Medical Simulation Centers as a National Resource in Medical Education

Executive Summary

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Simulation-based medical education (SBME) has become a cornerstone of clinical training by providing a safe and controlled environment for acquiring and practicing skills without exposing patients and students to real risk. This review traces the evolution of SBME from its historical origins (e.g., 17th-century obstetric models used to practice childbirth) to contemporary high-fidelity simulations, presenting seminal studies that established the foundations of SBME along with recent evidence. The effectiveness and educational impact of SBME are examined in comparison with traditional medical education. Consistent findings from meta-analyses demonstrate a clear advantage of SBME for skills acquisition, particularly when embedded within structured, deliberate practice frameworks. The majority of medical simulation experience to date has been in post-graduate professional team training. The gradual assimilation and comprehensive embedding of medical simulation within undergraduate medical education promises to enhance both the quality and relevance of students' preparation for clinical practice.

Training in medical simulation centers promotes the development of both technical and non-technical skills through repeated, goal-directed practice, immediate feedback, and meaningful curricular integration. A growing body of international research examines the impact of SBME on patient outcomes, with systematic reviews reporting small to moderate improvements in care-related metrics. Nevertheless, common methodological limitations persist, including unit-of-analysis errors and insufficient validity evidence.

The review also addresses technological innovations—virtual reality (VR) and artificial intelligence (AI), which enhance representational fidelity and enable personalized learning. VR simulations offer cost-effective, repeatable practice opportunities, while AI-driven scenarios provide adaptive feedback and individualized learning pathways. Finally, global implementation challenges are discussed, including cost, equipment requirements, and faculty training needs, which slow SBME adoption in low- and middle-income countries. Addressing these barriers through cost-sharing, cross-cultural scenario design, and integrated curricula is essential to realizing the full potential of SBME.

Chapter 1 Budgeting, Resources, and Inter-Institutional Collaboration in Medical Simulation

Medical simulation centers in Israel currently constitute a central pillar in the training of physicians and other healthcare professionals and in the transition toward competency-

based medical education (CBME). SBME plays a key role in this process, with extensive research demonstrating its substantial contribution to improving clinical skills, communication, and patient safety. However, operating simulation centers entails high costs and is often conducted without stable, designated funding, leading to disparities and undermining the stability and quality of training. Considering international accreditation requirements, a national initiative is needed to ensure sustainable funding, standardization, and resource sharing. It is recommended that simulation centers be formally recognized as national infrastructure and that a national consortium be established to unite medical faculties, universities, and additional institutions engaged in healthcare education. This consortium would define uniform standards, manage joint procurement and maintenance, develop shared educational content, and promote instructor training and a professional community of practice.

Funding should be based on a blended model combining multi-year governmental support, institutional participation, and external partnerships, leveraging economies of scale and reducing duplication. Such an initiative is expected to enhance the quality of medical training, reduce errors, and promote efficient use of national resources for the benefit of the healthcare system as a whole.

Chapter 2 Core Aspects of Medical Education in the Context of Simulation Center Activities

This chapter summarizes the work of a group tasked with formulating national recommendations for integrating simulation into medical education in Israel. The recommendations include defining uniform core curricular content across all medical schools, including medical communication, first aid and resuscitation, basic clinical skills, risk management, and patient safety, and embedding these components across the preclinical and clinical phases of training in accordance with best-practice principles.

To support implementation, dissemination, and ongoing updating, the establishment of a National Committee for Simulation-Based Medical Education is recommended, operating under the formal mandate of the Council for Higher Education or an equivalent body. The committee should be chaired by a senior physician and include representatives from all the medical schools, the Scientific Council of the Israeli Medical Association, simulation centers, subject-matter experts, and specialists in budgeting, pedagogy, technology and artificial intelligence, as well as representatives from nursing and other health professions.

The committee's mandate would include ensuring standardization, funding, and quality assurance of instruction, leading instructor-training programs ("Train the Trainers"), and

fostering research and development. In addition, simulation centers should be recognized as a nationally funded resource under the Ministry of Health, particularly for training students in emergency preparedness, pandemics, and wartime scenarios.

Chapter 3 Simulation as a Tool for Implementing CBME in Medical Schools

Competency-based medical education (CBME) represents a shift from time-based training to an outcomes-focused approach centered on achieving defined competencies. This approach requires graduates to demonstrate independent, professional, and safe performance of these competencies. Alongside skills training, CBME relies on continuous, precise assessment of performance.

Given its practice-oriented nature, simulation is uniquely suited to play a central role within CBME curricula. Two key features make simulation an optimal response to CBME challenges. First, it enables systematic instructional methods, such as deliberate practice, immediate feedback, and direct assessment across a broad spectrum of skills, from technical and procedural skills (e.g., resuscitation or invasive procedures) to cognitive-emotional competencies (e.g., interpersonal communication, teamwork, and decision-making). Second, simulation allows learners to practice skills at varying levels of complexity before encountering real patients, thereby creating a safe training environment for both learners and patients. Beyond its training role, simulation also serves as a standardized assessment tool for systematically evaluating learner progression and readiness for independent practice.

A comprehensive discussion of CBME within the context of SBME implementation in Israel is essential, as CBME provides the academic framework and educational rationale for building a national simulation infrastructure. CBME ensures a focus on clearly defined learning outcomes, as articulated by the Scientific Council of the Israeli Medical Association, and it creates a coherent educational continuum from undergraduate education to residency training. Leveraging simulation within CBME supports uniform national standards of professional competence among graduates, strengthening the justification for investment in simulation centers as a key mechanism for improving patient safety and quality of care. Accordingly, in this chapter, we recommend transitioning simulation from an “optional” to a “mandatory” educational tool and defining compulsory core competencies to be trained through simulation-based methods, explicitly linking competencies to specific skills practice.

Chapter 4 The Physician of the Future and Adapting Medical Training to the Technological Era

This chapter focuses on the profile of the future physician, emphasizing the role of simulation as a central component of experiential learning and competency development across clinical, technical, and communication domains. It outlines a framework for uniform core content to be taught through simulation across all Israeli medical schools and recommends establishing a national committee to lead implementation and standardization. The chapter further highlights the importance of integrating innovative approaches, such as virtual reality, artificial intelligence, and CBME, as integral elements of medical training. In conclusion, it underscores that SBME is a prerequisite for training future physicians who are professionally competent, humane, and prepared to meet the challenges of modern healthcare systems.

Chapter 5 Generative Artificial Intelligence in Medical Simulation: Potential, Challenges, and Policy Recommendations for Israel

The integration of generative artificial intelligence into medical simulation offers substantial educational potential alongside significant challenges and risks. This chapter presents a comprehensive review and evidence-based recommendations drawn from recent literature, surveys, and interviews with Israeli leaders in medical education and simulation. Identified benefits include personalized learning, immediate feedback, enhanced debriefing, and expansion of scenario diversity. Accompanying challenges include the need to safeguard essential human competencies, the requirement for dedicated faculty training, and considerable financial investment. Risks arising from the reliability limitations of large language models, such as bias and hallucinations, highlight the need for clear standards and robust oversight mechanisms.

Given the considerable potential of AI-enhanced simulation and the imperative to advance and refine these educational experiences, it is essential to develop faculty capable of using AI judiciously while preventing erosion of independent judgment, integrative knowledge acquisition, and flexible clinical reasoning. There is also a need for clearly defined methodologies and standards for AI use, as well as the development of explicit policies and regulation at both the simulation center and national levels. Inter-institutional collaboration is proposed as a critical strategy for improving educational quality while reducing costs.

Chapter 6 Faculty Development for Simulation-Based Teaching

Simulation-based teaching (SBT) has become a central component of health professions education, and is well established as an effective pedagogical tool for enhancing clinical skills and patient safety. However, its full effectiveness depends critically on the quality and expertise of the instructors. A substantial gap exists between instructors' clinical expertise and the pedagogical and operational training required for optimal facilitation in simulation environments. This chapter presents a comprehensive analysis of these challenges based on a literature review and findings from a national survey distributed among Israeli medical education institutions. It describes the work process of an expert group and provides a strategic recommendations model aimed at bridging existing gaps through the development of national and institutional infrastructure for simulation faculty training, with tailored content for instructors, managers, and field leaders at different levels.

Chapter 7 Assessment and Research in Medical Simulation Centers

This chapter presents a structured framework for skills assessment in medical simulation centers, integrating valid and reliable measurement tools for both technical and non-technical skills. Alongside implementation formats, such as OSCEs, observational and rating instruments, including checklists, Global Rating Scales (GRS), and Objective Structured Assessment of Technical Skills (OSATS), are discussed, as well as simulation-specific tools, such as Debriefing Assessment for Simulation in Healthcare (DASH) and Debriefing Assessment in Real Time (DART).

In the communication domain, three core instruments are highlighted—Four Habits, Calgary-Cambridge, and Kalamazoo—which enable end-to-end assessment of clinician–patient communication: opening, information gathering, empathy, shared decision-making, and closure. Integrating these tools enables immediate feedback, standardization and benchmarking, longitudinal progress tracking, and data-driven continuous improvement, thereby transforming assessment from a point-in-time measurement into a pedagogical engine for skill acquisition, quality assurance, and institutional and national alignment.

The chapter also presents a prospective, controlled, partially blinded pilot study designed to evaluate the impact of SBME on interpersonal communication skills among Israeli medical students—a domain in which SBME has not yet been widely implemented. Primary outcomes include (1) student self-efficacy, (2) skill assessment by senior physicians/evaluators, and (3) patient satisfaction and trust. Data will be collected using mixed methods (questionnaires and interviews), with evaluator score normalization (Z-scores) and documentation/transcription of encounters. The intervention group will train

using simulated clinical scenarios (e.g., medication counseling, multi-participant interviews, informed consent) followed by bedside application, while the control group will receive lecture-based instruction only. We hypothesize a significant 15–25% improvement in self-efficacy and external assessment measures compared with controls. The study's contribution lies in establishing an empirical foundation for the phased integration of SBME into the national curriculum, with practical measurement tools and recommendations for future research, including expansion to cognitive skills (questioning and critical thinking) and evaluation of clinical and economic outcomes.

Chapter 8 Summary and Recommendations: Key Aspects of Simulation Centers in Israeli Medical Faculties

This chapter synthesizes the main discussions and recommendations for improving medical simulation centers in Israeli universities. The establishment of a national consortium is recommended to recognize simulation centers as strategic infrastructure and enable their multi-year funding, centralized procurement, resource sharing, and standardization. In the educational domain, the creation of a National Committee for Simulation-Based Medical Education is proposed to define core content, quality standards, and assessment processes aligned with CBME principles. Emphasis is placed on training future physicians in clinical, technological, and emotional competencies, integrating generative AI and advanced tools (VR/AR), and developing professional instructional faculty through a nationally tiered model. Finally, the chapter recommends establishing a centralized body for research and evaluation, developing a shared repository of scenarios and standardized assessment tools, and promoting inter-institutional and international collaborations to support continuous improvement in the quality of medical education in Israel.

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