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Development and Implementation of a Minimally Invasive Surgery Curriculum for Military Medical Students

Ze Wang[1*], Zhenhua Wang[2*], Pei Wang[3#], Rongqiang Wei[1#]

[1]Department of Thoracic Surgery, Second Affiliated Hospital of Naval Medical University, Shanghai, China
[2]Department of Laboratory Medicine, Second Affiliated Hospital of Naval Medical University, Shanghai, China
[3]Department of Cardiothoracic Surgery, Second Affiliated Hospital of Naval Medical University, Shanghai, China
Email: 11211210060@fudan.edu.cn, #wuperty@126.com, #wrqdoc@163.com

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Abstract

The future battlefield under high-tech conditions features complex environments, high personnel concentration, and highly lethal weaponry. These factors lead to mass casualties presenting with diverse and severe injuries that are difficult to manage. Continuously improving battlefield casualty care theories, constructing a Tactical Combat Casualty Care (TCCC) system suited to our military, refining forward-deployed treatment techniques, and reducing the combat casualty mortality rate are pressing challenges for both current military medical student education and combat casualty care training. This is also an essential requirement to enhance our army's combat effectiveness and combat medical support capabilities. Minimally invasive surgery (MIS) is progressively becoming the mainstream of surgical procedures due to its advantages, including reduced trauma, enhanced visualization, faster postoperative recovery, and fewer complications. Currently, cultivating proficient minimally invasive surgeons domestically, internationally, within and outside the military is difficult, costly, and time-consuming, posing obstacles for the training of military medical talents and the future battlefield's comprehensive care for casualties. Focusing on the theory and practical training of MIS, our team's surgical education effort addresses this issue. Based on the current status of MIS teaching for undergraduate military medical students and integrating our team's methodologies and experiences in delivering MIS theoretical instruction and hands-on training, we propose a systematic "Six-Step" strategy tailored for military medical students. This strategy aims to develop and implement a structured MIS teaching system.

*Ze Wang and Zhenhua Wang are co-first authors.
#Pei Wang and Rongqiang Wei are co-corresponding authors.

Subject Areas

Curriculum Development

Keywords

Military Medical Student Education, Minimally Invasive Surgery (MIS), Minimally Invasive Surgery Teaching

1. Background

The future battlefield under high-tech conditions is characterized by complex environments, high concentrations of personnel, and highly lethal weaponry. These factors inevitably result in mass casualties presenting with diverse and complex injuries that are challenging to manage. This necessitates enhancing the comprehensive treatment capabilities of our military for casualties, continuously refining the theory of combat casualty care, establishing a Tactical Combat Casualty Care (TCCC) system appropriate for our military, perfecting forward-deployed medical techniques, and reducing the combat casualty mortality rate. These challenges represent pressing real-world issues for current military medical student education and combat casualty care training within our military, as well as critical requirements for improving combat effectiveness and combat medical support capabilities [1].

Concurrently, propelled by advancements in medical technology, shifts in medical paradigms, and the pursuit of higher quality of life, minimally invasive surgery (MIS) is progressively becoming the mainstream approach in surgery. MIS achieves therapeutic goals through access via minimal trauma, prioritizing the reduction of tissue damage to facilitate postoperative functional recovery and rapid patient convalescence [1]. The advent and application of endoscopic technologies, techniques, and specialized instruments hold profound significance in the history of surgical development, ushering in the era of MIS. Compared to traditional open surgery, MIS offers distinct advantages, including enhanced visualization, reduced surgical trauma, diminished postoperative pain, fewer complications, accelerated recovery, and improved cosmetic outcomes at incision sites [2]-[4]. However, under conventional training paradigms, cultivating skilled minimally invasive surgeons remains a difficult, costly, and time-consuming endeavor with a steep overall learning curve, both within and outside the military.

Currently, dedicated MIS curricula are notably absent within undergraduate military medical programs [5]. Consequently, students are typically exposed to MIS theory and practical training relatively late, often only upon entering clinical practice. Opportunities for hands-on experience are limited, and the clinical teaching they do receive is often specialized and fragmented, leading to inefficient use of teaching resources. A pressing need exists for a comprehensive, systematic, and efficient MIS training system [5] [6]. In the new era, rapid advancements in information technology, such as Virtual Reality (VR), Mixed Reality (MR), and Hologram Projection (HP), offer transformative learning experiences through tools like virtual simulation and biosimulation training [7]-[9]. These technologies hold significant potential for application in key components of MIS training. Our team has already leveraged MR technology to facilitate pre-operative physician-patient communication, surgical planning, and provided real-time intra-operative navigation. This technology clearly pre-visualizes critical anatomical structures (e.g., vessels, trachea, lesions) and their spatial relationships. Surgeries conducted with MR assistance have proceeded smoothly, with patients experiencing positive post-operative recovery outcomes and successful discharges.

Based on the current implementation status of MIS-related teaching within the undergraduate curriculum for military medical students and integrating the practical teaching experience of our team, this paper proposes a "Six-Step" instructional strategy specifically designed for military medical students. The aim is to preliminarily construct and implement a structured MIS teaching system within the military medical academic setting [10].

2. Course Overview

Currently, minimally invasive surgery (MIS) theory and practice are not formally integrated into the curriculum for military medical students as a dedicated course, whether elective or compulsory. This gap impedes the advancement of medical technology and the cultivation of surgical talent. For military medical institutions, it further hinders the training of military medical professionals and compromises comprehensive battlefield casualty care. Focusing on MIS theory and practical training, our team's surgical education initiative addresses this issue. By synthesizing our methodologies and empirical experience in delivering MIS instruction, we propose a "Six-Step" instructional strategy for military medical students. This strategy encompasses:

1) Theoretical MIS instruction (including textbook development).
2) Foundational surgical skills training.
3) Virtual simulation training.
4) Biosimulation training.
5) Animal surgical labs.
6) Standardized course assessment.

This progressive, interconnected framework aims to establish a structured MIS teaching system within the military medical curriculum, initially implemented through an elective course format [11] [12].

The course is designed for fourth-year, second-semester students in the five-year military medicine program, with a class size of 30 - 35. Enrollment criteria include successful completion of General Surgery, ranking within the top 50% of the cohort, and no history of VR-induced motion sickness. The curriculum comprises 36 contact hours delivered during the eight weeks immediately preceding clinical clerkships, thereby laying the groundwork for subsequent rotations in combat-trauma specialties.

3. Current Status of MIS-Related Education in Military Medical Institutions

While domestic and international experts have extensively researched MIS training theories, most studies lack targeted practical components. Some scholars maintain that "students will gradually acquire these skills during clinical practice" [13]. Presently, the absence of systematic MIS theory and hands-on courses in military medical curricula results in limited trainee exposure to clinical MIS applications. Students typically gain fragmented knowledge through observation and self-directed learning during clinical rotations or residency, guided variably by supervisors across specialties [14].

In China's continuing medical education phase, young surgeons' MIS training yields mediocre outcomes due to insufficient professional textbooks, standardized training systems, and assessment criteria [14]. This deficiency is even more pronounced for undergraduate medical students or interns. Disparities in instructor quality, coupled with non-targeted self-learning, lead to fragmented educational resources, inconsistent teaching quality, and prolonged learning curves [11]-[13]. Systematically training students during their academic phase—followed by residency and specialty standardization—would streamline learning. Integrating pre-employment theory courses, simulation drills, animal labs, and certification exams could significantly shorten training cycles for military surgical professionals.

Key issues in current MIS education include the following contents.

3.1. Should MIS Theory and Practical Training Start "From the Ground Up"?

The necessity of early "enlightenment-style" higher education in MIS for undergraduate students remains debated due to their heavy academic workload, foundational medical training stage, and uncertainty regarding future specialization. Some scholars argue that introducing clinical surgical skills training—especially advanced techniques like MIS—during undergraduate studies is premature, potentially yielding suboptimal results and inefficient resource utilization [15]. Conversely, we contend that MIS-related theoretical and practical courses should be integrated into the curriculum. Early exposure fosters an MIS-centric mindset within academia. Tailored approaches are essential: students nearing clinical rotations or internships derive significant benefits: Accelerated transition through the initial transitional disorientation phase when encountering MIS; Enhanced preceptor-trainee rapport and smoother clinical teaching initiation; Strengthened professional identity and career planning confidence; Proactive cultivation of specialized surgical talent through early, structured training.

3.2. Lack of Dedicated MIS Courses, Specialized Faculty, and Standardized Teaching Materials

The absence of MIS-focused electives or workshops impedes tailored education for interested students. For trainees entering clinical practice, such courses are crucial for understanding surgical evolution, accelerating clinical acclimatization, and discerning disciplinary trends. Furthermore, a shortage of multidisciplinary faculty (e.g., general surgery, thoracic, urology, gynecology) with deep expertise, pedagogical experience, and surgical proficiency hinders effective instruction. The lack of systematic, high-quality textbooks—despite numerous available resources—compromises educational consistency and depth.

3.3. Absence of a Structured MIS Training System in the Curriculum

Current curricula lack cohesive MIS courses and skills labs. Consequently, trainees typically first encounter MIS haphazardly during clinical apprenticeships through observation and self-directed learning. This delayed, fragmented exposure leads to inefficient skill acquisition and suboptimal foundational competency.

3.4. Insufficient Integration of Simulation Technologies in MIS Training

Emerging technologies like Virtual Reality (VR), Mixed Reality (MR), and Hologram Projection (HP) offer transformative learning paradigms [8] [11] [14]-[16]. MR—an evolution of VR—enables real-virtual synthesis, dynamic interaction, and spatial precision [17] [18]. It generates hybrid environments where physical and digital objects co-exist and interact, merging elements of augmented/virtual reality. MR has shown promise in clinical training (e.g., pre-operative counseling, pulmonary nodule localization, CPR simulation) [19] [20]. Despite this potential, simulation technologies remain underutilized in current MIS pedagogy. Integrating VR/MR into virtual/biosimulation training modules could substantially elevate educational outcomes [21]-[25].

3.5. Lack of Standardized Assessment Metrics for MIS Training

Optimizing MIS training efficacy requires not only refining skill-building activities but also establishing uniform assessment standards. A comprehensive framework should evaluate theoretical knowledge, foundational technical skills, simulation performance, animal lab proficiency, and clinical operative competence [26]-[28]. Existing assessment tools are inconsistent, lack systemic rigor, and fail to address military medical trainees' unique needs [29] [30]. Developing and refining military-specific, competency-based benchmarks is imperative [31].

4. Implementation Strategy: The "Six-Step" MIS Training System

Building on global pedagogical research and our team's practical expertise, we propose that MIS training requires integrated theoretical instruction and systematic skill progression. Our strategy targets military medical students across three key settings: university classrooms, MIS training centers, and clinical environments. The "Six-Step" framework comprises:

1) Theoretical MIS instruction (including textbook development).

2) Foundational technical skills training.
3) Virtual simulation training.
4) Biosimulation training.
5) Animal surgical labs.
6) Standardized competency assessment.

This structured approach establishes a comprehensive MIS training system for military medical students, with the long-term goal of developing a national MIS training hub for military-civilian medical talent cultivation [21] [22]. Implementation details follow.

4.1. Step 1: Theoretical Instruction

Curriculum Development

A systematic MIS textbook is essential to address current gaps in standardized materials [27]. The proposed textbook will cover: fundamental principles of endoscopic surgery, instrumentation classification and applications, core technical protocols, and specialty-specific procedures (General/Thoracic/Urologic/Gynecologic Surgery) with case-based illustrations [28].

Course Delivery

Delivered as an elective course for students transitioning to clinical practice, theoretical instruction includes: historical evolution and current trends in MIS, clinical applications across surgical specialties, indications/contraindications for MIS procedures, equipment identification and operation protocols, patient positioning, access techniques, and sterile principles [29], and prevention/management of postoperative complications [30].

4.2. Step 2: Foundational Technical Skills Training

Conducted at clinical skills centers, this phase trains: instrument proficiency: Graspers, scissors, suction devices, needle holders.

System setup: Endoscope-camera-light source connections, insufflator calibration, sterile, technique.

Energy device operation: Electrocautery (monopolar/bipolar), ultrasonic shears, vessel sealers (e.g., Ligasure®).

Core techniques: Trocar placement, tissue manipulation, suturing, knotting, hemostasis in simulated environments [31].

4.3. Step 3: Virtual Simulation Training

After mastering basics, students advance to VR simulators for: depth perception and bimanual coordination drills, procedure-specific modules (e.g., cholecystectomy, tubal ligation) and real-time performance metrics to enhance spatial reasoning and tissue handling [32] [33].

4.4. Step 4: Biosimulation Training

High-fidelity biologic models enable:

Specialty-specific simulations (laparoscopic/thoracoscopic procedures).

Tactile feedback for realistic tissue interaction.

Physiologic response systems (e.g., bleeding control challenges) [7].

4.5. Step 5: Animal Surgical Labs

Porcine models provide advanced training:

Pre-op system setup: Endoscope calibration, insufflation parameters (pressure: 12 - 15 mmHg).

Energy device optimization: Power settings for dissection/coagulation.

Procedural execution: Laparoscopic cholecystectomy, appendectomy, bowel anastomosis under instructor supervision [34].

4.6. Step 6: Standardized Assessment & Training Hub Development

A multistage evaluation framework includes: written examinations (theory), OSCE stations for technical skills, simulation task metrics, and animal lab performance rubrics [31] [35]. This culminates in establishing a dedicated MIS training center for scalable military-civilian medical education [36].

Assessment Tools and Pass/Fail Thresholds for Step 6 include:

1) Theoretical examination: 2023 MIS-Knowledge Exam; ≥80/100 is passing.

2) OSCE: MISTELS scoring system; ≥74 points constitutes a pass.

3) VR module: LapSim® 2024 release; Global Score ≥ 70% and ≤3 errors.

4) Animal laboratory: ACS/APDS 2022 five-level scale; completion requires a rating ≥ 4.

4.7. Pilot Evaluation

A pilot evaluation conducted from May to July 2024 with 32 fifth-year military medical students (class of 2020) at the Naval Medical University demonstrated that the proposed curriculum significantly improved learning outcomes: mean theoretical-exam scores rose by 18.4 % ($p < 0.01$), VR-module task-completion time decreased by 21.7%, and the overall pass rate reached 90.6%, thereby providing initial evidence for the feasibility and effectiveness of the Six-Step model.

4.8. Resources and Ethics

- VR/MR equipment: 8 sets, funded by the university education and training grant (RMB 180,000).
- Animal laboratory: 15 Bama miniature pigs per year, approved by the Naval Medical University Animal Ethics Committee.
- Cost reduction: Shared use of the VR training center with a local tertiary-grade-A hospital lowered consumables cost from RMB 450 to 190 per trainee per session.

5. Conclusions

This study addresses the current status of minimally invasive surgery (MIS) education in undergraduate military medical curricula. Synthesizing our team's methodologies and empirical insights, we propose a systematic "Six-Step" instructional strategy tailored for military medical students. This framework establishes an integrated MIS teaching system centered around large-scale teaching hospitals and animal surgical centers. Key components include:

- Development of specialized faculty teams.
- Creation of evidence-based teaching materials.
- Design and implementation of progressive training modules.
- Standardized competency assessment protocols [10] [36].

The ultimate objective is to establish a national MIS training hub to advance military-civilian surgical education. This initiative holds significant implications for:

1) Cultivating elite MIS practitioners within military medical forces.

2) Enhancing comprehensive combat casualty care capabilities.

3) Refining forward-deployed medical technologies.

4) Reducing combat/training casualty mortality rates.

5) Addressing the military's pressing operational demands for heightened combat effectiveness and optimized medical support [1] [12] [37].

Compared with the ACS/APDS curriculum, our framework introduces VR training during the undergraduate phase and, for the first time, incorporates a "combat-trauma" module featuring MR real-time navigation. Relative to the 2023 EAES guidelines, we have added a dedicated unit on "MIS under resource-limited tactical conditions," underscoring its military character and minimizing overlap with civilian courses [38] [39].

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Butler, F.K., Holcomb, J.B., Shackelford, S.A., Barbabella, S., Bailey, J.A., Baker, J.B., *et al.* (2018) Advanced Resuscitative Care in Tactical Combat Casualty Care: TCCC Guidelines Change 18-01:14 October 2018. *Journal of Special Operations Medicine*, **18**, 37-55. https://doi.org/10.55460/yjb8-zc0y

[2] Gallagher, A.G. and O'Sullivan, G.C. (2011) Fundamentals of Surgical Simulation: Principles and Practice. Springer.

[3] Szold, A., Bergamaschi, R., Broeders, I., Dankelman, J., Forgione, A., Langø, T., *et al.* (2015) European Association of Endoscopic Surgeons (EAES) Consensus Statement on the Use of Robotics in General Surgery. *Surgical Endoscopy*, **29**, 253-288. https://doi.org/10.1007/s00464-014-3916-9

[4] Scott, D.J. and Dunnington, G.L. (2008) The New ACS/APDS Skills Curriculum: Moving the Learning Curve out of the Operating Room. *Journal of Gastrointestinal Surgery*, **12**, 213-221. https://doi.org/10.1007/s11605-007-0357-y

[5] Patel, E.A., Aydin, A., Cearns, M., Dasgupta, P. and Ahmed, K. (2020) A Systematic Review of Simulation-Based Training in Neurosurgery, Part 1: Cranial Neurosurgery. *World Neurosurgery*, **133**, e850-e873. https://doi.org/10.1016/j.wneu.2019.08.262

[6] Schauer, S.G., April, M.D., Naylor, J.F., *et al.* (2019) Predeployment Combat Medic

Training: A Survey of Reported Training Gaps. *Military Medicine*, **184**, e668-e675.

[7] Barsom, E.Z., Graafland, M. and Schijven, M.P. (2016) Systematic Review on the Effectiveness of Augmented Reality Applications in Medical Training. *Surgical Endoscopy*, **30**, 4174-4183. https://doi.org/10.1007/s00464-016-4800-6

[8] Sutherland, J., Belec, J., Sheikh, A., *et al.* (2019) Applying Modern Virtual and Augmented Reality Technologies to Medical Imaging and Surgical Planning. *Journal of Medical Imaging and Radiation Sciences*, **50**, 68-75.

[9] Hughes-Hallett, A., Mayer, E.K., Marcus, H.J., *et al.* (2014) The Views of Senior Clinicians in Surgery on the Role of Technology in the Operating Room: A Qualitative Study. *International Journal of Surgery*, **12**, S15-S19.

[10] Smith, R.J., Ereso, A.Q., García, P., *et al.* (2020) Holographic Mixed-Reality Navigation for Laparoscopic Surgery: Impact on Surgical Planning and Education. *Military Medicine*, **185**, 592-599.

[11] Santos, B.F., Enter, D., Soper, N.J., *et al.* (2017) Simulation-Based Training for Flexible Endoscopy: A Systematic Review. *Journal of Surgical Education*, **74**, 1024-1033.

[12] Kahol, K., Satava, R.M., Ferrara, J.J., *et al.* (2009) A Competency-Based Virtual Reality Training Curriculum for Surgical Residents. *Archives of Surgery*, **144**, 1136-1144.

[13] Ericsson, K.A. (2015) Acquisition and Maintenance of Medical Expertise. *Academic Medicine*, **90**, 1471-1486. https://doi.org/10.1097/acm.0000000000000939

[14] Haney, C.M., Kowalski, R., Jow, N., *et al.* (2020) Gaps in Simulation Training: A National Survey of Surgical Education Program Directors. *Journal of Surgical Research*, **256**, 30-36.

[15] Yang, T., Yang, X., Farnan, I., *et al.* (2022) Challenges in Standardizing Surgical Simulation Education in China: A Nationwide Survey. *Medical Teacher*, **44**, 780-788.

[16] Satava, R.M. (2011) Surgical Education and Surgical Simulation. *World Journal of Surgery*, **35**, 1487-1491.

[17] Sauer, I.M., Queisner, M., Tang, P., Moosburner, S., Hoepfner, O., Horner, R., *et al.* (2017) Mixed Reality in Visceral Surgery. *Annals of Surgery*, **266**, 706-712. https://doi.org/10.1097/sla.0000000000002448

[18] Bichlmeier, C., Wimmer, F., Heining, S.M. and Navab, N. (2007) Contextual Anatomic Mimesis Hybrid *In-Situ* Visualization Method for Improving Multi-Sensory Depth Perception in Medical Augmented Reality. 2007 6*th IEEE and ACM International Symposium on Mixed and Augmented Reality*, Nara, 13-16 November 2007, 129-138. https://doi.org/10.1109/ismar.2007.4538837

[19] Pratt, P., Ives, M., Lawton, G., Simmons, J., Radev, N., Spyropoulou, L., *et al.* (2018) Through the Hololens™ Looking Glass: Augmented Reality for Extremity Reconstruction Surgery Using 3D Vascular Models with Perforating Vessels. *European Radiology Experimental*, **2**, Article No. 2. https://doi.org/10.1186/s41747-017-0033-2

[20] Worlikar, H., Coleman, S., Kelly, J., O'Connor, S., Murray, A., McVeigh, T., *et al.* (2023) Mixed Reality Platforms in Telehealth Delivery: Scoping Review. *JMIR Biomedical Engineering*, **8**, e42709. https://doi.org/10.2196/42709

[21] DeMeester, T.R. (2010) When Should We Start Teaching Surgical Techniques? *The American Journal of Surgery*, **200**, 1-2.

[22] Pugh, C.M., DaRosa, D.A., Santacaterina, S., *et al.* (2015) A Mixed-Reality Trainer for Surgical Resident Readiness. *Surgical Endoscopy*, **29**, 2025-2033.

[23] Kozar, R.A., Anderson, K.D., Escobar-Chaves, S.L., *et al.* (2021) Early Exposure to Surgical Sub-Specialties Influences Career Choice: A Multi-Institutional Study. *Journal of Surgical Research*, **258**, 326-331.

[24] Klim, S.M., Amerstorfer, F., Gruber, G., *et al.* (2018) Military-Specific Surgical Training Programs: A Systematic Review. *Military Medicine*, **183**, e402-e410.

[25] Han, H., Roberts, N.K. and Korte, R. (2015) Learning in the Real Place: Medical Students' Learning and Supervision in Clinical Workplaces. *Perspectives on Medical Education*, **4**, 230-235.

[26] Mattar, S.G., Alseidi, A.A., Jones, D.B., Jeyarajah, D.R., Swanstrom, L.L., Aye, R.W., *et al.* (2013) General Surgery Residency Inadequately Prepares Trainees for Fellowship. *Annals of Surgery*, **258**, 440-449. https://doi.org/10.1097/sla.0b013e3182a191ca

[27] Xu, A.M., Huang, L. and Li, Y. (2022) Standardizing Surgical Simulation Curricula in China: Current Gaps and Solutions. *Medical Education Online*, **27**, Article 2010292.

[28] Ericsson, K.A. and Pool, R. (2016) Peak: Secrets from the New Science of Expertise. Houghton Mifflin Harcourt, 178-203.

[29] Pottle, J. (2019) Virtual Reality and the Transformation of Medical Education. *Future Healthcare Journal*, **6**, 181-185. https://doi.org/10.7861/fhj.2019-0036

[30] Vassiliou, M.C., Feldman, L.S., Andrew, C.G., Bergman, S., Leffondré, K., Stanbridge, D., *et al.* (2005) A Global Assessment Tool for Evaluation of Intraoperative Laparoscopic Skills. *The American Journal of Surgery*, **190**, 107-113. https://doi.org/10.1016/j.amjsurg.2005.04.004

[31] Chen, L., Tang, Y., Huan, J., *et al.* (2023) Developing Competency-Based Assessments for Military Surgical Training: A Delphi Consensus Study. *Journal of Surgical Education*, **80**, 689-697.

[32] Gallagher, A.G., Ritter, E.M. and Satava, R.M. (2005) Fundamental Principles of Validation and Reliability: Rigorous Science for the Assessment of Surgical Education and Training. *Surgical Endoscopy*, **19**, 1527-1531.

[33] Munz, Y., Kumar, B.D., Moorthy, K., *et al.* (2004) Laparoscopic Virtual Reality and Box Trainers: A Structured Comparison. *Annals of Surgery*, **240**, 518-528.

[34] Aggarwal, R., Ward, J., Balasundaram, I., Sains, P., Athanasiou, T. and Darzi, A. (2007) Proving the Effectiveness of Virtual Reality Simulation for Training in Laparoscopic Surgery. *Annals of Surgery*, **246**, 771-779. https://doi.org/10.1097/sla.0b013e3180f61b09

[35] Vassiliou, M.C., Ghitulescu, G.A., Feldman, L.S., Stanbridge, D., Leffondré, K., Sigman, H.H., *et al.* (2006) The MISTELS Program to Measure Technical Skill in Laparoscopic Surgery. *Surgical Endoscopy*, **20**, 744-747. https://doi.org/10.1007/s00464-005-3008-y

[36] DuBose, J.J., Teixeira, P.G.R., Neff, L.P., *et al.* (2018) The Military-Civilian Partnership for Advancing Surgical Training. *Journal of Trauma and Acute Care Surgery*, **84**, 962-968.

[37] Rasmussen, T.E. and Kellermann, A.L. (2016) Wartime Lessons at Home: Trauma System Maturation. *New England Journal of Medicine*, **375**, 1612-1615. https://doi.org/10.1056/nejmp1607636

[38] Dormegny, L., Yaïci, R., Koestel, E., Dhubhghaill, S.N., Ahiwalay, C., Bacchav, A., *et al.* (2025) Global Trends and Practice Patterns in Virtual Reality Simulation Training for Ophthalmic Surgery: An International Survey Use of Virtual Reality Simulation Training around the World. *Scientific Reports*, **15**, Article No. 30886. https://doi.org/10.1038/s41598-025-16227-7

[39] Chau, R.C.W., Neshka, M., Pantea, M., Rampf, S., Liukkonen, M., Rice, D.R., *et al.* (2025) Shaping the Future of Dentistry: How Digital VR-Haptic Thinkers Are Revolutionizing Education by Thinking Big for Better Future in Oral Care. *European Journal of Dentistry*. https://doi.org/10.1055/s-0045-1810611