Li, C.-H.; Kuan, W.-S.; Mahadevan, M.; Daniel-Underwood, L.; Chiu, T.-F.; Nguyen, H.B. A multinational randomised study comparing didactic lectures with case scenario in a severe sepsis medical simulation course. *Emerg. Med. J.* **2011**, *29*, 559–564. [\[CrossRef\]](#)
41. Lucey, C.R.; Johnston, S.C. The Transformational Effects of COVID-19 on Medical Education. *JAMA* **2020**, *324*, 1033–1034. [\[CrossRef\]](#)
42. Cook, D.A.; Garside, S.; Levinson, A.J.; Dupras, D.M.; Montori, V.M. What do we mean by web-based learning? A systematic review of the variability of interventions: What do we mean by web-based learning? *Med. Educ.* **2010**, *44*, 765–774. [\[CrossRef\]](#)
43. Walsh, K. E-learning in medical education: The potential environmental impact. *Educ. Prim. Care* **2017**, *29*, 104–106. [\[CrossRef\]](#) [\[PubMed\]](#)
44. Li, C.; He, J.; Yuan, C.; Chen, B.; Sun, Z. The effects of blended learning on knowledge, skills, and satisfaction in nursing students: A meta-analysis. *Nurse Educ. Today* **2019**, *82*, 51–57. [\[CrossRef\]](#) [\[PubMed\]](#)
45. Van Gaalen, A.E.J.; Brouwer, J.; Schönrock-Adema, J.; Bouwkamp-Timmer, T.; Jaarsma, A.D.C.; Georgiadis, J.R. Gamification of health professions education: A systematic review. *Adv. Health Sci. Educ.* **2021**, *26*, 683–711. [\[CrossRef\]](#) [\[PubMed\]](#)
46. Evans, K.H.; Daines, W.; Tsui, J.; Strehlow, M.; Maggio, P.; Shieh, L. Septris: A Novel, Mobile, Online, Simulation Game That Improves Sepsis Recognition and Management. *Acad. Med.* **2015**, *90*, 180–184. [\[CrossRef\]](#) [\[PubMed\]](#)
47. Ribeiro, C.; Monteiro, M.; Hauge, J.B.; Pereira, J.; Antunes, T. Sepsis Fast Track: A simulation game for Clinical education based on the Sepsis Fast Track. protocol. In Proceedings of the 2016 IEEE International Conference on Serious Games and Applications for Health, Orlando, FL, USA, 11–13 May 2016; pp. 1–8. [\[CrossRef\]](#)
48. Alejandre, C.; Corniero, P.; Claret, G.; Alaez, C.; Esteban, E.; Jordan, I. New Resident Training Strategy Based on Gamification Techniques: An Escape Room on Sepsis in Children. *Children* **2022**, *9*, 1503. [\[CrossRef\]](#) [\[PubMed\]](#)
49. Lighthall, G.K.; Bahmani, D.; Gaba, D. Evaluating the Impact of Classroom Education on the Management of Septic Shock Using Human Patient Simulation. *Simul. Heal. J. Soc. Simul. Health* **2016**, *11*, 19–24. [\[CrossRef\]](#) [\[PubMed\]](#)
50. Breuer, R.K.; Hassinger, A.B. Impact of a Multidisciplinary Sepsis Initiative on Knowledge and Behavior in a Pediatric Center. *Pediatr. Qual. Saf.* **2020**, *5*, e267. [\[CrossRef\]](#) [\[PubMed\]](#)
51. Chung, H.-O.; Medina, D.; Fox-Robichaud, A. Interprofessional sepsis education module: A pilot study. *CJEM* **2015**, *18*, 143–145. [\[CrossRef\]](#)
52. Ventre, R.; Pardoe, C.; Cripps, D. Millennial learners—A blended approach to simulation for sepsis. *Futur. Health J.* **2020**, *7*, s108–s109. [\[CrossRef\]](#)
53. Chua, W.L.; Legido-Quigley, H.; Jones, D.; Hassan, N.B.; Tee, A.; Liaw, S.Y. A call for better doctor–nurse collaboration: A qualitative study of the experiences of junior doctors and nurses in escalating care for deteriorating ward patients. *Aust. Crit. Care* **2020**, *33*, 54–61. [\[CrossRef\]](#)
54. Cory, M.J.; Colman, N.; McCracken, C.E.; Hebbar, K.B. Rapid Cycle Deliberate Practice Versus Reflective Debriefing for Pediatric Septic Shock Training*. *Pediatr. Crit. Care Med.* **2019**, *20*, 481–489. [\[CrossRef\]](#) [\[PubMed\]](#)
55. Turi, S.K.; Von Ah, D. Implementation of Early Goal-directed Therapy for Septic Patients in the Emergency Department: A Review of the Literature. *J. Emerg. Nurs.* **2013**, *39*, 13–19. [\[CrossRef\]](#) [\[PubMed\]](#)
56. Gaba, D.M. The future vision of simulation in health care. *BMJ Qual. Saf.* **2004**, *13*, i2–i10. [\[CrossRef\]](#)
57. Park, C.S.; Clark, L.; Gephardt, G.; Robertson, J.M.; Miller, J.; Downing, D.K.; Koh, B.L.S.; Bryant, K.D.; Grant, D.; Pai, D.R.; et al. Manifesto for healthcare simulation practice. *BMJ Simul. Technol. Enhanc. Learn.* **2020**, *6*, 365–368. [\[CrossRef\]](#) [\[PubMed\]](#)
58. Rudolph, J.W.; Raemer, D.B.; Simon, R. Establishing a Safe Container for Learning in Simulation: The Role of the Presimulation Briefing. *Simul. Healthc. J. Soc. Simul. Healthcare* **2014**, *9*, 339–349. [\[CrossRef\]](#)
59. Deutsch, E.S.; Dong, Y.; Halamek, L.P.; Rosen, M.A.; Taekman, J.M.; Rice, J. Leveraging Health Care Simulation Technology for Human Factors Research: Closing the Gap Between Lab and Bedside. *Hum. Factors* **2016**, *58*, 1082–1095. [\[CrossRef\]](#) [\[PubMed\]](#)
60. Macrae, C. Imitating Incidents: How Simulation Can Improve Safety Investigation and Learning from Adverse Events. *Sim Healthcare* **2018**, *13*, 227–232. [\[CrossRef\]](#) [\[PubMed\]](#)
61. Burden, A.R. High-Fidelity Simulation Education and Crisis Resource Management. *Anesthesiol. Clin.* **2020**, *38*, 745–759. [\[CrossRef\]](#)
62. Roussin, C.J.; Weinstock, P. SimZones: An Organizational Innovation for Simulation Programs and Centers. *Acad. Med.* **2017**, *92*, 1114–1120. [\[CrossRef\]](#)
63. Fey, M.K.; Roussin, C.J.; Rudolph, J.W.; Morse, K.J.; Palaganas, J.C.; Szyld, D. Teaching, coaching, or debriefing With Good Judgment: A roadmap for implementing “With Good Judgment” across the SimZones. *Adv. Simul.* **2022**, *26*, 39. [\[CrossRef\]](#)
64. Fanning, R.M.; Gaba, D.M. The Role of Debriefing in Simulation-Based Learning. *Simul. Healthc. J. Soc. Simul. Healthc.* **2007**, *2*, 115–125. [\[CrossRef\]](#) [\[PubMed\]](#)
65. Motola, I.; Devine, L.A.; Chung, H.S.; Sullivan, J.E.; Issenberg, S.B. Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. *Med. Teach.* **2013**, *35*, e1511–e1530. [\[CrossRef\]](#)
66. Levine, A.I.; DeMaria, S.; Schwartz, A.D.; Sim, A.J. *The Comprehensive Textbook of Healthcare Simulation*; Springer: New York, NY, USA, 2013.
67. Bessmann, E.L.; Østergaard, H.T.; Nielsen, B.U.; Russell, L.; Paltved, C.; Østergaard, D.; Konge, L.; Nayahangan, L.J. Consensus on technical procedures for simulation-based training in anaesthesiology: A Delphi-based general needs assessment. *Acta Anaesthesiol. Scand.* **2019**, *63*, 720–729. [\[CrossRef\]](#) [\[PubMed\]](#)

68. Aherne, M.; Lamble, W.; Davis, P. Continuing medical education, needs assessment, and program development: Theoretical constructs. *J. Contin. Educ. Health Prof.* **2001**, *21*, 6–14. [[CrossRef](#)] [[PubMed](#)]
69. Zern, S.C.; Marshall, W.J.; Shewokis, P.A.; Vest, M.T. Use of simulation as a needs assessment to develop a focused team leader training curriculum for resuscitation teams. *Adv. Simul.* **2020**, *5*, 1–7. [[CrossRef](#)] [[PubMed](#)]
70. McKimm, J.; Forrest, K. *Essential Simulation in Clinical Education*; Wiley Blackwell: Hoboken, NJ, USA, 2013; pp. 1–10. [[CrossRef](#)]
71. Lopreiato, J.O. *Healthcare Simulation Dictionary*; Agency for Healthcare Research and Quality: Rockville, MD, USA, 2016.
72. Rutherford-Hemming, T.; Lioce, L.; Breymier, T. Guidelines and Essential Elements for Prebriefing. *Simul. Health J. Soc. Simul. Health.* **2019**, *14*, 409–414. [[CrossRef](#)] [[PubMed](#)]
73. Eller, S.; Rudolph, J.; Barwick, S.; Janssens, S.; Bajaj, K. Leading change in practice: How “longitudinal prebriefing” nurtures and sustains in situ simulation programs. *Adv. Simul.* **2023**, *8*, 1–9. [[CrossRef](#)] [[PubMed](#)]
74. Benishek, L.E.; Lazzara, E.H.; Gaught, W.L.; Arcaro, L.L.; Okuda, Y.; Salas, E. The Template of Events for Applied and Critical Healthcare Simulation (TEACH Sim): A Tool for Systematic Simulation Scenario Design. *Simul. Healthc. J. Soc. Simul. Healthc.* **2015**, *10*, 21–30. [[CrossRef](#)]
75. Gómez-López, L.; Tena-Blanco, B.; Bergè-Ramos, R.; Coca-Martínez, M.; Forero-Cortés, C.; Gomar-Sancho, C. Nueva plantilla para diseñar escenarios de simulación: Interrelación de elementos en un vistazo. *Educ. Méd.* **2018**, *19*, 350–359. [[CrossRef](#)]
76. De Melo, B.C.P.; Falbo, A.R.; Souza, E.S.; Muijtjens, A.M.M.; Van Merriënboer, J.J.G.; Van Der Vleuten, C.P.M. The limited use of instructional design guidelines in healthcare simulation scenarios: An expert appraisal. *Adv. Simul.* **2022**, *7*, 30. [[CrossRef](#)]
77. Maestre, J.M.; Sancho, R.; Rábago, J.L.; Martínez, A.; Rojo, E. Diseño y desarrollo de escenarios de simulación clínica: Análisis de cursos para el entrenamiento de anestesiólogos. *FEM* **2013**, *16*, 49–57. [[CrossRef](#)]
78. Issenberg, S.B.; Mcgaghie, W.C.; Petrusa, E.R.; Gordon, D.L.; Scalese, R.J. Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. *Med. Teach.* **2005**, *27*, 10–28. [[CrossRef](#)] [[PubMed](#)]
79. Voyer, S.; Hatala, R. Debriefing and Feedback: Two Sides of the Same Coin? *Simul. Healthc. J. Soc. Simul. Healthc.* **2015**, *10*, 67–68. [[CrossRef](#)] [[PubMed](#)]
80. Sawyer, T.; Eppich, W.; Brett-Fleegler, M.; Grant, V.; Cheng, A. More Than One Way to Debrief: A Critical Review of Healthcare Simulation Debriefing Methods. *Sim. Healthc.* **2016**, *11*, 209–217. [[CrossRef](#)] [[PubMed](#)]
81. Capogna, G.; Ingrassia, P.L.; Capogna, E.; Bernardini, M.; Valteroni, E.; Pietrabissa, G.; Nardone, G. *Strategic Debriefing for Advanced Simulation*; Springer: Berlin/Heidelberg, Germany, 2022. [[CrossRef](#)]
82. Gaba, D.M. *Crisis Management in Anesthesia*, 2nd ed.; Elsevier: Amsterdam, The Netherlands, 2015.
83. Phillips, E.C.; Smith, S.E.; Tallentire, V.; Blair, S. Systematic review of clinical debriefing tools: Attributes and evidence for use. *BMJ Qual. Saf.* **2023**, 65–87. [[CrossRef](#)] [[PubMed](#)]
84. Arriaga, A.F.; Szyld, D.; Pian-Smith, M.C. Real-Time Debriefing After Critical Events. *Anesthesiol. Clin.* **2020**, *38*, 801–820. [[CrossRef](#)] [[PubMed](#)]
85. Toews, A.J.; Martin, D.E.; Chernomas, W.M. Clinical debriefing: A concept analysis. *J. Clin. Nurs.* **2021**, *30*, 1491–1501. [[CrossRef](#)] [[PubMed](#)]
86. Twigg, S. Clinical event debriefing: A review of approaches and objectives. *Curr. Opin. Pediatr.* **2020**, *32*, 337–342. [[CrossRef](#)]
87. Purdy, E.; Borchert, L.; El-Bitar, A.; Isaacson, W.; Bills, L.; Brazil, V. Taking simulation out of its “safe container”—Exploring the bidirectional impacts of psychological safety and simulation in an emergency department. *Adv. Simul.* **2022**, *7*, 1–9. [[CrossRef](#)]
88. Kurup, V.; Matei, V.; Ray, J. Role of in-situ simulation for training in healthcare: Opportunities and challenges. *Curr. Opin. Anaesthesiol.* **2017**, *30*, 755–760. [[CrossRef](#)]
89. Wu, Q.; Wang, Y.; Lu, L.; Chen, Y.; Long, H.; Wang, J. Virtual Simulation in Undergraduate Medical Education: A Scoping Review of Recent Practice. *Front. Med.* **2022**, *9*, 855403. [[CrossRef](#)] [[PubMed](#)]
90. Cheng, A.; Grant, V.; Huffman, J.; Burgess, G.; Szyld, D.; Robinson, T.; Eppich, W. Coaching the Debrief: Peer Coaching to Improve Debriefing Quality in Simulation Programs. *Sim. Healthc.* **2017**, *12*, 319–325. [[CrossRef](#)] [[PubMed](#)]
91. Ortiz-Ruiz, G.; Maestre, J.M.; Szyld, D.; Del Moral, I.; Rudolph, J.W.; Díaz, G. *Sepsis*; Springer: New York, NY, USA, 2018; pp. 151–166.
92. Sackett, D.L.; Rosenberg, W.M.; Gray, J.A.; Haynes, R.B.; Richardson, W.S. Evidence based medicine: What it is and what it isn't. *BMJ* **1996**, *312*, 71–72. [[CrossRef](#)] [[PubMed](#)]
93. Leape, L.L.; Berwick, D.M.; Bates, D.W. What Practices Will Most Improve Safety? Evidence-Based Medicine Meets Patient Safety. *JAMA* **2002**, *288*, 501. [[CrossRef](#)] [[PubMed](#)]
94. Ziv, A.; Wolpe, P.R.; Small, S.D.; Glick, S. Simulation-Based Medical Education: An Ethical Imperative. *Simul. Healthc. J. Soc. Simul. Healthc.* **2006**, *1*, 252–256. [[CrossRef](#)] [[PubMed](#)]
95. Pope, C.; van Royen, P.; Baker, R. Qualitative methods in research on healthcare quality. *Heart* **2002**, *11*, 148–152. [[CrossRef](#)] [[PubMed](#)]
96. Nguyen, H.B.; Daniel-Underwood, L.; Van Ginkel, C.; Wong, M.; Lee, D.; Lucas, A.S.; Palaganas, J.; Banta, D.; Denmark, T.K.; Clem, K. An educational course including medical simulation for early goal-directed therapy and the severe sepsis resuscitation bundle: An evaluation for medical student training. *Resuscitation* **2009**, *80*, 674–679. [[CrossRef](#)]
97. Ottestad, E.; Boulet, J.R.; Lighthall, G.K. Evaluating the management of septic shock using patient simulation. *Crit. Care Med.* **2007**, *35*, 769–775. [[CrossRef](#)]

98. Smith, D.; Miller, D.; Cukor, J. Can Simulation Measure Differences in Task-Switching Ability Between Junior and Senior Emergency Medicine Residents? *West. J. Emerg. Med.* **2016**, *17*, 149–152. [\[CrossRef\]](#)
99. Dugan, M.C.; McCracken, C.E.; Hebbar, K.B. Does Simulation Improve Recognition and Management of Pediatric Septic Shock, and If One Simulation Is Good, Is More Simulation Better? *Pediatr. Crit. Care Med.* **2016**, *17*, 605–614. [\[CrossRef\]](#)
100. Palleschi, M.T.; Sirianni, S.; O'Connor, N.; Dunn, D.; Hasenau, S.M. An Interprofessional Process to Improve Early Identification and Treatment for Sepsis. *J. Health Qual.* **2014**, *36*, 23–31. [\[CrossRef\]](#) [\[PubMed\]](#)
101. Edwards, S.; Platt, S.; Lenguerrand, E.; Winter, C.; Mears, J.; Davis, S.; Lucas, G.; Hotton, E.; Fox, R.; Draycott, T.; et al. Effective interprofessional simulation training for medical and midwifery students. *BMJ Simul. Technol. Enhanc. Learn.* **2015**, *1*, 87–93. [\[CrossRef\]](#) [\[PubMed\]](#)
102. Armenia, S.; Thangamathesvaran, L.; Caine, A.D.; King, N.; Kunac, A.; Merchant, A.M. The Role of High-Fidelity Team-Based Simulation in Acute Care Settings: A Systematic Review. *Surg. J.* **2018**, *04*, e136–e151. [\[CrossRef\]](#) [\[PubMed\]](#)
103. Weile, J.; Nebbsjerg, M.A.; Ovesen, S.H.; Paltved, C.; Ingeman, M.L. Simulation-based team training in time-critical clinical presentations in emergency medicine and critical care: A review of the literature. *Adv. Simul.* **2021**, *6*, 1–12. [\[CrossRef\]](#) [\[PubMed\]](#)
104. Davis, A.H.; Hayes, S.P. Simulation to Manage the Septic Patient in the Intensive Care Unit. *Crit. Care Nurs. Clin. North. Am.* **2018**, *30*, 363–377. [\[CrossRef\]](#) [\[PubMed\]](#)
105. Nishisaki, A.; Hales, R.; Biagas, K.; Cheifetz, I.; Corriveau, C.; Garber, N.; Hunt, E.; Jarrah, R.; McCloskey, J.; Morrison, W.; et al. A multi-institutional high-fidelity simulation “boot camp” orientation and training program for first year pediatric critical care fellows. *Pediatr. Crit. Care Med.* **2009**, *10*, 157–162. [\[CrossRef\]](#) [\[PubMed\]](#)
106. Adler, M.D.; Trainor, J.L.; Siddall, V.J.; McGaghie, W.C. Development and Evaluation of High-Fidelity Simulation Case Scenarios for Pediatric Resident Education. *Acad. Pediatr.* **2007**, *7*, 182–186. [\[CrossRef\]](#)
107. Jenkins, Z.; Laswell, E.; Stute, N. WITHDRAWN: Evaluation of a sepsis teaching rounds simulation for pharmacy students. *Curr. Pharm. Teach. Learn.* **2019**, *11*, 936–942. [\[CrossRef\]](#)
108. Storey, A.; White, K.; Treder, K.; Woodhams, E.; Bell, S.; Cannon, R. First-Trimester Abortion Complications: Simulation Cases for OB/GYN Residents in Sepsis and Hemorrhage. *MedEdportal* **2020**, *16*, 10995. [\[CrossRef\]](#)
109. Webb, T.T.; Boyer, T.J.; Mitchell, S.A.; Eddy, C. Intraoperative Sepsis: A Simulation Case for Anesthesiology Residents. *MedEdPORTAL* **2020**, *16*, 10886. [\[CrossRef\]](#)
110. Weil, J.; Cassara, M. Occult Sepsis Masked by Trauma—Exploration of Cognitive Biases Through Simulation with Emergency Medicine Residents. *MedEdPORTAL* **2020**, *16*. [\[CrossRef\]](#) [\[PubMed\]](#)
111. Diaz, D.A.; Anderson, M.; Quelly, S.B.; Clark, K.D.; Talbert, S. Early Recognition of Pediatric Sepsis Simulation Checklist—An Exploratory Study. *J. Pediatr. Nurs.* **2019**, *50*, 25–30. [\[CrossRef\]](#) [\[PubMed\]](#)
112. Anderson, N.B.; Chan, M.-K.; Gutierrez, C.; Kambestad, K.; Walker, V. Identification and Management of Pediatric Sepsis: A Medical Student Curricular Supplement for PICU and NICU Rotations. *MedEdPORTAL* **2021**, *17*, 11142. [\[CrossRef\]](#) [\[PubMed\]](#)
113. Mihaljevic, S.E.D.; Howard, V.M.E. Incorporating Interprofessional Evidenced-Based Sepsis Simulation Education for Certified Nursing Assistants (CNAs) and Licensed Care Providers Within Long-term Care Settings for Process and Quality Improvement. *Crit. Care Nurs. Q.* **2016**, *39*, 24–33. [\[CrossRef\]](#) [\[PubMed\]](#)
114. Fernández-Ros, N.; Alegre, F.; Huerta, A.; Gil-Alzugaray, B.; Landecho, M.F.; García, N.; Quiroga, J.; Lucena, J.F.M. Acquiring sepsis competencies through simulation-based learning bundle during intermediate care unit internship. *Medicine* **2021**, *100*, e24483. [\[CrossRef\]](#) [\[PubMed\]](#)
115. Martin, D.; Bekiaris, B.; Hansen, G. Mobile emergency simulation training for rural health providers. *Rural. Remote. Heal.* **2017**, *17*, 4057. [\[CrossRef\]](#) [\[PubMed\]](#)
116. Powell, E.S.M.; Bond, W.F.; Barker, L.T.; Cooley, K.R.; Lee, J.; Vincent, A.L.D.; Vozenilek, J.A. In Situ Simulation for Adoption of New Technology to Improve Sepsis Care in Rural Emergency Departments. *J. Patient Saf.* **2022**, *18*, 302–309. [\[CrossRef\]](#)
117. Steiner, M.; Langgartner, M.; Cardona, F.; Waldhör, T.; Schwindt, J.; Haiden, N.; Berger, A. Significant Reduction of Catheter-associated Blood Stream Infections in Preterm Neonates After Implementation of a Care Bundle Focusing on Simulation Training of Central Line Insertion. *Pediatr. Infect. Dis. J.* **2015**, *34*, 1193–1196. [\[CrossRef\]](#)
118. Tofil, N.M.; Lin, Y.; Zhong, J.; Peterson, D.T.; White, M.L.; Grant, V.; Grant, D.J.; Gottesman, R.; Sudikoff, S.N.; Adler, M.; et al. Workload of Team Leaders and Team Members During a Simulated Sepsis Scenario. *Pediatr. Crit. Care Med.* **2017**, *18*, e423–e427. [\[CrossRef\]](#)
119. Meurling, L.; Hedman, L.; Liddefelt, K.-J.; Escher, C.; Felländer-Tsai, L.; Wallin, C.-J. Comparison of high- and low equipment fidelity during paediatric simulation team training: A case control study. *BMC Med. Educ.* **2014**, *14*, 221. [\[CrossRef\]](#)
120. Englert, N.C.; McDermott, D. Back to Fundamentals: Using High- and Low-Fidelity Simulation to Provide Reinforcement of Preventative Measures for Sepsis. *Crit. Care Nurs. Q.* **2016**, *39*, 14–23. [\[CrossRef\]](#) [\[PubMed\]](#)
121. Chua, W.L.; Ooi, S.L.; Chan, G.W.H.; Lau, T.C.; Liaw, S.Y. The Effect of a Sepsis Interprofessional Education Using Virtual Patient Telesimulation on Sepsis Team Care in Clinical Practice: Mixed Methods Study. *J. Med. Internet Res.* **2022**, *24*, e35058. [\[CrossRef\]](#) [\[PubMed\]](#)
122. Toto, R.L.; Vorel, E.S.; Tay, K.-Y.; Good, G.L.; Berdinka, J.M.; Peled, A.; Leary, M.; Chang, T.P.; Weiss, A.K.; Balamuth, F.B. Augmented Reality in Pediatric Septic Shock Simulation: Randomized Controlled Feasibility Trial. *JMIR Med. Educ.* **2021**, *7*, e29899. [\[CrossRef\]](#) [\[PubMed\]](#)

123. McNaughten, B.; Storey, L.; Corkin, D.; Cardwell, P.; Thompson, A.; Bourke, T.; O'Donoghue, D. Familiarity with the clinical environment, achieved by priming, improves time to antibiotic administration in a simulated paediatric sepsis scenario: A randomised control trial. *Arch. Dis. Child.* **2020**, *106*, 467–469. [[CrossRef](#)] [[PubMed](#)]
124. Geis, G.L.; Wheeler, D.S.; Bunger, A.; Militello, L.G.; Taylor, R.G.; Bauer, J.P.; Byczkowski, T.L.; Kerrey, B.T.; Patterson, M.D. A Validation Argument for a Simulation-Based Training Course Centered on Assessment, Recognition, and Early Management of Pediatric Sepsis. *Simul. Heal. J. Soc. Simul. Health* **2018**, *13*, 16–26. [[CrossRef](#)] [[PubMed](#)]
125. Hunt, E.A.; Duval-Arnould, J.M.; Nelson-McMillan, K.L.; Bradshaw, J.H.; Diener-West, M.; Perretta, J.S.; Shilkofski, N.A. Pediatric resident resuscitation skills improve after “Rapid Cycle Deliberate Practice” training. *Resuscitation* **2014**, *85*, 945–951. [[CrossRef](#)] [[PubMed](#)]
126. Aponte-Patel, L.; Salavitarab, A.; Fazzio, P.; Geneslaw, A.S.; Good, P.; Sen, A.I. Implementation of a Formal Debriefing Program After Pediatric Rapid Response Team Activations. *J. Grad. Med. Educ.* **2018**, *10*, 203–208. [[CrossRef](#)] [[PubMed](#)]
127. Galligan, M.M.; Wolfe, H.A.; Papili, K.E.; Porter, E.; O'shea, K.; Liu, H.; Colfer, A.; Neiswender, K.; Granahan, K.; McGowan, N.; et al. Implementation of a Multidisciplinary Debriefing Process for Pediatric Ward Deterioration Events. *Hosp. Pediatr.* **2021**, *11*, 454–461. [[CrossRef](#)]
128. Berchtenbreiter, K.; Innes, K.; Watterson, J.; Nickson, C.P.; Wong, P. Intensive care unit nurses' perceptions of debriefing after critical incidents: A qualitative descriptive study. *Aust. Crit. Care* **2023**. [[CrossRef](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.