MedVR Education

Clinical Procedures

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"A clinical procedure can be defined as any practice of a health practitioner that involves a combination of special skills or abilities and may require drugs, devices, or both." - National Center for Biotechnology Information.

In laying down the definition, the National Center for Biotechnology Information is also making it clear how important these procedures are to the health and wellbeing of patients. It could be a simple wound suturing or a major heart surgery but for the concerned patient it holds utmost importance. Precision and accuracy are vital to the successful completion of each procedure.

In this Clinical Procedures literature, we will be discussing the various ways in which virtual reality simulations can prove to be highly effective in achieving desired results from healthcare training solutions. We also look at the various ways in which MedVR Education is creating VR simulations that meet training requirements to help train a force of efficient and capable healthcare professionals. Before we delve into that it is important to understand the significance of training in itself and what factors contribute to giving shape to quality training programs.

Importance of Training

A healthy society cannot be possible without a healthy healthcare system. This calls for a team of skilled and confident professionals who can contribute towards treating the ill. To develop a team of efficient and effective healthcare professionals, it requires well-organized and well-structured training material which is adequately made available to trainees.

According to a Project Hope report, in the year 2012, US nursing schools turned away 79,650 qualified applicants due to insufficient training resources. The Association of American Medical Colleges (AAMC) has stated that by the year 2032 the US is projected to face a shortage of close to 121,000 physicians. With such alarming figures, the idea of building a capable, sufficient, and strong healthcare workforce can be difficult, unless adequate and quality training opportunities are made available to trainees at all levels. This not only includes new trainees but also the experienced ones who look for opportunities to upgrade or refresh their skills.

What Makes a Good Training Program

Healthcare training is all about achieving better patient outcomes. The focus is always on saving lives and ensuring each patient gets the best treatment possible. This involves a good deal of learning, practicing, and gaining confidence to deliver to the best of one's abilities. All these can be possible only with a well-trained workforce. What makes a good training program that can ensure that our healthcare professionals are receiving the finest training opportunities?

- **Organization specific customization**: With technical advancements and ongoing medical research, clinical procedures are undergoing changes. New treatment methods are being developed and procedures are becoming increasingly minimally invasive. Many procedures are performed at the bedside, much unlike older methods. Along with this, the small but significant and unique modifications by organizations make one organization stand out from the others. These nuances make an impactful difference in patient experience. To train the workforce in these distinctive services, organizations will require customized training content that is uniquely relevant to the specific organization.
- **Maintain work and training balance**: Every individual comes from a unique background with their own set of responsibilities and duties. There could be learners performing critical jobs and may be able to attend training sessions at odd hours. Training content

should be such that it does not create a clash or force the learner to compromise on any front, helping them develop their skills and competencies while fulfilling their responsibilities.

- **Keep training updated with medical development:** Scientific research is a continuing process. New and improved methods of treatments are constantly being developed. Along with this, new diseases crop up once in a while which require medical professionals to increase their knowledge and be abreast of ways to treat and prevent them. When it comes to training, it is of the utmost necessity to incorporate these developments in the training sessions and be prepared to face any emergency.
- **Make optimum use of technology:** Not only do we witness development in medical procedures but so do we in the technology used to deliver treatment. This could be something as basic as an innovation in the methods of drawing blood to something as critical as minimally invasive surgery. In order to deliver the best treatment to patients, healthcare professionals and organizations must incorporate technological developments in their procedures, and this will be possible only when appropriate training is made available.
- **Provide feedback:** No training is ever complete without feedback. An assessment does give a performance score but along with that it is necessary to let the learner know where they faltered, what were the mistakes, which areas need further attention and how to improve upon mistakes. What is required is criterion-based feedback that will enable learners to improve and enhance their skills. An effective training program will lay equal emphasis on both training and feedback.

Emergence of VR Training Methods

There was a time when clinicians learned by practicing their skills on patients. This practice is not acceptable anymore and has long been abandoned. We all know the risks it carries for both the patient and the practitioner. Cadavers were another means for training. Till not very long ago this continued to be the practice, but a gradual shift was made towards including high fidelity mannikins. Proven to be highly effective in providing realistic and effective training, mannikins have now been a valuable part of the healthcare procedure training for a long time. However, the recent pandemic brought about a drastic change in learning and training methods, especially in the healthcare sector. This was a time for urgency and training had to continue, at any cost.

Virtual reality or VR, that had been lurking in the background, moving at a very slow pace, suddenly came to the forefront. Training in virtual reality meant learners could attend sessions and still maintain the condition of ‘isolation’. Though conditions are once more conducive to attending in-person training sessions VR is gaining ground. This can be attributed to the many benefits it carries as opposed to the traditional methods. For one thing, providing high fidelity mannikin-based training requires maintaining expensive equipment, a center with overhead staff, and faculty to supervise.

On the contrary, VR-based training barely requires any large equipment, learners direct their training independently without a supervisor and can practice as many times as they want to. There are no longer standardized patients or actors as virtual patients are designed to provide practice for all procedures. One simulation can be accessed by multiple learners simultaneously making it highly scalable. Another significant benefit of VR lies in its being a very cost-effective solution. The pandemic is gone but the world realized the benefits of VR simulation training and there is no going back now.

Virtual reality or VR based simulations are now a part of the learning and training environment of many healthcare organizations. Learners are required to strap on a head-mounted device, login to a training session and perform tasks using hand-controllers. Once logged in, learners find themselves in photorealistic virtually simulated healthcare environments which are equipped with required equipment, referred to as affordances, and virtual patients to perform procedures.

Scenarios are scripted, designed, and created bearing in mind the learning needs of learners. Cases are consistent in their approach to fulfilling all required training needs, making them a reliable source for acquiring skills, knowledge and practice. This applies for all levels of training needs, be it essential skills or highly critical procedures.

Often guided by a virtual assistant, procedures are learned, practiced, and assessed virtually. Assessments can be conducted with or without prompts. Whether the learner gets the procedure right or wrong, it does not bear any consequences. Learners can return to the training, practice again, and take the assessment afresh. Learning can be tracked through a web based XR platform where trainers can view learners' progress, point out errors and suggest improvements. Learners can also view their personal performance and conduct a self-analysis of their skills.

The integration of AI facilitates the inclusion of AI-empowered virtual patients. Learners can interact with these patients as they would with real patients. Scenarios can have a mixed patient demographic and procedures can be set in a variety of environments to include multiple locations.

How are MedVR Ed Procedures Created

Every clinical procedure simulation in the MedVR Education library is created under the expert guidance and supervision of highly experienced and qualified professionals. Right from selecting a procedure to finalizing the simulation, experts monitor every step and detail, making sure that the simulations created are accurate and closely related to a real-life scenario.

A typical simulation creation process involves four important steps:

1. Assessing requirements
2. Collating resources and references
3. Designing VR clinical procedures
4. Implementing and delivering

1. Assessing requirements:

This is the first and foremost step that leads to the creation of simulations for practice and assessment. It is essential to correctly identify the requirements of the learners to help them in their professional development. This is achieved through extensive evidence-based research. MedVR Ed's experts help select appropriate content, ensure clinical accuracy, select core objectives, and decide on how best to build the modules. Experts not only bring in their knowledge and experience but also follow the gold standard of referring to highly trusted and acclaimed sources like Lippincott and UpToDate when it comes to formulating cases for training and practice. Identification of procedures also involves prioritizing the sequence of simulation creations. While all procedures in the healthcare domain carry their own level of significance there are some that take precedence over others. For example, procedures like IV insertions and administering injections fall under the essential skill category, are performed more frequently and require all healthcare professionals to be skilled at them.

Assessing requirements involves:

- Conducting market research for usability of procedures
- Examining training requirements
- Prioritizing procedures for development
- Creating a course outline

2. Collating resources and references

Medical simulations created for practice purpose must be reflections of real-life situations. This includes aspects like patient cases, causes leading up to a medical condition, the symptoms, the treatment, possible reactions, or side-effects, etc. In order to create such realistic scenarios a great deal of effort is invested in researching and studying aspects of each medical procedure. Resources are tapped, relevant information filtered, commonalities in cases studied, and references gathered.

MedVR Education advisory team lends their insights, directs the course developers towards pertinent resources that prove to be invaluable sources of information.

The step of collating resources and references involves:

- Formulating applicable patient cases
- Preparing checklists for steps to be included in the procedure
- Drawing up a list of guidelines to be followed for each procedure
- Referring to sources like documents, books, videos and research papers
- Documenting and defining the procedure steps from start to finish

3. Designing clinical procedures

With all the necessary information gathered in one place, the task is now to give shape to the simulation. This involves a team of highly skilled designers and developers. Under the guidance of SMEs, aspects like an appropriate patient, environment, the equipment to be used and the simulation timing are finalized. The tasks to be performed in the VR environment are listed out, both for training and assessment modes.

This stage of designing clinical procedures involves:

- Creating a design document
- Identifying the appropriate environment for the procedure
- Designing the patient, environment and equipment
- Finalizing the debriefing points based on training requirements and procedure checklist

4. Implementation and delivery

The three steps of requirement assessment, resource and reference collation and designing of procedures come to fruition in this stage of implementation and delivery, with a team having put together a thorough design and an equally efficient team executing the plan to create realistic scenarios with realistic virtual patient set in virtual environment. Aspects like multiplayer features, physics-based interactions, voice-chat in real-time, and affordances that enable interactions with and within the environment are stitched together.

Created simulations are thoroughly tested at multiple levels by multiple users with each feedback given due attention and acted upon. Rounds of testing, feedback implementing, and bug fixing are carried out. When the MedVR Education team is absolutely sure of its simulations' performances, they are released for the end user.

The implementation and delivery stage involve:

- Multiple levels of user acceptance testing
- Review by SMEs
- Implementing feedback to eliminate errors and bugs
- Deployment of apps to user headsets

Features of MedVR Ed Clinical Procedures and its Benefits:

1. **Clinical procedures with training and assessment**: Clinical procedures consist of training and assessment modes. Learners are first handheld through the procedure with detailed instructions. In the assessment mode, no help is provided, and learners are expected to complete the procedure individually, as they would in a real-world situation.
   Benefit: Learners are first given the opportunity to learn and practice and when familiar with the process they can perform it individually to test their own skill and ability.
2. **Solo and guided sessions**: All procedures in the MedVR Ed library can be performed with or without a moderator. Learners can be part of sessions that can be run asynchronously.
   Benefit: Asynchronous learning opportunities provide learners the flexibility to learn at their pace and be owners of their own learning.
3. **Physics-based interactions**: Every procedure requires the user to handle and make use of multiple objects including actions like grasping, lifting, unpacking material, attaching objects, pulling, pushing, and more such actions. Physics-based interactions replicate actions and effects similar to those in the real-world.
   Benefit: When an action and its effects are in sync with the real world, a close connection is created between the real and the virtual. It creates an immersive and engaging experience within the environment.
4. **Multiplayer**: Multiplayer sessions enable participants, both learners and trainers, to join on a common virtual platform from anywhere in world at the same given time and perform as a team. Communication is facilitated by voice-chat in real time.
   Benefit: This allows the sharing of experiences and knowledge, and helps promote teamwork.
5. **Photorealistic**: All MedVR Education simulation scenarios are created to closely mimic the real-world. This includes the environment of a healthcare setup, the equipment used, the virtual patients, and most importantly, the process of the procedure being performed.
   Benefit: Practicing in realistic set-ups helps develop familiarity with the environment, making users feel comfortable and at ease when placed in a real-world scenario. The realism of the procedure provides true-to-life experiences.
6. **Data Analytics**: This is an effective way to analyze a user's performance; the tasks that the user performs correctly as well as the ones that were missed or performed incorrectly. Session-end debriefing helps learners identify their own strengths and weaknesses, the tasks they need to pay special attention to in order to perform skillfully without any mistakes. Being a virtual environment, learners perform in a safe, controlled and zero-risk environment and an error made here serves more of as a learning with no consequences.

Benefit: Users and trainers are able to view a detailed performance report of every individual, be it a single player or multiplayer activity, helping analyze and understand the strengths and weaknesses of every user.

7. **AI-powered post session analysis**: Session-end performance analysis is AI-powered as it gives an accurate account of the tasks performed. The system is trained to identify and differentiate between crucial tasks and not so very important ones. Based on this, it gives the user and trainer an analysis of the user's performance.
   Benefit: Being an AI-powered analysis system, it gives a systematic and detailed account of the user's performance. Identifying and listing down crucial tasks also provides a thorough review helping users concentrate on the areas requiring significant attention.
8. **Unique patient cases**: All patient cases in the MedVR Ed library are created in close consultation with qualified and experienced healthcare professionals. Each case is unique in itself and closely replicates a real-life case. The team of subject matter experts (SMEs) bring with them years of experience and knowledge, helping give shape to precisely accurate cases.
   Benefit: As every case is different in the real-world, similar experiences are provided to learners in the virtual world helping build skills like analyzing and decision-making.
9. **Customization**: Within the simulations, features that can be customized include the patient and the virtual environment. The MedVR Ed team can customize all simulations in the library based on specific requirements. The timeframe for these modifications ranges from a period of two days to a week, depending upon the complexity of the customization.
   Benefit: Customization helps create simulations that are unique and specific to user requirements. Modules can be made as diverse and realistic as possible to reflect guidelines and policies specific to organizations and training scenarios.
10. **Diverse patient library**: MedVR Education cases consist of virtual patients from diverse backgrounds. They include people from diverse cultures, races, ethnicities, nationalities, religions, beliefs, sexual orientation and gender identification.
    Benefit: This helps represent a realistic diaspora of the society, something learners will encounter in their day-to-day life when they step out into the real world.
11. **Remote delivery and OTA**: All solutions are delivered to the user headset remotely and require minimal technical knowledge on the part of the user. When new updates are made to solutions, existing users' experiences are taken care of, and all updates are delivered over the air (OTA) automatically.
    Benefit: This overrides the process of sideloading, system setup, configurations and installation. The technical team completes the entire installation process at the backend. Users only need a login id and password to begin a session. With regard to updates, users only need to check and allow the update to be completed before beginning a session.
12. **24/7 tech support**: 24X7 tech support is available to address the slightest issues faced by users at any given point in time. Users can reach out over an email or call tech support for prompt resolutions.
    Benefit: Issues, if any, are addressed at the earliest, providing users with seamless productive learning sessions.
13. **No elaborate set up required**: When training in VR all that a learner needs is a headset. Once a session is complete the user can go back to the beginning of the simulation and start over, if required. When attempting the assessment, the user needs to simply change the mode from Training to Assessment and proceed as instructed.
    Benefit: With no elaborate set up required, the need to maintain a dedicated facility is eliminated, which in turn means a reduction in costs. The fact that users can perform the procedure back-to-back with no time lag in between sessions means saving time.

Program Advisory Team – Core Members

With evidence-based research and thorough source references, it is possible to arrive at a decision of what procedures to create for training purposes, but it takes expertise in the field to create accurate simulations. In the healthcare field, nothing is insignificant. Every step of a procedure has to be correct to the minutest detail. Precision and accuracy in simulations are achieved, thanks to the consistent, detailed, and critical guidance of a highly qualified, experienced and knowledgeable program advisory team. It is their valuable guidance that helps MedVR Education's skilled and talented pool of artists to put together minutely accurate procedures that reflect absolute attention to detail.

This core team of program advisors includes:

1. **Dr. Andrew J. Eyre - MD, MS, Program Advisor**

Dr. Andrew Eyre serves as the Medical Director for the STRATUS Center for Medical Simulation at Brigham and Women's Hospital in Boston, Massachusetts where he is also a practicing emergency medicine physician. He attended medical school at the University of Vermont College of Medicine where he was inducted into the Alpha Omega Alpha and Gold Humanism Honor Societies. After completing residency at the Harvard Affiliated Emergency Medicine Residency (HAEMR) based out of Brigham and Women's Hospital and The Massachusetts General Hospital, Dr. Eyre completed a fellowship in medical simulation at STRATUS/Brigham and Women's Hospital and earned a master's degree in health Professions Education from the MGH Institute of Health Professions. Throughout his career, Dr. Eyre has held a variety of leadership roles in medical education at both Harvard Medical School and Brigham and Women's Hospital, including serving as the Assistant Program Director for HAEMR. Dr. Eyre has received numerous awards for teaching and education, including the Brigham and Women's Hospital Bernard Lown Award for Excellence in Teaching. In addition to medical simulation, Dr. Eyre's academic interests include international medical education, curriculum design, and procedure education.

2. **Dr. Michael E. Zychowicz - DNP, ANP, ONP, FAAN, FAANP, Program Advisor**

Dr. Michael E. Zychowicz is a Professor at Duke University School of Nursing where he provides leadership for the Orthopedic NP Specialty and is Co-Director for the Duke - VA Primary Care NP Residency. An educator for more than two decades, Dr. Zychowicz has a deep interest in the application of virtual reality as a modality to teach psycho-motor skills to distance-based health professional students. Dr. Zychowicz earned a BSN from the State University of New York at Plattsburgh. His MSN as a Nurse Practitioner was completed at Syracuse University while he earned a DNP degree at Case Western Reserve University. Dr. Zychowicz's clinical practice experience includes a variety of orthopedic specialty practices. He is board certified as both an Adult Primary Care NP and an Orthopedic NP. Dr. Zychowicz has authored several journal articles, book chapters on a wide variety of orthopedic topics and is frequently invited to speak at national and international conferences on orthopedic nursing practice.

3. **Dr. Ali Hafiz - MD, Program Advisor**

Dr. Ali Hafiz is a Pulmonary/Critical Care physician with special expertise in advanced medical simulation, whose goal is to ensure that VR simulation training modules are developed upon a solid foundation of evidence-based medicine and in alignment with major society guidelines. Ali received his undergraduate degree in Chemistry from the University of Virginia (go Hoos!) and subsequently his M.D. from Ross University School of Medicine. He completed his residency in Internal Medicine at Albert Einstein College of Medicine - NYC Health+Hospitals/Jacobi, where he had the honor of serving as a Chief Resident. He then completed his fellowship training in Pulmonary and Critical Care Medicine at NYU Grossman School of Medicine, where he remains on faculty as Adjunct Instructor in Medicine. During his fellowship he completed additional training in all aspects of medical simulation, under the mentorship of Dr. Brian Kaufman at the Manhattan VA Medical Center. Ali deeply believes that XR technologies will transform the future of both medical education and clinical practice. He is a passionate educator and has been involved in the development of several XR-based immersive medical training experiences, including as a consultant with the American College of Chest Physicians.

4. **Terri Millerd - BSN, RN, CCDS, MLT (ASCP), Clinical Educator**

Terri has been a registered nurse for 17 years and a medical laboratory technician for 10 years. She graduated with a degree in Associates of Science in Medical Laboratory Technician in 1992 and Nursing in 2004. Terri graduated with a Bachelor of Nursing from University of Texas at Arlington in 2005. Currently she holds certifications in Medical Laboratory Technician from American Society of Clinical Pathology, Nursing from Texas Board of Nursing, and Clinical Documentation Specialist from Association of Clinical Documentation Improvement Specialists.

MedVR Education Clinical Procedures Library

The MedVR Education simulations' app library is host to multiple categories with a diverse variety of procedures. It is a dynamically growing library and is set to become the largest simulation library for healthcare procedures.

Clinical procedures are offered in the following categories:

- Essential collection
- Emergency collection
- Critical care collection
- Pediatric collection
- Perinatal collection
- Allied healthcare

The list of categories can be explored at https://medvr.education/.

How to Access MedVR Education

Accessing MedVR Education simulations is smooth and super easy. All that users need is a headset with a Wi-Fi connection and login credentials.

Apps are delivered to the headsets over-the-air. As soon as users enter their login id and password, they gain access to the simulation app library, and they can begin practicing right away.