OMS

OXFORD MEDICAL SIMULATION

Virtual Reality Healthcare Simulation

–

Spring 2020

A brief note

Thank you for your interest in Oxford Medical Simulation.

What follows is a brief proposition outlining how OMS can provide cutting-edge technology and proven educational techniques to help you deliver quality, objective, standardized healthcare education.

We look forward to hearing your thoughts and to refining a cost effective and practical solution with you.

With very best wishes,

The OMS team

WHY WE DO IT

- **INCREASE SIM DELIVERY**
  - Flexible, faculty-free, time saving
  - Integrate simulation with practice
- **OPTIMIZE PERFORMANCE**
  - Focus on confidence, competence and outcomes
- **IMPROVE SATISFACTION**
  - Engaging, immersive, 'real', enjoyable

HOW WE DO IT

VIRTUAL REALITY PLATFORM

- Immersive, engaging, relevant scenarios
- Explicit learning outcomes
- Reflection, feedback, scoring, blended learning
- Repetition and deliberate practice

DATA

WHAT WE DO

- **DECISION MAKING**
- **CLINICAL REASONING**
- **CRITICAL THINKING**

Competency-based education

WHO WE ARE

- **VR DEVELOPERS**
- **ARTISTS, MODELERS**
- **ANIMATORS**
- **SIM PROFESSIONALS**
- **EDUCATIONALISTS**
- **CLINICIANS**

OVERVIEW OF OMS

OMS platform
Overview

OMS exists to optimize and standardize the delivery of simulation-based training and assessment. We do this using virtual reality - saving institutions time, space and money to improve patient care.

Clinical experiences on demand

- Providing students and healthcare professionals with quality clinical training is a challenge.
- As a world-leading Virtual Reality (VR) simulation company, we build fully immersive and interactive medical scenarios so learners can practice managing patients without risking lives.
- This regular, flexible training builds confidence and competence to optimize transfer of learning to practice.

Testimonials

*"The ability for our nursing students to practice standardized, realistic clinical scenarios whenever they need is **game-changing**."*

Executive Director of Simulation, NYU School of Nursing

*"Beginning, sceptical. End, gobsmacked! **Seriously clever stuff**!"*

Simulation Lead, Bristol Medical Simulation Center, UK

*"Honestly, this is the **single most useful experience I've had so far in my medical training.**"*

Emergency Medical Doctor, NHS

Proven impact on performance

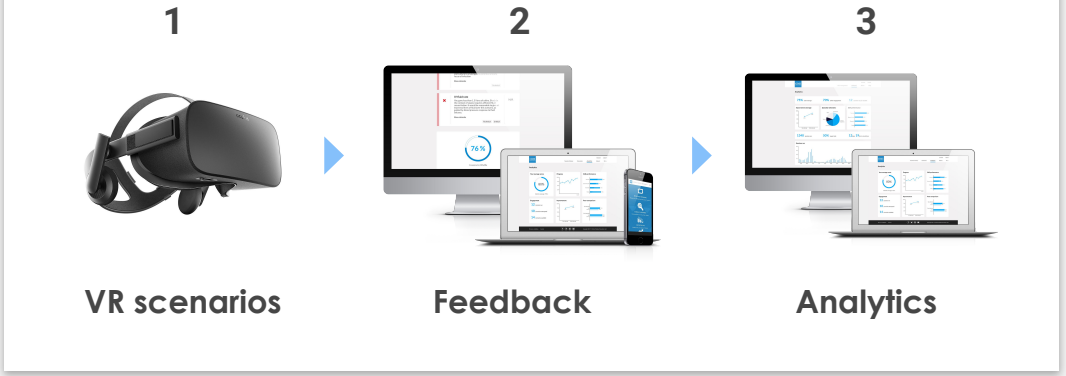
- Independent studies demonstrate the OMS system produces significantly improved learner behavior in key areas affecting patient safety.

OMS platform
How it works

Designed to reflect optimal learning in physical simulation: delivering proven techniques with innovative technology.

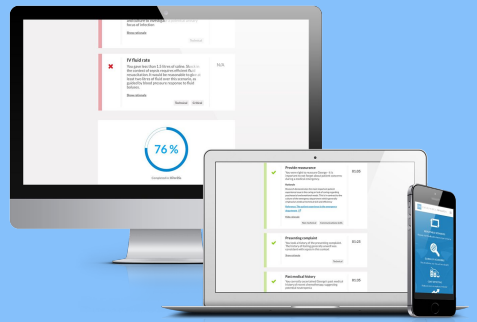
Engaging; Immersive; Efficient; Effective

- Using VR headsets, learners are immersed in clinical situations with dynamic, engaging patients in true-to-life clinical scenarios.
- The focus is on decision making, critical thinking and clinical reasoning - allowing healthcare professionals to apply their knowledge, learn from their mistakes and repeat as often as they like.
- Learners then receive guided debrief, feedback, and blended learning.
- Personal performance metrics and analytics are available to learners and faculty, allowing progress tracking and needs identification.



VR SIMULATION

GUIDED REFLECTION & FEEDBACK

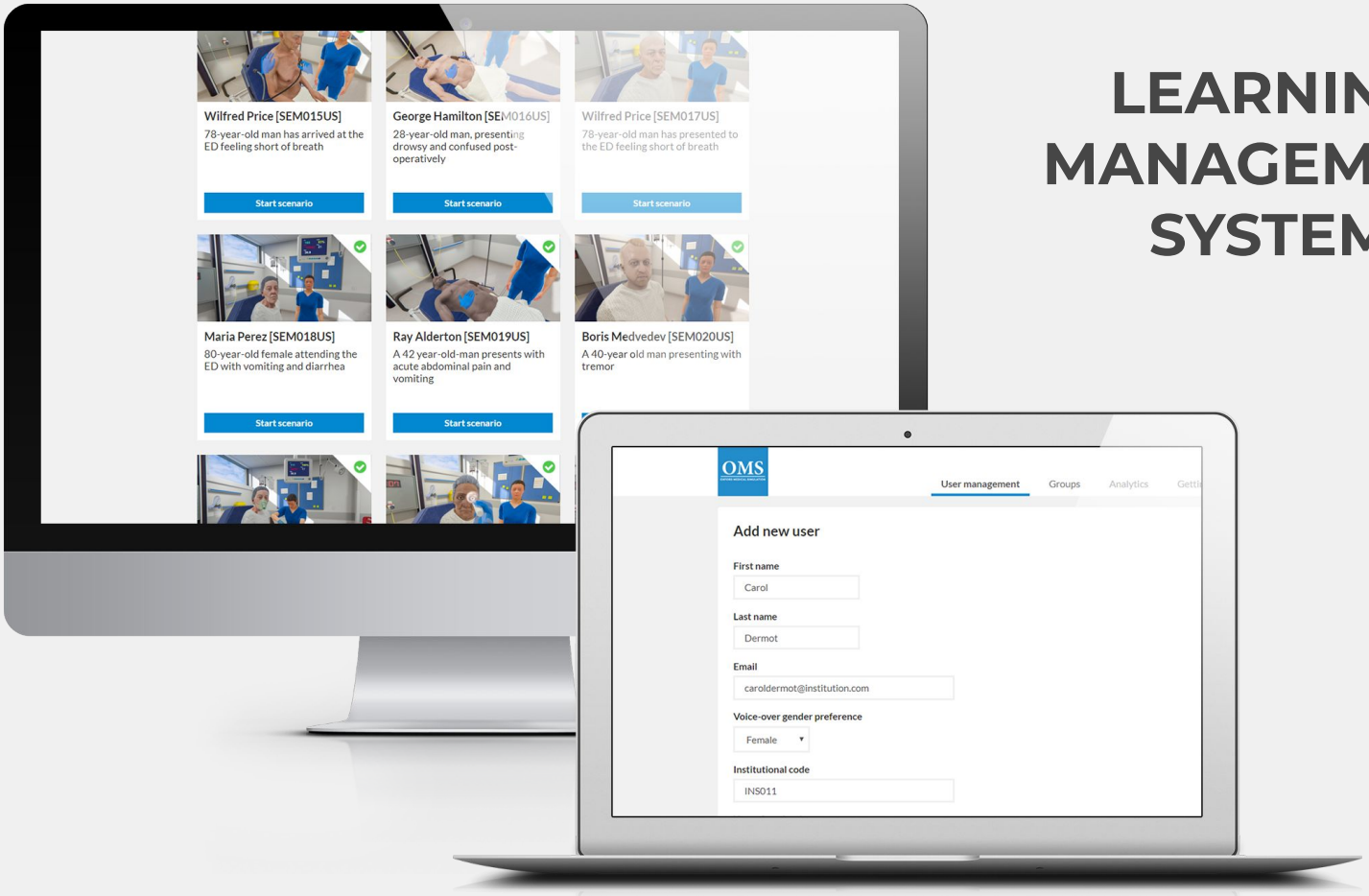


DATA, ANALYTICS & REPORTING

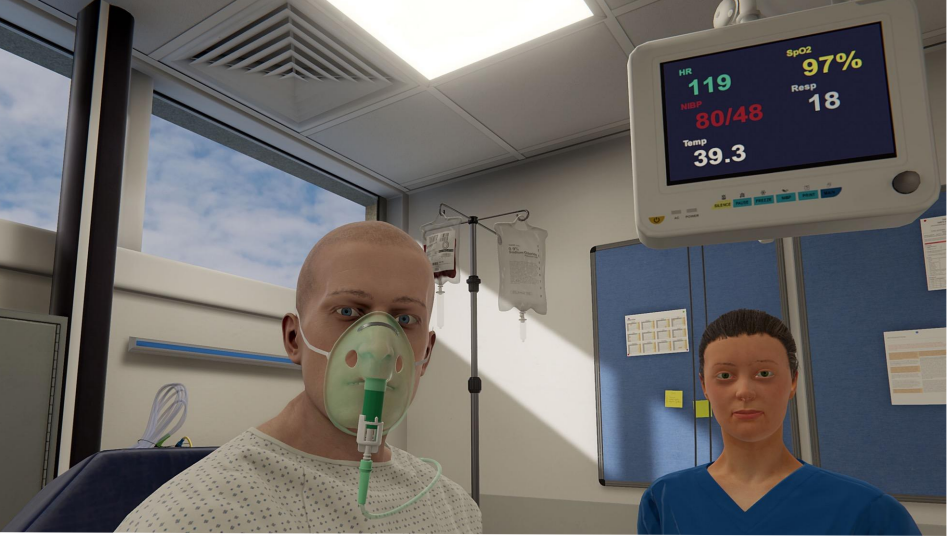
LEARNING MANAGEMENT SYSTEM

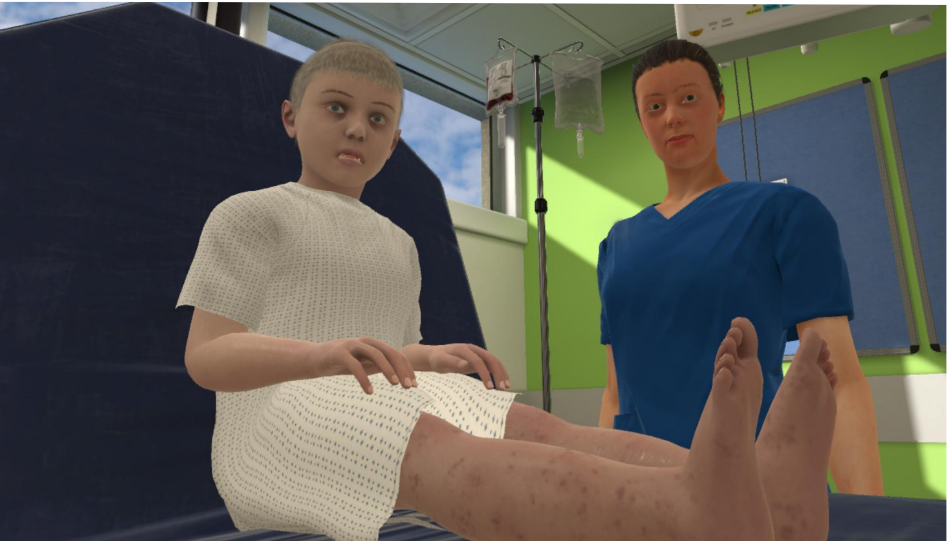
LEARNING MANAGEMENT SYSTEM

LEARNING MANAGEMENT SYSTEM



IMMERSIVE SCENARIOS


HR
119
SpO2
97%
NIBP
80/48
Resp
18
Temp
39.3

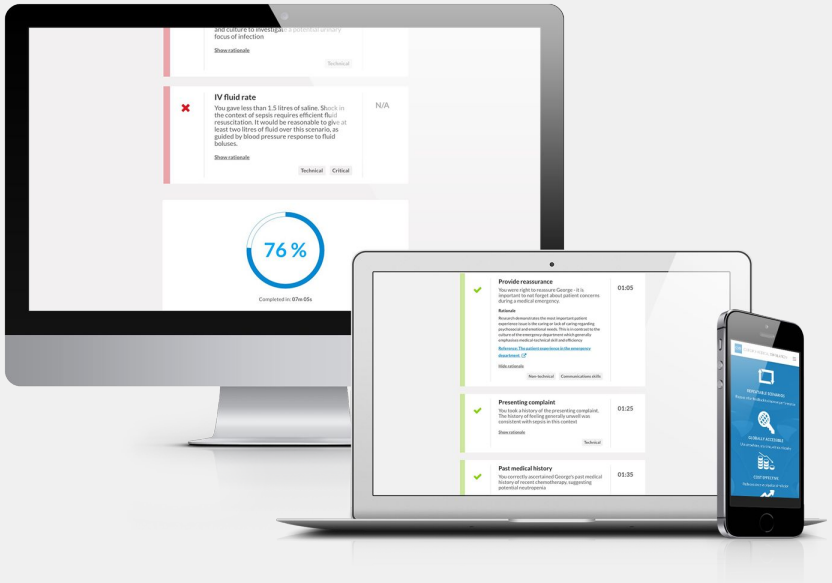



10:20

FEEDBACK

2. FEEDBACK & BLENDED LEARNING

Real-time feedback on learning performance covers technical and non-technical fields including teamwork, communication and prioritization.



Performance-based

- Timestamped feedback identifies strengths and areas for improvement in technical and non-technical fields

Personal and interactive

- Intelligent, individualized feedback allows learners to engage and explore learning points in detail

Blended learning

- Blended learning links out to latest evidence and local protocols to meet curriculum requirements

Customizable

- All learning is instantly customizable to integrate with any organization's curriculum and protocols

Targeted to competencies

- Feedback is linked to relevant educational competencies to ensure learning requirements are met

George, Neutropenic Sepsis [SEM001US]

Learning Objectives

Diagnosis

Neutropenic sepsis and penicillin allergy.

Case Summary

Acutely septic patient, immunocompromised due to chemotherapy. Penicillin allergic.

Clinical Findings

Shocked. Septic (heart rate >100, systolic blood pressure <100, pyrexial, lactate >4). No clear source of sepsis identifiable.

Technical Skills

Assessment

- Perform ABCDE assessment
- Take a focused patient history

Initial Investigations

- Take and review routine labs
- Take and review blood gas
- Take blood cultures
- Order and review a urine dip
- Request and review chest x-ray

Management

- Deliver oxygen to maintain saturations over 94%
- Start appropriate IV fluid resuscitation
- Administer appropriate IV antibiotics
- Commence urine output monitoring

Non-technical Skills

- Make rational & timely clinical decisions
- Effectively communicate with patient and team
- Maintain patient safety and comfort
- Contact appropriate clinical teams (oncology)
- Seek advice from Attending
- Access appropriate guidelines (sepsis)

What went well

Hand hygiene

Antibiotics for neutropenic sepsis

You correctly treated a penicillin allergic patient for neutropenic sepsis

Show rationale

Technical Critical

06:45

Antipyretic administation

You gave paracetamol to relieve George's symptoms of fever and shivering. Note that IV administration has a quicker onset that oral

Technical

06:55

Efficient patient managment

You finished this scenario in under eight minutes. Provided you carried out the required clinical steps, this demonstrated efficient managment.

Technical Critical

07:05

What to improve on

IV assignment

You secured IV access yourself - you could have asked the nurse to do this to make better use of your team

Show rationale

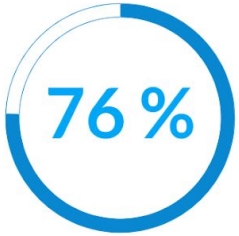
Non-technical Teamwork

03:45

response to fluid boluses.

Show rationale

Technical Critical



Completed in: **07m 05s**

How we calculate your score & provide feedback

My reflective practice

Record your reflections on the scenario here. These can be saved and used as an example of your learning development.

Save reflection

ANALYTICS

3. DATA, ANALYTICS & REPORTING

A full data and analytics dashboard allows learners and institutions to view and act on real-time performance metrics.

Personalized

- Performance-derived analytics outline specific clinical strengths and areas for improvement

Motivating

- Clinically-weighted and transparent scoring system motivates learners to ensure ongoing engagement

Collaborative

- Analytics are available to learners and faculty simultaneously, facilitating performance review and mentorship

Flexible

- All data is available on the user's personal device and institutional computers to create a shared learning passport

Exportable

- Learner reflection, feedback and score can be exported as certificates for portfolios

OMS
OXFORD MEDICAL SIMULATION

Account Logout

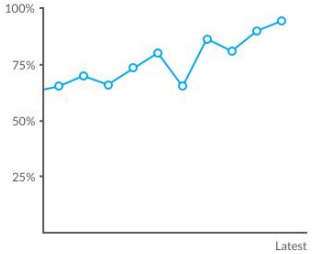
Session history Scenarios Analytics About Help

Analytics

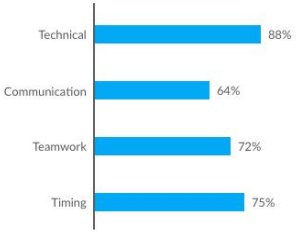
Your average score

Cohort average: 75%

Progress



Skill performance



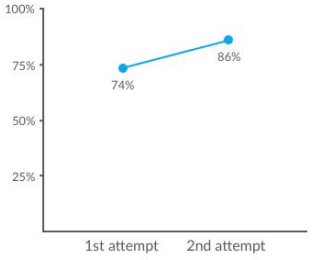
Engagement

12 sessions run

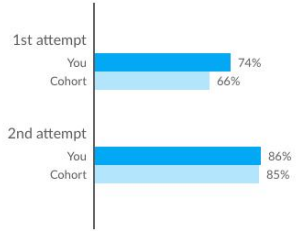
10 scenarios attempted

14 scenarios available

Improvement



Peer comparison



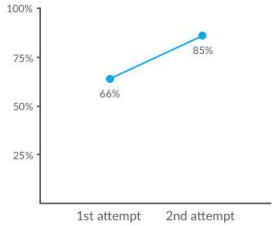
Analytics

75% score average

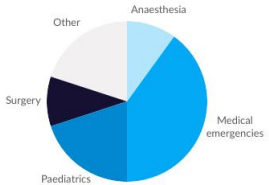
70% cohort engagement

12 sessions run per student

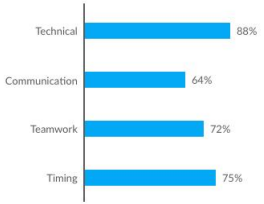
Improvement average



Specialty selections



Skill performance

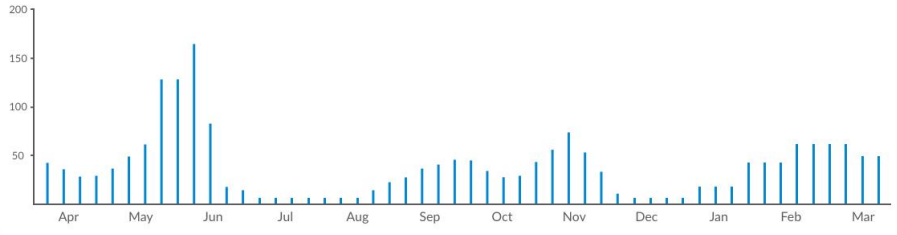


1340 sessions run

50% repeat rate

12 days **19** hrs in simulations

Sessions run



OMS INTERPROFESSIONAL

Multiplayer design

- Scenarios designed for team training, focusing on human factors

Active, faculty & observer roles

- Multiple roles to fulfill learning needs: active, speech only or passive observer role

Full collaborative debrief

- Debrief suite allows interprofessional debrief based on team and individual performance

Timeline and detailed feedback

- Multiple feedback views, learning objectives & radiology to help facilitate debrief

VR and screen modes

- Blending immersion and accessibility with VR and screen-based multiplayer modes


Presenting complaint
You took a history of the presenting complaint. The history of feeling generally unwell was consistent with sepsis in this context.
Technical
George
00:20
Update nurse
You correctly discussed the clinical situation with the nurse to ensure shared mental models and goals
Non-technical, Teamwork
Denis
00:35
IV fluids
You correctly gave fluids to a septic patient. It would be reasonable to give 1 to 2 litres initally, but reviewing after 500ml boluses is another option
Technical, Critical
Michael
00:35
Hand hygine
You correctly carried out hand hygiene to help prevent the spread of infection
Technical
Artur
00:30
SCENARIO TIMELINE
user 1
user 2
0:00
4:21
10:54
10:54
8:23 Chest X-ray
8:34 Medication Administration Record
8:53 Fluid Administration Record
9:00 Medical history
9:03 Medication Administration Record
9:17 Calcium gluconate 30ml of 10%
9:21 Medication Administration Record
9:35 Medication Administration Record
9:44 Insulin: 10 units in 25g glucose IV
9:47 Medication Administration Record
10:07 Cyclizine 50mg IV
10:08 Fluid Administration Record
10:14 Medical history
10:17 Medication Administration Record
10:32 Ask about pain
10:46 How are you feeling?
10:54 Leave scenario
Vbg Results
Abg Results
Result 1
Result 2
Result 3
MANAGEMENT OF ANAPHYLAXIS IN ADULTS

Comparison of Benefits:
Single Player vs Multiplayer

Single player	Multiplayer
Learner-driven	Human factors focus - communication and teamwork
Simple scheduling	Interprofessional engagement
Psychological safety	In-scenario tuition and mentoring
100% objective and standardized	Remote teaching and learning
	Full team debrief

CONTENT

Scenario Libraries

- Scenarios in the OMS catalogue are divided into libraries. Each library is composed of up to twenty scenarios.

- These libraries cover:
  - **Medical Emergencies**
    For Doctors and Medical Students
  - **Nursing Emergencies (NP)**
    For Nurse Practitioners
  - **Nursing Medical-Surgical (RN)**
    For Nursing students and Registered Nurses
  - **Junior Nursing Medical-Surgical (RN)**
    For Junior Nursing Students
  - **Pediatric Emergencies**
    For Doctors and Medical Students
  - **Pediatric Nursing Emergencies (RN)**
    For Nursing Students and Registered Nurses
  - **Psychiatric Nursing, inpatient/community**
    - For Nursing Students, Registered Nurses

Overleaf is the selection of clinical presentations that go into any library. Note specific scenarios can differ and libraries can be adapted to institutional requirements.

Medical Emergencies Library

- **Sepsis**
  - Neutropenic sepsis with penicillin allergy
  - Pneumonia and renal transplant
  - Delirium with urosepsis
  - Intravenous drug user with cellulitis and abscess
  - Perforated diverticular disease and peritonitis
  - Bacterial meningitis
- **Cardiac**
  - Congestive heart failure and pulmonary edema
  - NSTEMI
- **Respiratory**
  - Acute severe asthma
  - Deep vein thrombosis and pulmonary embolism
  - Pneumothorax
  - Infective exacerbation of COPD
- **Gastroenterology**
  - Upper gastrointestinal bleed
  - Steroid-induced pancreatitis
- **Other**
  - Diabetic ketoacidosis
  - Anaphylaxis
  - Seizure and hypoglycemia
  - Post-operative morphine overdose
  - Hyperkalemia and AKI
  - Alcohol withdrawal and suicidal ideation

Nursing Emergencies Library

- **Sepsis**
  - Neutropenic sepsis with penicillin allergy
  - Pneumonia and renal transplant
  - Delirium with urosepsis
  - Intravenous drug user with cellulitis and abscess
  - Perforated diverticular disease and peritonitis
  - Bacterial meningitis
- **Cardiac**
  - Congestive heart failure and pulmonary edema
  - NSTEMI
- **Respiratory**
  - Acute severe asthma
  - Deep vein thrombosis and pulmonary embolism
  - Pneumothorax
  - Infective exacerbation of COPD
- **Gastroenterology**
  - Upper gastrointestinal bleed
  - Steroid-induced pancreatitis
- **Other**
  - Diabetic ketoacidosis
  - Anaphylaxis
  - Seizure and hypoglycemia
  - Post-operative morphine overdose
  - Hyperkalemia and AKI
  - Alcohol withdrawal and suicidal ideation

Junior Nursing Med-Surg Library

- **Sepsis**
  - Neutropenic sepsis with penicillin allergy
  - Pneumonia and renal transplant
  - Delirium with urosepsis
  - Intravenous drug user with cellulitis and abscess
  - Perforated diverticular disease and peritonitis
  - Bacterial meningitis
- **Cardiac**
  - Congestive heart failure and pulmonary edema
  - NSTEMI
- **Respiratory**
  - Acute severe asthma
  - Deep vein thrombosis and pulmonary embolism
  - Pneumothorax
  - Infective exacerbation of COPD
- **Gastroenterology**
  - Upper gastrointestinal bleed
  - Steroid-induced pancreatitis
- **Other**
  - Diabetic ketoacidosis
  - Anaphylaxis
  - Seizure and hypoglycemia
  - Post-operative morphine overdose
  - Hyperkalemia and AKI
  - Alcohol withdrawal and suicidal ideation

Pediatrics

- Sepsis
- Acute asthma
- Seizure
- Anaphylaxis
- Diabetic ketoacidosis
- Non-accidental injury

Mental Health

- Bulimia nervosa & self harm
- Acute anxiety
- Alcohol withdrawal with suicidal Ideation
- Illicit drug dependence
- Suicide attempt

LEARNING OBJECTIVES

Sample Learning Objectives

All scenarios are designed from general learning objectives, linked to specific actions that demonstrate competencies. This is an example of one set of objectives.

Urosepsis (Medical)

- Patient: Maria Perez, 86-year-old woman with a change in mental status and non-healing sacral wound
- Diagnosis: Sepsis secondary to urinary tract infection
- Case summary: 86-year-old woman with chronic pressure ulcer presenting with severe sepsis and acute organ dysfunction secondary to urosepsis
- Clinically: Confused, SOB, febrile, hypotensive (systolic <90), tachycardia (HR >110), hypoxic (sats<86), tachypnea (RR>24), urine dip positive

Technical skills

- **Perform ABCDE Assessment**
  - Airway
    - Assess patency
  - Breathing
    - Assess respiratory rate and O2 sats
    - Perform respiratory exam
    - Provide supplemental oxygen
  - Circulation
    - Assess peripheral cap refill, pulses, HR, BP
    - Perform cardiovascular exam
  - Disability
    - Assess pain
    - Check blood glucose
    - Check pupils and orientation
  - Exposure
    - Measure temperature
    - Perform skin exam
- **Take focused history (patient +/- chart)**
  - Presenting complaint
  - History of presenting complaint
  - Past medical history
  - Medications and allergies
- **Check protocols**
- **Perform investigations**
  - Take and review blood tests
  - Take and review arterial or venous blood gas
  - Take or review appropriate cultures (blood/urine)
  - Order chest x-ray if protocol allows
- **Management**
  - Deliver oxygen to maintain saturations over 94%
  - Start appropriate IV fluid resuscitation
  - Commence urine output monitoring
  - Administer appropriate IV antibiotics

Non-technical skills

- Make appropriate, timely clinical decisions
- Prioritize to efficiently to expedite scenario completion
- **Maintain patient safety and comfort**
  - Identify patient
  - Observe hand hygiene
  - Ensure no harmful medications, radiation doses
- **Effectively communicate with patient**
  - Introduce yourself
  - Explain ongoing assessment
  - Provide reassurance
  - Provide opportunity for questions
- **Effectively manage your team**
  - Delegate appropriately to nurse
- **Questions: Patient safety and comfort**
  - Recognize importance of bed rails
  - Recognize importance of call bell proximity
  - Recognize importance of personal belongings
- **General learning objectives**
  - Gather and synthesise information to define each patient's clinical issue
  - Practice patient-centred care, responding to unique patient characteristics and needs
  - Demonstrate clinical decision-making and critical thinking in a clinical environment
  - Apply clinical knowledge and adapt to changes in patient condition
  - Provide consultative and interdisciplinary care
  - Communicate effectively with patients and caregivers
  - Escalate and refer appropriately
  - Work effectively in an interprofessional team
  - Demonstrate learning from formative feedback

Sample Learning Objectives

All scenarios are designed from general learning objectives, linked to specific actions that demonstrate competencies. This is an example of one set of objectives.

Upper GI Bleed (Nurse Practitioner)

- Patient: Deepak Patel, 64-year-old male presenting with hematemesis and melena
- Diagnosis: Upper GI Bleed
- Case summary: Mild epigastric pain with two large volume hematemesis. Recent melena.
- Clinically: Tachycardia, hypotension, abdominal pain, positive blood in stool, low hemoglobin

Technical skills

- **Perform ABCDE Assessment**
  - Airway
  - Breathing
    - Assess respiratory rate and O2 sats
    - Perform respiratory exam
  - Circulation
    - Assess peripheral cap refill, pulses, HR, BP
    - Perform cardiovascular exam
  - Disability
    - Perform abdominal exam
    - Examine mouth and fluid status
  - Exposure
    - Perform PR exam
- **Take focused history (patient +/- chart)**
  - Presenting complaint
  - History of presenting complaint
  - Past medical history
  - Medications and allergies
  - Social history or risk factors
- **Check protocols**
- **Perform investigations**
  - Take and review blood tests
  - Take and review arterial or venous blood gas
  - Order and review erect chest x-ray
- **Management**
  - Deliver oxygen to maintain saturations over 94%
  - Start appropriate IV fluid resuscitation
  - Commence urine output monitoring
  - Administer IV analgesic, antiemetic, Vitamin K
  - Give Blood
  - Discuss case with Gastroenterology

Non-technical skills

- Make appropriate, timely clinical decisions
- Prioritise to efficiently to expedite scenario completion
- **Maintain patient safety and comfort**
  - Identify patient
  - Observe hand hygiene
  - Ensure no harmful medications, radiation doses
- **Effectively communicate with patient**
  - Introduce yourself
  - Explain ongoing assessment
  - Provide reassurance
  - Provide opportunity for questions
- **Effectively manage your team**
  - Delegate appropriately to nursing assistant
- **General learning objectives**
  - Gather and synthesise information to define each patient's clinical issue
  - Practice patient-centred care, responding to unique patient characteristics and needs
  - Demonstrate clinical decision-making and critical thinking in a clinical environment
  - Apply clinical knowledge and adapt to changes in patient condition
  - Provide consultative and interdisciplinary care
  - Communicate effectively with patients and caregivers
  - Escalate and refer appropriately
  - Work effectively in an interprofessional team
  - Demonstrate learning from formative feedback

Sample Learning Objectives

All scenarios are designed from general learning objectives, linked to specific actions that demonstrate competencies. This is an example of one set of objectives.

Pediatric sepsis (Registered Nurse)

- Patient: Sam Brock, 5 years old presenting to ED with mother
- Diagnosis: Difficulty breathing with chest sepsis
- Case summary: Five-year-old boy presenting with shortness of breath secondary to community acquired pneumonia
- Clinically: Unwell; drowsy; respiratory rate 42; temperature 39.1, signs of respiratory distress (intercostal recession, tracheal tug, subcostal recession); heart rate 130; prolonged cap refill; blood pressure 85/50

Technical skills

- **Perform ABCDE Assessment**
  - Airway
    - Assess patency
  - Breathing
    - Assess O2 sats
    - Recognize respiratory distress
    - Provide supplemental oxygen
  - Circulation
    - Assess central and peripheral cap refill
    - Assess heart rate
    - Assess blood pressure
  - Disability
    - Assess AVPU/orientation
    - Check blood glucose
    - Check pupils
  - Exposure
    - Measure temperature
    - Expose patient
- **Documentation**
  - Document assessment findings
- **Handover**
  - Deliver appropriate SBAR handover

Non-technical skills

- Make rational, timely clinical decisions
- Sensitively communicate with patient and carer
- Appropriately ask for help from other team members
- Maintain patient safety
- **Recognize ongoing needs**
  - Sepsis six
    - Deliver oxygen to maintain sats >94%
    - Take cultures
    - Take blood
    - Start IV fluid resuscitation
    - Administer IV antibiotics
    - Commence UOP monitoring
- **General learning objectives**
  - Gather and synthesize information to define each patient's clinical issue
  - Practice patient-centered care, responding to unique patient characteristics and needs
  - Demonstrate clinical decision-making and critical thinking in a clinical environment
  - Apply clinical knowledge and adapt to changes in patient condition
  - Provide consultative and interdisciplinary care
  - Communicate effectively with patients and caregivers
  - Escalate and refer appropriately
  - Work effectively in an interprofessional team
  - Demonstrate learning from formative feedback

Relationship to Competencies

All scenarios are linked to educational objectives and competencies.
This is an example of one such selection of competency domains for nursing; please contact us for relationship to other competencies.

Domain 1: Professional values

Scenarios necessitate demonstration of person-centered, evidence-based nursing practice, respecting and maintaining dignity within professional, ethical and legal frameworks. All scenarios require interaction with other health and social care professionals and agencies, service users, their carers and families for effective care. Self-debrief facilitates student evaluation of own patient care practices while feedback and blended learning encourage learner-led performance improvement, accountability and professional growth

Domain 2: Communication and interpersonal skills

Scenarios require and model safe, effective, compassionate and respectful patient and family communication in order to foster therapeutic relationships.
Colleague and interdisciplinary team interaction ensures learners can work effectively in the wider healthcare team.

Domain 3: Nursing practice and decision-making

Scenarios necessitate accurate assessment of people of all ages using appropriate diagnostic and decision-making skills, across essential and complex physical and mental health needs.
Successful scenario completion requires autonomous performance informed by the best available evidence and compliance with national guidelines. Scenarios span care systems allowing effective practice in various health care settings.

Domain 4: Leadership, management and team working

Scenarios test leadership in managing nursing care, responding to the needs of people of all ages in a variety of circumstances, including situations where immediate or urgent care is needed.
All scenarios require an understanding and coordination of interprofessional care when needed, and liaison with specialist teams.

2018-2019
NCSBN/CCNE Standards

The OMS platform provides an answer to the high number of clinical hours demanded by national accreditation bodies.

OMS and the NCSBN/CCNE standards

- ADN and BSN nursing programs require significant clinical hours, some as many as 1800.
- Simulation is one method of delivering these clinical hours, with some states allowing 50% of clinical hours to be replaced by simulation.
- On a national level, the most recent CCNE Standards of Accreditation "*do not specify or limit the number of hours of simulation that are acceptable.*" CCNE, 2013
- The National Council of State Boards of Nursing (NCSBN) elaborates that "*...experts agree that it is not the number of hours, but the quality of the experience.*" NCSBN, 2019
- The NCSBN additionally states that "*Nursing education programs are advised to begin slowly and steadily increase the amount of simulation as they acquire expertise in this pedagogy*." NCSBN, 2019
- The OMS nursing VR platform responds to the need for increased clinical hours in the context of limited resources.

CCNE Accreditation Resources
https://www.aacnnursing.org/CCNE-Accreditation/Resources/FAQs/Clinical-Practice

NCSBN National Simulation Guidelines for Prelicensure Nursing Programs
https://www.ncsbn.org/9535.htm

2018-2019

The Next-Gen NCLEX

OMS adapts to the changing nature of nursing education and licensure requirements - helping prepare nurses for the future workplace.

OMS and the Next Generation NCLEX (NGN)

- The NCLEX licensure exam and its recent implementation of the NCSBN Clinical Judgment Model (NCSBN-CJM) reflect the transition away from rote memorization to the application of clinical reasoning to patients in a complex healthcare system.
    - *"...an effective system of evaluating nursing clinical judgment is essential across the education and practice spectrums to ensure competent and safe practitioners."* Dickison, Haerling, and Lasater, 2019.
- Rather than a static understanding of pathophysiology, pharmacology, and disease processes, students will be tested on the integration of this knowledge in the context of patient scenarios.
    - To better facilitate the changes in licensure expectations, the NCSBN encourages nursing programs to adopt this "*framework of clinical judgment… when developing formative and summative performance and licensure evaluations and assessments.*" Dickison, Haerling, and Lasater, 2019.
- The OMS library of dynamic nursing scenarios facilitates the integration of the NCSBN-CJM framework by providing learners opportunities to practice complex clinical reasoning and decision-making, thus bridging the academic-practice gap.

Integrating the National Council of State Boards of Nursing Clinical Judgment Model Into Nursing Educational Frameworks. https://doi-org.ezproxy.fau.edu/10.3928/01484834-20190122-03

IMPLEMENTATION

Implementation

Hardware

- Oculus Rift VR hardware is commercially available and simple to setup and use.
- OMS provides setup and a train the trainer session as part of any hardware purchase.

Software

- OMS provide learner management tools for institutional administrators in addition to dedicated institutional software support.

Use cases

- OMS is a flexible system, designed to be adapted to your needs. The system can be used for training, teaching, remediation, assessment or recruitment.
- Some example use case are noted overleaf. Please contact us directly for a free consultation on how best to use the OMS system in your institution.

Example
Use Cases

Please contact us for a free needs analysis and consultation on how the system could best be utilized in your institution.

Training	○ **Independent:** OMS VR system in dedicated room with open access or sign-in system. Allows learner-led, faculty-free simulation delivery. ○ **Peer-supported:** Learner in VR with real-time projection on screen. Allows peer contribution to scenario. ○ **Debriefed:** Learner in VR, real-time projection for observers, followed by group debrief. Allows VR sim to mirror current modes of sim delivery allowing faculty debrief as required.
Teaching	○ **Real-time:** Learner in VR, real-time faculty assistance or review. Allows supported learning or assessment depending on needs. ○ **Interval:** Learner in VR, followed by asynchronous mentor review using feedback report as shared learning and mentorship tool.
Remediation	○ **Targeted:** Simulation delivered to struggling students. Allows identification of specific areas of weakness requiring support or further training.
Assessment	○ **Exam practice:** Simulated VR OSCE situations to improve pass rates and reduce exam anxiety. ○ **Exam station:** Standardized OMS VR scenarios allow objective assessment of clinical performance as in physical OSCEs.
Recruitment	○ **Clinical performance review:** Scenarios can be used to benchmark clinical performance across candidates, scaling and standardizing the recruitment process.

Example
Implementation Cases

OMS is a flexible system, designed to be adapted to your needs.

Please contact us for a free needs analysis and consultation on how the system could best be utilized in your institution.

Faculty Free **Independent**	**Flexible access** • Flexible access in secure room, no faculty required • Ability for asynchronous debrief **Simulation at home** • Screen based simulation prep
Faculty Free **Group**	**Peer learning** • Independent use with a group of peers - with or without faculty **Super users** • Dedicated students that act on your behalf (e.g. users teaching Medical Students)
Faculty Led **Small Groups**	**Focused Discussion** • Ideal for result interpretation. (e.g. pause scenario on ECG/ABG/Blood results, then discuss findings and next steps) **Tag activity** • One learner in a headset for first part of scenario, then another taking over for second part (e.g. obtain a history/examine/investigate/treat)
Faculty Led **Large Groups**	**Large screen projection** • One learner in a scenario, others observing on screen, then collective debrief with all present **Blended simulation and rotation** • Different stations (VR/Physical simulation/Task trainers/ Communication)
Alternative methods	**Sitting vs. Standing**

Cost Analysis & Return on Investment

Physical simulation is costly, involving high fixed and frequently hidden ongoing costs. Virtual reality simulation from OMS demonstrates clear cost utility and return on investment benefits.

*Detailed breakdown of cost analysis / ROI available upon request.

Scaling the delivery of traditional simulation is a challenge due to associated costs, including:

- Faculty hours for scenario design, coordinating, onboarding, sim operations, debriefing
- Staff hours for technician support
- Equipment purchasing, maintenance, storage
- Design, construction, and installation of simulation rooms
- AV and other software subscriptions

Cost-Utility Comparison

- Acknowledging wide variations in the practice of simulation, research shows an average cost of $390 for an institution to deliver **1 traditional simulation scenario.**[1-3]
- Alternatively, for the same price, an institution could purchase virtual reality hardware and licenses providing access to **80 virtual reality scenarios with OMS**.

Return on Investment (ROI)

- Compared to manikin-based simulation, if learners complete only two VR simulation sessions per year, the ROI is already a substantial **166%.**
- If learners complete 20 VR simulation sessions per year the ROI is **2,560%.**
- There is a clear return on investment from adopting VR simulation.

1. McIntosh (2006) Simulation: What does it really cost?
2. Iglesias-Vázquez (2007) Cost-efficiency assessment of Advanced Life Support (ALS) courses based on the comparison of advanced simulators with conventional manikins
3. Pottle (2019) Virtual Reality Medical Simulation: Economic Evaluation and Return on Investment.

HARDWARE

Hardware Specifications

OMS software runs both in virtual reality and on flat screen

Virtual Reality Requirements

VR Headsets

- Oculus Rift S (Touch Controllers included as standard)
- Oculus Rift (Touch Controllers included as standard)
- Oculus Quest + Oculus Link (beta)

Computers and Operating Systems

- Gaming/VR-ready desktop or laptop PC*
- Operating system
    - Windows 10
    - (Mac does not currently support VR capability)
- Minimum Specifications:
    - Graphics Card - NVIDIA GTX1080 or RTX2070 (RTX2080 recommended)
    - CPU - Intel i7 required (i9 recommended)
    - Memory - 16GB+ RAM required
    - Video Output for Rift S: Compatible miniDisplay Port
    - USB Ports for Rift S: 2 x USB 3.0 ports

*Most laptops or desktop computers meeting the Oculus requirements will be suitable - see https://www.oculus.com/rift-s/ for details.

Hardware Specifications

Without any VR equipment, OMS also runs on a regular computer screen (flat screen)

Flat Screen Requirements

General

- Desktop or laptop computers*
- PC and Mac compatible
- Web App access through latest versions of Chrome, Edge & Firefox

Computers and Operating Systems

- **PC**
  - Windows 10 OS
  - Intel i5 or above
  - 8GB RAM
  - Integrated graphics card
  - Storage: minimum 15 GB free space for installation and running
- **Mac**
  - Sierra OS and above
  - Intel i5 or above
  - 8GB RAM
  - Integrated graphics card
  - Storage: minimum 15 GB free space for installation and running

In practice this means OMS runs on essentially any desktop or laptop under 5 years old

*Mobile devices (i.e. tablets, phones) and Chromebooks are not supported

Virtual Reality & Flat Screen: A Comparison

Feature	VR	Flat Screen
Fully immersive experience with increased conceptual fidelity, improved post-intervention expert knowledge, skills, memory retrieval, and transfer to learning [1-5]	✔	
Mac-compatible		✔
Additional hardware requirements	VR-ready laptop and VR headset	None*
Dynamic, non-linear scenarios with multiple simultaneous actions	✔	✔
Adaptive conversation, dynamic physiology, examinations, and investigations in response to clinical condition and user interventions	✔	✔
Access to real-time prescriptions, labs, radiology, guidelines and ability to chart early warning scores, give SBAR report, and document on flowsheets	✔	✔
Post-scenario guided reflection, access to personalized, objective feedback and detailed analytics	✔	✔
High definition, life-like appearance of patients and visual feedback in-scenario with increased affective learner response	✔	✔

*most learners already have access to a flat screen-compatible device

VR vs Screen
References

1. Krokos, E., Plaisant, C., & Varshney, A. (2019). **Virtual memory palaces: Immersion aids recall.** Virtual Reality, 23(1), 1-15.

2. Kyaw, B.M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C.K., George, P.P., Divakar, U. ,Masiello, I., Kononowicz, A.A., Zary, N., & Car, L.T. (2019). **Virtual Reality for Health Professions Education: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration.** Journal of Medical Internet Research, 21(1), 1-13

3. Repetto, C., Serino, S., Macedonia, M., & Riva, G. (2016). **Virtual Reality as an Embodied Tool to Enhance Episodic Memory in Elderly.** Frontiers in Psychology, (7)1839,1-4

4. Ragan, E.D., Sowndararajan, A., Kopper, R., & Bowman, D.A. (2009). **The Effects of Higher Levels of Immersion on Procedure Memorization Performance and Implications for Educational Virtual Environments.** Presence, (19)6, 527-543

5. Gutiérrez, F., Pierce, J., Vergara, V.M., Coulter, R., Saland, L., Caudell, T.P., Goldsmith, T.E., & Alverson, D.C. (2007). **The Effect of Degree of Immersion Upon Learning Performance in Virtual Reality Simulations for Medical Education. In Medicine Meets Virtual Reality**, J.D. Westwood et al. (Eds.)

RESEARCH

Independent Trials

Conducted by University College London Institute of Education

Overview

Independent study conducted by UCL Institute of Education as part of technology-enhanced learning masters program.

Structure

1. Literature review of simulation best practice and learning methods
2. Study using OMS prototype

Mixed methods - qualitative and quantitative - examining usability of VR system, engagement with guided reflection, response to feedback, efficacy (behavior change) and learning transfer.

Participants

N=15, preclinical medical students to Foundation Year 2 doctors

Trial Results

- Well liked
- Significantly improved student and clinician behaviour in key areas affecting patient safety

Results

Qualitative:
Users felt the OMS VR system was usable and reviewed positively on all fronts.
Using a likert scale of 1-7, feedback was perceived as valuable (median of 7), the score was perceived as valuable (median of 7) self-reflection was considered appropriate and influenced how the participant behaved in future (median of 7). Participants also said that they would review objective feedback and scores if given the opportunity (median of 7).

Verbal responses
"Definitely made me feel like I was in the situation dealing with the patient, as I would be in real life."

"I felt a lot more comfortable in knowing how to manage acute sepsis and interpreting different results as a result of the feedback received in the previous sort of scenario."

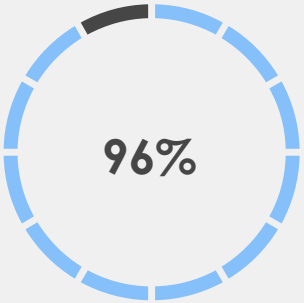
"I think the most important part was that it felt really life-like. Like it felt really, really real."

"And I genuinely think, I genuinely think if medical students did use this, I think it would definitely calm a lot of us down and allow us to make better decisions in real life."

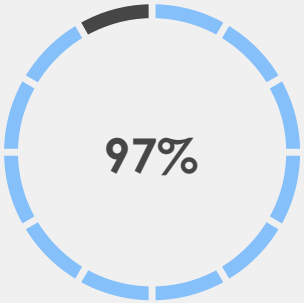
Quantitative:
Significant improvement in time to appropriate fluid resuscitation ($p<0.005$)
Significant improvement in time to correct antibiotics ($p=0.014$)
Significant improvement in overall score ($p<0.005$)

Conclusions
The OMS VR simulation adheres to best practice in simulation design and implements novel methods of training through immersive scenarios, deliberate practice, guided reflection and feedback. It is a valuable tool in training medical students and doctors how to improve patient care and transfer this knowledge to practice.

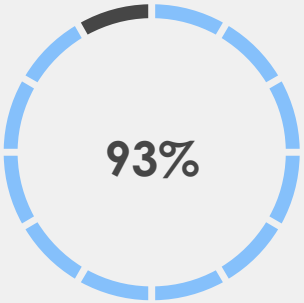
TRIALS



"This VR simulation is a **valuable** training resource"



"I would **choose** this VR simulation as a method of learning in future"



"This simulation is likely to **impact** on my clinical practice to the benefit of patient **care**"

TIME TO FLUID RESUS (P<0.005)

TIME TO ANTIBIOTICS (P=0.014)

OVERALL SCORE (P<0.005)

The DEVICE Study

NHS England

Diabetes Emergencies: Virtual Interactive Clinical Education

Dr Ben Atkinson – Consultant in Emergency Medicine[1], Dr Mayank Patel – Consultant in Diabetes & Endocrinology[2], Ana Flores – Trainee Emergency Medicine Advanced Clinical Practitioner[1], Sarah Goyder-Shanks - Trainee Emergency Medicine Advanced Clinical Practitioner[1], Maj. Tom Barnes – Staff Grade in Emergency Medicine[1], Prof. Partha Kar – Consultant in Diabetes & Endocrinology[3]

[1]Queen Alexandra Hospital, Portsmouth Hospitals NHS Trust
[2]University Hospital Southampton Foundation Trust

Background:

Simulation Based Medical Education (SBME) supports the development of competencies in technical skills and human factors (or non-technical skills) for all. SBME is an excellent tool to allow staff prepare for clinical crises that are seen every day in healthcare.

The clinical care of people with diabetes (PWD) of any type is becoming increasingly complex as PWD are living longer with multiple comorbidities and polypharmacy. The TOPDOC Study[1] reported low confidence in the acute management of hyperglycaemic crises by non-diabetes specialist doctors. In addition, the prevalence of Type 1 diabetes is increasing and there is a national awareness of increased risk of Diabetic Ketoacidosis (DKA) in hospital with Type 1 diabetes and specialist diabetes advice may not be readily available for non-specialist staff to call upon to support clinical inpatient diabetes care, particularly out of hours. Since 2017, the National Diabetes Inpatient Audit has estimated that the risk of a patient with type 1 diabetes developing DKA whilst a hospital inpatient is 1 in 25.

"The risk of a patient developing DKA as an inpatient is 1 in 25"

Individuals living with type 1 diabetes have also voiced concern about being admitted to hospital as they worry about staff knowledge of type 1 diabetes. Nationally, the high turnover and number of non-specialist clinical staff make it challenging for specialist diabetes teams to deliver regular diabetes training, to help inform and reduce clinical risk.

Virtual reality (VR) simulation has been used in training successfully in multiple industries. Recently VR technology has been shown to be a viable platform for medical simulation and may provide a means of offering junior doctors a safe training environment in the management of diabetes emergencies without any risk of harm to patients.

Aims:

To explore the feasibility of using VR as a means of delivering effective training in diabetes emergencies for clinicians in training. This will be assessed by measuring confidence in ability to manage clinical scenarios and potential future changes to clinical practice, whilst also being an enjoyable educational experience that trainees want to use regularly. Achieving this would take the trainees to Kirkpatrick Level 3.

Kirkpatrick Levels
1. Impact on **Reaction**
2. Impact on **Learning**
3. Impact on **Behaviour**
4. Impact on **Systems**

Methods:

Clinical project planning was conducted collaboratively, involving 2 senior Diabetes Consultants, a Specialist Registrar in Diabetes, an Emergency Medicine Consultant and a person with type 1 diabetes.

The use of VR as a training tool was enabled through working with Oxford Medical Simulation. They provided the Oculus Rift VR headsets, software and developed the diabetes emergency training scenarios with the clinical project team.

Four diabetes scenarios were created, providing an immersive realistic clinical experience for the user. Novo Nordisk, a pharmaceutical company, provided an educational grant to enable the pilot project to be developed.

Two sites were selected for this pilot - University Hospital Southampton and Queen Alexandra Hospital, Portsmouth. Both sites enrolled junior clinicians (Foundation Year 2 to Core Training 2 and trainee ACPs) currently working in the specialities of Emergency Medicine or Acute Medicine.

The trainees had a pre-brief and orientation with the setup and then went through the diabetes emergency scenarios. The supervising clinician observed the trainees and only offered support if requested.

After the test scenario (DKA) was complete the supervising clinician debriefed the trainee and an electronic feedback evaluation form was emailed to the participant to assess their confidence managing the diabetes emergency before and after use of the VR training tool. The trainees were sent a curriculum mapped certificate for their eFortfolio.

Results:

39 Trainees completed the test scenario all of which had little or no previous experience with VR education or gaming.

100% of trainees deemed these scenarios were suitable for their level and will improve their daily practice. 56% felt that they would use all of what they learned in daily practice. 42% felt they would use more than half of what they learned in their daily practice. One trainee said "...honestly, this was the single most useful learning experience I've had so far in my medical training."

Regarding the knowledge acquired from the VR experience, 72% expected they would use the knowledge within a week, 18% expected they would use the knowledge within the next month and 10% expected they would use the knowledge within the next 3 months.

Before VR the mean trainee confidence in managing DKA (on an 8-point Likert scale) was 3.92 (3.38-4.47). After VR this increased to 5.41 (4.79-6.03) using 95% confidence intervals. The mean confidence increased by 28% after the VR training.

72% of trainees expect to use the knowledge gained within a week at work

28% increase in confidence in managing DKA after using VR

"Honestly, this was the single most useful learning experience I've had so far in my medical training"

Conclusion & Discussion:

An evaluation of the results obtained from this pilot project to date would suggest that VR is a useful and well-liked educational tool for junior trainees which increases their confidence in managing Diabetic Ketoacidosis, taking them to Kirkpatrick level 2. The trainees felt they would use what they had learned in their daily practice in the near future.

Many positive comments were shared by the trainees expressing their preference to this mode of learning over PowerPoint presentations and over eLearning modules. They all recommended the training to others. Although the increase in confidence and trainee experience was excellent, delivering the VR experience is a fairly time-consuming exercise as the trainees use the VR training in series, compared to 8-10 trainees using a small group traditional simulation-based session (being taught concurrently). This VR training does not examine teamwork and systems like other modes of simulation training can, as it focuses mainly on personal clinical knowledge and prioritisation.

All trainees will receive another follow up evaluation survey regarding whether the knowledge gained in the VR pilot has changed their clinical practice and behaviour at work over the 3 months since they participated in the study (taking them to Kirkpatrick Level 3).

Further work is being planned to take this study to a larger group and compare it to standard simulation training or other teaching methods using a crossover trial.

References:

[1] Lack of confidence among trainee doctors in the management of diabetes: the Trainees Own Perception of Delivery of Care (TOPDOC) Diabetes Study. George JT et al. Q J Med 2011; 104:797-766

Sim Wessex | ASPIH Bursary 2019 | Portsmouth Hospitals NHS Trust | University Hospital Southampton NHS Foundation Trust | QMS | novo nordisk

Future Healthcare Journal 2019 Vol 6, No 3: 1–5

EDUCATION AND TRAINING Virtual reality and the transformation of medical education

Author: Jack Pottle[A]

ABSTRACT

Medical education is changing. Simulation is increasingly becoming a cornerstone of clinical training and, though effective, is resource intensive. With increasing pressures on budgets and standardisation, virtual reality (VR) is emerging as a new method of delivering simulation. VR offers benefits for learners and educators, delivering cost-effective, repeatable, standardised clinical training on demand. A large body of evidence supports VR simulation in all industries, including healthcare. Though VR is not a panacea, it is a powerful educational tool for defined learning objectives and implementation is growing worldwide. The future of VR lies in its ongoing integration into curricula and with technological developments that allow shared simulated clinical experiences. This will facilitate quality interprofessional education at scale, independent of geography, and transform how we deliver education to the clinicians of the future.

KEYWORDS: Virtual reality, medical education, nursing education, simulation, innovation

Introduction

The pace of change in medical practice is relentless. The complex needs of an ageing population, the range of treatment options available, the interprofessional nature of care and the complexity of healthcare systems themselves are vastly different today than they were 20 years ago.

As such, how we prepare future clinicians for practice has had to adapt. It is no longer a question of whether an individual can retain or access facts, but how they use them, evaluate them and apply them to patient care.

There is therefore a move to replace rote learning with more clinically relevant and practical teaching. Problem-based learning, communication skills training and simulation-based learning have all entered curricula. With the increasing drive to provide clinical learning experiences, and the inherent difficulties in doing so, simulation in particular has gained momentum as a method of delivering experiential learning.

Simulation is an educational technique that involves creating situations that replicate real life, letting a learner act as they would do in real life, then providing feedback and debrief on performance. Simulation is effective in many domains and has been found to be 'superior to traditional clinical education, producing powerful educational interventions that yield immediate and lasting results'.[1]

However, while simulation is becoming central to healthcare education, it requires significantly more resources than traditional education. At a time when healthcare systems and educational institutions globally are struggling with growing demands and limited budgets, additional resources are hard to come by.

Fortunately, there has been a recent dramatic expansion in the ways in which we can deliver medical education. This has not only been through the internet and mobile devices, but through immersive technologies. These technologies – including augmented reality (AR) and virtual reality (VR) – can transform how we deliver educational experiences.

VR in particular has been adopted across medical and nursing fields. VR involves the user putting on a VR headset to become completely immersed in an interactive virtual environment. When used with appropriate educational software, this allows the user to learn from experience in the virtual world. This paper outlines what VR is; its strengths, its weaknesses, the evidence behind it, its use in practice and where the future lies.

What is virtual reality?

VR is the use of software to create an immersive simulated environment. Unlike traditional user interfaces, to experience VR, users put on head-mounted display (HMD) which places the user inside an experience, where they can engage with the environment and virtual characters in a way that feels real. VR has a unique power, more than any other technology that has ever existed, to make users believe they are in a different environment. This allows them to learn from experience as they would do in real life.[2] This ability to deliver experiences on demand is where the power of VR lies.

Screen-based learning

Confusingly, screen-based learning has previously been referred to as 'virtual reality' in the medical literature. However, there is now an understanding that the value of virtual reality comes from immersion and the sense of presence – the feeling of 'being there' – that it generates.[3,4] As such, only VR that is immersive – using headsets that completely block out the real world – is now referred to as 'virtual reality'.

Author: [A]co-founder and chief medical officer, Oxford Medical Simulation, London, UK

EVIDENCE FOR VR EFFICACY IN SIMULATION

Virtual reality simulation has been widely adopted in surgical training where it has been shown to "**decrease injury, increase speed of operations and improve overall outcomes**."[16]

The same is true in medicine where "virtual reality simulations can **bridge the gap between theory and practice** by immersing the learner in a realistic, dynamic, complex setting."[17]

It can teach clinicians **complex procedures**,[18] is **effective in CPR training**,[19] can **improve communication skills**,[20] **enhance critical thinking**[21] and **improve clinical decision-making**.[22]

Selected Simulation References

Physical simulation overview

- Aggarwal et al (2010) Training and simulation for patient safety
- Zendejas et al (2013) Patient outcomes in simulation-based medical education: a systematic review

Physical simulation costs

- Abdulmohsen (2010) Simulation based teaching and learning
- Vazquez et al (2007) Cost-efficiency assessment of ALS courses
- McIntosh et al (2006) Simulation: what does it really cost?

VR simulation overview

- Kleinert (2015) 3D Immersive patient simulators and their impact on learning success: a thematic review
- Graafland et al (2013) Systematic review of serious games for medical education and surgical skills training

VR simulation efficacy

- Harrington et al (2017) VR in trauma decision-making
- Bric et al (2016) VR in robotic surgery training
- Maytin et al (2015) VR for physician removal of cardiac leads
- Karakus et al (2014)VR in emergency department and malpractice
- Creutzfeldt et al (2016) VR in resuscitation training

TESTIMONIALS

"It's **a brilliant simulation** for practicing how to interact with patients."

"Honestly, this is **the single most useful experience I've had so far in my medical training**."

"It's something I'd be happy to **spend some time on doing a session each day.**"

"It felt really life-like. **Like it felt really, really real!**"

"I genuinely think if we used this it would **allow us to make better decisions in real life.**"

OMS

OXFORD MEDICAL SIMULATION

For further information contact
info@oxfordmedicalsimulation.com