Virtual reality: a cost-effective alternative to high-fidelity simulation in low-resource settings?

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Abstract

Background: Healthcare systems in low-resource settings face an equal concern around patient safety compared to those in wealthier nations, while facing a disproportionate burden of disease. Virtual reality (VR) has been developed as an innovative, less resource-intensive approach to simulation training, which has the same potential to improve patient safety through interactive simulation scenarios.

Aims: This investigation aimed to probe how well VR simulation could replicate a clinical scenario when compared to the well-established high-fidelity manikin, and how adaptable and accessible this may be to implement in a low-resource setting.

Approaches: The features of two neurological simulation scenarios designed for the CAE iStan high-fidelity manikin were qualitatively assessed. This formed the basis of a feature comparison with two similar virtual reality simulation scenarios by Oxford Medical Simulation run using the Oculus Rift S VR headset. A cost analysis was performed and existing simulation solutions in low-resource settings were appraised.

Findings: VR simulation was shown to better replicate a clinical scenario when compared to high-fidelity manikin-based simulation. VR simulation was easier to set up, required less staff involvement and training, plus less equipment. The cost of running one VR simulation per learner was found to be 22 times cheaper than for manikin-based simulation, although low-cost non-VR simulation may still be more cost-effective and adaptable to different settings.

Conclusion: Virtual reality simulators such as the one developed by Oxford Medical Simulation present a desirable alternative to high-fidelity manikin simulators for neurology training and there is clear potential for application in low-resource settings, although application to other conditions requires further study.

Keywords: healthcare simulation, virtual reality, low-resource, cost-effectiveness, fidelity, medical education
Introduction

1. The role of simulation

The goal of simulation-based medical education (SBME) is to enhance patient safety. It aims to provide practice opportunities for clinically relevant skills without the need for a real patient, increasing the preparedness of medical professionals and potentially reducing cost. The level of fidelity, the realism of the situation being recreated, can be definitive of simulation effectiveness in facilitating learning. Stress response attenuation is observed with repeated simulation practice, possibly explaining popular uptake. This may contribute to reducing medical error, as stress is eliminated in decision-making.

A positive relationship between simulation fidelity and clinical performance has been postulated (Figure 1). High-fidelity simulation (HFS) typically involves a manikin maximally representative of the patient and clinical condition, allowing for enhanced immersion and simulation outcomes. Defining components are structured debrief, an environment allowing room for error, clear learning outcomes and adaptability to various settings. There are several dimensions used to describe fidelity. The importance of structural fidelity or realism in simulator appearance may be overemphasised - referred to as the fidelity trap, or applying high-fidelity HPS (human patient simulation) where advanced realism is not required. Some comparisons of LFS (low-fidelity simulation) and HFS could not demonstrate an advantage for HFS in knowledge gain.

Figure 1: The relationship between fidelity and knowledge gain summarised by the Miller’s Pyramid.
2. From the fidelity trap to the fidelity gap: Low-resource access

Cost is one of the greatest barriers to introducing HFS, but this is highly under-reported\(^{11}\). Literature about the SMBE development in lower-resource settings is scarce, though compromised patient safety may be a greater concern in lower to middle-income countries (LMICs)\(^{12}\). The burden of disease is double that in developed countries, with both issues of healthcare access and health problems of a more globalised and industrialised society\(^{13}\). Medical education should be reflective of this clinical need\(^{13}\), making this a highly relevant challenge for SBME. Riaz\(^{14}\) suggests part-task trainers (like cannulation arms) and standardised patients (patient actors) should be introduced before more advanced simulation. Implementation of LFS across many resource-limited healthcare systems has been documented for areas like resuscitation\(^{15}\) and surgery\(^{16}\), among others\(^{17,18}\). Infrastructure for LFS may exist in teaching facilities, but equipment start-up costs are still an obstacle\(^{19}\).

3. Virtual reality: the future of simulation?

Virtual reality (VR) is seen as a promising simulation technology, offering highly immersive and innovative learning experiences\(^{20}\). It is argued that VR experiences delivered via a head-mounted display (HMD; Figure 2) provide the greatest educational value\(^{21}\). Greater immersion in a VR environment facilitates improvements in both basic memorisation and in clinical training\(^{22,23}\). In one example of bronchoscopy simulation, VR was shown to be more or similarly efficient when compared to a high-fidelity manikin in training\(^{24}\). This may be promising but likely difficult to generalise to other training programmes.

**Figure 2:** Screen-based simulation\(^{25}\) (right) is sometimes incorrectly referred to as VR but lacks the same immersive capacity as ‘true VR’ or HMD-enabled simulation\(^{26}\) (left).

Increasing commercial availability has lowered costs associated with VR simulation\(^{27}\). When manikin-based simulation may incur great setup costs due the wide range of equipment, VR
relies on interactive computer-generated equipment. VR technologies have enhanced both knowledge and skills-based learning in comparison to other well-established approaches\textsuperscript{28}. Currently, there is a stark absence of research concerning implementation of VR simulation in low-resource settings, as well as its cost-effectiveness. These are concerning findings regarding SBME benefit distribution due to the challenge of simulation costs in LMICs, when healthcare systems may be most in-need of medical teaching innovation\textsuperscript{29}.

With an evident research gap in understanding SBME access issues, this paper sets out to investigate the fidelity, utility, and cost-effectiveness of medical simulation in VR. High-fidelity manikin-based simulation will be appraised to produce a feature comparison of clinical training software for fully immersive HMD-enabled VR, aided by a literature review of manikin-based simulation in LMICs, to gauge if VR may provide a well-rounded solution.

**Methods of Evaluation**

CAE Muse software designed for CAE iStan (Figure 3) by CAE Inc. (formerly Canadian Aviation Electronics) was run on a HP 14 laptop PC. Neurological signs have been particularly challenging to reproduce in HFS\textsuperscript{29}, so two preconfigured simulated clinical experiences (SCEs) simulating neurological deficit were chosen to inspect how VR simulation may tackle this. These were ‘Organophosphate Exposure’ and ‘Pneumonia with Septic Shock’. Best practice guidelines were studied to familiarise with and validate clinical simulation aspects. Several SCE run-throughs were performed. Features general to both SCEs were recorded, followed by more scenario-specific documentation. A table of features was derived to study the equivalent that exist in the chosen VR simulation platform (Appendix A).

The VR application was developed by Oxford Medical Simulation (OMS). Oculus Rift S VR HMD hardware (Figure 4) was connected to a Dell Precision Tower 3620 PC. Testing was carried out in a 1m-by-1m space, following best practice familiarisation. Two SCEs complementing CAE Muse SCEs were chosen: ‘Sepsis and delirium’ and ‘Seizure and hypoglycaemia’. A brief needs assessment was performed to confirm clinical need of simulation training via chosen scenarios.

A cost analysis was carried out, and an informal literature review was used to determine the costs involved in common HFS setups. This was compared with data provided by OMS, and to establish how realistic such costs may be for a setup in a low-resource setting.
Figure 3: CAE Healthcare iStan HPS, simulating an adult male, which receives interaction input via CAE Muse software\textsuperscript{26,30}.

Figure 4: Oculus Rift S VR headset, which receives input from infrared diodes, accelerometers, and the Oculus Touch controllers\textsuperscript{31,32}.
Findings

1. General Feature Assessment: Issues of Staffing and Equipment

Figure 5: A still from the OMS application showing a standard layout of a virtual hospital room which serves as the setting for the simulation scenarios\textsuperscript{33}.

Both manikin-based SCEs rely heavily on facilitator involvement, which may limit scenario standardisation and undermine repetitive practice cited as a critical HFS feature\textsuperscript{5}. Optimal staff involvement is not defined but it is critical that staff have scenario-appropriate clinical knowledge. In contrast, VR simulation requires minimal staff involvement, as staff are also simulated. Low-resource settings face great healthcare staff deficits\textsuperscript{34}, so such a feature may address understaffing. Hardware setup requires around one hour, and no learner pre-training is needed, since the student, as with all scenarios, can access a tutorial on-demand. This implies VR-based training is more standardised and repeatable. When manikin-based simulation calls for costly additional equipment, this need does not exist in VR (Appendix A). The VR environment accurately reproduces a busy hospital room (Figure 5), but available medication, while comprehensive, may not reflect local availability. This highlights a necessity to integrate SBME with local practice in an evidence-based manner.
2. To what extent can high-fidelity simulator features support fidelity in a resource-limited setting?

2.1 Organophosphate Exposure SCE

Organophosphate poisoning is common in developing countries due to lack of safety regulations. Status epilepticus is frequently adjunct and is the sort of high-stakes low-occurrence event for which SBME is deemed effective in optimising management. Management in low-resource settings is set back by poor antidote treatment and resuscitation, demonstrating clinical need for targeted medical training.

This SCE presents a patient with breathing difficulties, tearing and pupil constriction. All these responses are replicable by the manikin and physiological parameters are continuously updated. Interventions like decontamination are easily simulated, but patient interaction must be relayed via facilitator and can depend on medical equipment availability. Focal seizure simulation is minimally representative and does not capture the diversity of this presentation, as it varies immensely depending on affected brain region, so this must be taught alternatively to ensure awareness. Atropine and pralidoxime chloride are available antidotes, mirroring best practice. No treatment is suggested for recommended seizure prophylaxis facilitators, although available medication is relevant. The US Centre for Disease and Control advises diazepam, but flupirtine and midazolam is argued to be equally effective. It is vital that up-to-date medication guidelines are covered in training. Well-structured debrief concludes teaching (Appendix B), including review of a recording, which may incur additional costs.

2.2 Pneumonia with Septic Shock SCE

Sepsis and septic shock are associated with much higher mortality in resource-limited locations due to high infection prevalence. International guidelines are often based on research in higher-income countries, so may not be appropriate for low-resource healthcare. It may therefore be difficult to adapt SBME without resource-appropriate understanding. Previously developed sepsis HFS was reported to increase confidence in key clinical competencies and knowledge gain.

The SCE involves intensive fluid resuscitation of a febrile patient. Initial diagnostic test results are provided to the learner upon request, assessing team communication. Limited patient communication is not a limitation due to patient unconsciousness post respiratory failure. Following resuscitation, the learner must administer a vasopressor. Dopamine is the most
common low-resource first line agent\textsuperscript{45}, compared to noradrenaline in international guidelines\textsuperscript{46}. Medication choice interestingly includes dopamine instead of noradrenaline. Infection management is not included even though the case suggests bacterial infection. Choice of antimicrobials in low-resource settings is often poor, but antimicrobial therapy is essential within an hour of presentation no matter the setting\textsuperscript{42}.

3. How does VR compare to HFS in delivering a resource-appropriate simulation experience?

![Figure 6: A still from the OMS application demonstrating how interaction via multiple-choice menus allows communication with the patient and virtual staff, as well as clinical examination\textsuperscript{33}.

3.1 Seizure and Hypoglycaemia Scenario

No international guidelines on diabetes mellitus associated seizures exist due to poor understanding. They are hence often treated as epileptic, with corresponding anti-convulsants\textsuperscript{47}. Treatment resistance is common, and epidemiology has not been widely studied. Appropriate training may both improve patient safety and reduce hospital readmission, positively impacting resources.

This scenario involves a patient with type 1 diabetes mellitus, admitted presenting with acute confusion and fatigue. Medical records available via computer or telephone call to the patient’s
partner allows collateral history taking, while hypoglycaemia can be investigated using blood glucose tests (Figures 6 and 7). Convulsions prompt a phone call to on-call medical staff (Figure 7), assessing SBAR (Situation, Background, Assessment, Recommendation), handover and following prescription guidance. The administration routes are adapted so that intravenous access is impossible during seizures. Learner mistakes are recorded for debrief, but there is guidance towards correct management so practice may carry on without deleterious effects to the patient. This may not reflect a real-life scenario but enables learning from one’s mistakes through self-guided feedback. Debrief is comprehensive (Appendix B) and includes sources to guidelines to explore unfamiliar rationale. No such resources are provided in CAE facilitation notes - an advantage for VR simulation.

Figure 7: A recording of the virtual representation of a tonic-clonic seizure in the ‘Seizure and hypoglycaemia’ scenario, captured using the OMS application, which is more accurate to real-life episodes than the corresponding HFS simulation.

3.2 Sepsis and Delirium Scenario

Delirium is an encephalopathy linked to greater sepsis patient mortality. Prevalence in developing countries is not well-documented but infection rates are high. Poor diagnosis is not uncommon, and treatment can only address underlying infection. Delirium simulation has been developed for standardised patients and high-fidelity manikins. These require intricate equipment setups, a possible barrier for low-resource settings.
In this scenario, an elderly patient presenting with confusion and urosepsis is admitted. The patient repeatedly asks for his partner and dismisses questions, so a collateral history is needed. Patient communication is key in gauging the confused state, but no staff are required; unlike in one manikin-based simulation which requires up to five staff members. Investigation results such as of blood tests can be independently reviewed, not possible in manikin-based simulation. As in the manikin SCE reviewed earlier, fluids are used in management, but here the timely administration of antibiotics is central to treatment, as derived from Surviving Sepsis guidelines.

4. Cost: how financially feasible is VR implementation?

The most common approach to simulation cost reporting identifies all resources involved, places value and calculates cost per learner. Cost-utility analyses may be more appropriate for comparisons used for policymaking. The full cost for VR simulation setup was considerably cheaper than that of manikin-based simulation (Appendix C). OMS offer a recommended hardware package with a fixed cost of £5000. This may be more appropriate to run VR; our hardware encountered some problems, so the sizeable difference in costs of these setups suggests a possible middle ground. Approximating from the cost of advanced life support simulation, one simulation per learner is at least 22 times cheaper to run in VR. Strikingly, the cost of one manikin simulation is equivalent to 83 VR scenarios.

Compared to LFS, implementation of which has been studied in low-resource settings, initial VR simulation setup costs may be greater. Five days of physician trauma training using standardised patients in Nicaragua cost £2064.18 for 33 participants. However, this required recruitment of community members and costs of time lost by staff were not discussed. The cost post-setup is £6.62 for 33 participants - similar to one OMS virtual simulation per participant. A Rwandan anaesthetist non-technical skills simulation course utilising a basic airway manikin cost ~ £2900 for 10 participants. Involving more staff in simulation teaching was discussed with concerns of exacerbating patient safety. The latter study drew particular attention to the need to consider SBME adaptation to regional clinical practice. In Rwanda, anaesthetists may not be familiar with preparing procedure supplies as all are provided by patients. Highly standardised OMS VR simulation may not reflect these regional particularities and affect learning and cost outcomes.
Limitations of this study

Simulations that modelled the exact same neurological conditions were not accessible; comparison may not be generalisable to all scenarios beyond those reproducing neurological deficit. Furthermore, not all cost analysis parameters were examined due to limited resources, and local challenges in implementation of VR simulation, especially without understanding of all stakeholders, is impossible to predict. Moreover, further analysis of local clinical need of specific scenarios is required.

Future directions

Future studies may assess the effects of newly launched multiplayer VR platform OMS Interprofessional\textsuperscript{25} on learning outcomes, especially as an alternative to tele-simulation in remote locations used in many low-resource settings\textsuperscript{56,57}. It may be particularly relevant to SBME during the Covid-19 pandemic as Moscote-Salazar \textit{et al.}\textsuperscript{58} have noted that simulation is able to quickly prepare emergency clinics. If institutions may wish to implement VR simulation teaching in a low-resource setting, this investigation may provide some background when a more formal needs assessment is conducted. It may be useful that the SBME implementation process is studied, with comparison of existing training to VR simulation in learning and patient safety outcomes. Little evidence exists of such studies in LMICs. This presents a possibility of an implementation science or quality improvement project that may be able to help address the existing "research-to-practice" gap that exists in simulation research\textsuperscript{59}.

Conclusion

This study concludes that VR may indeed be more cost-effective compared to high-fidelity manikin-based simulation, due to numerous features that increase the fidelity of training at a substantially lower price. However, simulations for a broader range of conditions must be compared to confirm wider application of this. While VR may not provide the same interactive experience with all aspects of a clinical setting, it can be a better representation of a clinical scenario, as seen from seizure scenario comparisons. As for the application to medical education in a low-resource setting, it is not clear that this technology should be introduced in place of low-cost simulation. Simulation is still not a commonplace component of medical training in LMICs. Stretched resources may suggest that low-cost, more often basic manikin or standardised patient teaching, is still the best way to introduce simulation. The limitations of manikin-based simulation are nonetheless significant. Hence if an opportunity to develop a
simulation programme arises, VR should be considered as an alternative to high-fidelity manikin-based simulation, as it may be much more accessible.

**Acknowledgements**

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**Appendices**

**Appendix A**: A general qualitative assessment of the features common to all scenarios that are involved in running CAE manikin-based simulation and OMS VR-based simulation scenarios.

<table>
<thead>
<tr>
<th>Feature</th>
<th>High-Fidelity Manikin</th>
<th>Virtual Reality Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to case</strong></td>
<td>Given by facilitator who can play the role of a member of the medical team</td>
<td>Given by virtual nursing assistant</td>
</tr>
<tr>
<td><strong>Setting flexibility</strong></td>
<td>Easily adaptable to suit training needs</td>
<td>Standardised setting throughout all scenarios</td>
</tr>
<tr>
<td><strong>Role of facilitator or faculty member</strong></td>
<td>May act as secondary actor; essential to run training scenario and relay learner interactions as manikin input</td>
<td>Little faculty involvement required</td>
</tr>
<tr>
<td><strong>Patient history taking</strong></td>
<td>Relayed by facilitator</td>
<td>Accessed by communication with virtual patient. Collateral history may be obtained from virtual family members or staff by phone</td>
</tr>
<tr>
<td><strong>Suggested equipment/supplies</strong></td>
<td>List provided to facilitator. Includes wide range of medical equipment; display screen provided with manikin; PC or laptop PC essential</td>
<td>Only hardware required is PC or laptop PC with sufficient requirements; choice of VR headsets given for fully</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Characteristics</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Choice of medication</td>
<td>Small range of appropriate medication available</td>
<td>Available in medication box or crash trolley; A-Z list of wide range of medication, including not scenario specific</td>
</tr>
<tr>
<td>Stage advancement in patient state</td>
<td>Stages advance after a set time has elapsed; manual advancement may be required by facilitator or simulation technician</td>
<td>No set stages detailed, but patient state progresses after set time</td>
</tr>
<tr>
<td>Time given per scenario</td>
<td>Variable, but standardised to each scenario unless stage requires manual advancement</td>
<td>Variable, but standardised to each scenario; displayed to learner on countdown timer; possible to pause if learner removes VR headset</td>
</tr>
<tr>
<td>Team communication</td>
<td>Possible to have several members of the team working together on the same scenario; facilitator may act as team member</td>
<td>Can be assessed if learner interacts with virtual nursing assistant or other virtual staff available via phone call</td>
</tr>
<tr>
<td>Multiplayer aspect</td>
<td>Easily accessible, can be adapted according to training needs</td>
<td>Not currently available</td>
</tr>
</tbody>
</table>

**Appendix B:** In-depth qualitative assessment of features in a selection of simulation scenarios to compare high-fidelity manikin-based and VR-based simulation.
<table>
<thead>
<tr>
<th>Feature</th>
<th>High-Fidelity Manikin</th>
<th>Virtual Reality Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizure scenarios</td>
<td>Organophosphate exposure</td>
<td>Seizure and hypoglycaemia</td>
</tr>
<tr>
<td>Breath sounds</td>
<td>Automatic or initiated by facilitator; relevant sounds: wheezing, crackles</td>
<td>Heard during lung auscultation, results announced as “No stridor”</td>
</tr>
<tr>
<td>Neurological signs</td>
<td>Initiated/communicated by facilitator; convulsions represented by manikin shaking; pupil size</td>
<td>Accurately reproduced convulsions; drowsiness and confusion; pupil size</td>
</tr>
<tr>
<td>Physiological parameters available</td>
<td>Heart rate, blood pressure, respiratory rate, oxygen saturation, mean arterial blood pressure; on monitor</td>
<td>Heart rate, blood pressure, oxygen saturation: on virtual monitor; body temperature</td>
</tr>
<tr>
<td>Pulse palpation</td>
<td>Carotid, femoral, brachial, radial, popliteal, posterior tibial, dorsalis pedis; via tactile interaction</td>
<td>Central and peripheral; no tactile interaction</td>
</tr>
<tr>
<td>Patient communication</td>
<td>Manikin vocalises ‘I can’t breathe’</td>
<td>Via communication menu (Fig. 7), made difficult in scenario due to patient drowsiness</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>NA</td>
<td>ECG, ABG, blood tests, blood glucose</td>
</tr>
<tr>
<td>Clinical examination</td>
<td>NA</td>
<td>Capillary refill time, cardiac auscultation, lung auscultation, respiratory rate</td>
</tr>
<tr>
<td>Oxygen therapy</td>
<td>Nasal cannula, bag valve mask, non-rebreather mask</td>
<td>Nasal cannula, venturi mask, non-rebreather mask</td>
</tr>
<tr>
<td>Intubation</td>
<td>Endotracheal tube</td>
<td>Oropharyngeal tube, laryngeal mask, endotracheal tube</td>
</tr>
<tr>
<td>Debrief</td>
<td>Via facilitator; detailed, 9 prompts; ‘Teaching Q+A’ used to discuss</td>
<td>Short, guided reflection post-scenario; learning objectives;</td>
</tr>
<tr>
<td>Sepsis scenarios</td>
<td>Pneumonia with septic shock</td>
<td>Sepsis and delirium</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>Breath sounds</strong></td>
<td>Automatic or initiated by facilitator; relevant sounds: crackles</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Neurological signs</strong></td>
<td>Alertness level; pupil size</td>
<td>Alertness level; pupil size; orientation assessment to people, time, and place</td>
</tr>
<tr>
<td><strong>Physiological parameters available</strong></td>
<td>Respiratory rate, blood pressure, mean arterial pressure</td>
<td>Heart rate, respiratory rate, blood pressure, oxygen saturation: on virtual monitor; body temperature</td>
</tr>
<tr>
<td><strong>Pulse palpation</strong></td>
<td>See ‘Pulse palpation’ for seizure scenarios</td>
<td>Central, peripheral; No tactile interaction</td>
</tr>
<tr>
<td><strong>Patient communication</strong></td>
<td>Limited due to low alertness</td>
<td>Alertness level, allergies</td>
</tr>
<tr>
<td><strong>Diagnostic tests</strong></td>
<td>ECG, X-ray</td>
<td>ECG, urine dip, urine cultures, urine output, blood tests, ABG</td>
</tr>
<tr>
<td><strong>Clinical examination</strong></td>
<td>NA</td>
<td>Range of exams: CNS, cardiovascular, respiratory, abdominal, skin</td>
</tr>
<tr>
<td><strong>Oxygen therapy</strong></td>
<td>Nasal cannula, bag valve mask, non-rebreather mask</td>
<td>Nasal cannula, venturi mask, non-rebreather mask</td>
</tr>
<tr>
<td><strong>Intubation</strong></td>
<td>Endotracheal tube</td>
<td>Oropharyngeal tube, laryngeal mask, endotracheal tube</td>
</tr>
<tr>
<td><strong>Debrief</strong></td>
<td>Structured debrief with learner reactions and scenario discussion; lead by facilitator</td>
<td>See ‘Debrief’ for seizure scenarios</td>
</tr>
</tbody>
</table>
Appendix C: A cost comparison table derived from Zendejas et al. Costs approximated using current retail price. Courtesy of Bristol Biomedical Simulation Centre and OMS.

<table>
<thead>
<tr>
<th>Cost category</th>
<th>Definition</th>
<th>Manikin-based simulation</th>
<th>VR-based simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment and materials</td>
<td>Purchase and maintenance, including regular fees, furnishings and appliances</td>
<td>Manikin, software, laptop PC required to run software, screen display for physiological parameters: £45,000</td>
<td>Oculus Rift S VR headset: £299, Desktop PC setup: ~£1000, Software subscription (per 20 scenarios): £200 per year</td>
</tr>
<tr>
<td>Personnel costs</td>
<td>Staff salary, time, number of staff, training</td>
<td>At least 2 members of staff</td>
<td>Max. 1 member of staff</td>
</tr>
<tr>
<td>Facility costs</td>
<td>Rent or purchase</td>
<td>Not available; likely more significant than that required for VR setup due to space required to replicate the same environment</td>
<td>None or minimal; 1x1m space in existing facility easy to adapt</td>
</tr>
<tr>
<td>Required client inputs</td>
<td>Learner’s expenses and lost revenue time away from clinical duties</td>
<td>Not available</td>
<td>Not available. Simulation training can be undertaken in own time or as part of training program or curriculum</td>
</tr>
<tr>
<td>Other inputs</td>
<td>Information technology, telephone and internet access</td>
<td>Internet access required</td>
<td>Internet access required</td>
</tr>
</tbody>
</table>
References


