

NOVEL METHODS OF SIMULATION IN HEALTHCARE AND HEALTH POLICY

A thesis presented for the degree of Doctor of Philosophy (PhD)

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DECLARATION OF ORIGINALITY

I am the sole author of this thesis. All work is my own except where referenced.

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Dedication

To the girl in the blue dress, always

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ABSTRACT

This thesis explores how innovative behavioural and virtual environment simulations could benefit healthcare and health policy. In the first half of the thesis I review the use of behavioural simulations in healthcare and contextualise an evidence-based approach for development and analysis. This approach informs the successful design and completion of two simulations – The Crucible and Lateral Play. The Crucible was designed to improve leadership skills and understanding of the Health and Social Care Act amongst clinicians. Lateral Play was designed to aid organisational development of Imperial College Health Partners, the Academic Health Sciences Partnership in North-West London. Detailed analysis demonstrated, for the first time, the measurable positive effect of Behavioural Simulations on participant learning and behaviours.

In the second half of the thesis I examine and demonstrate the potential for virtual world simulations to enhance major incident preparation, reviewing the evidence behind major incident training the potential benefits of using virtual world environments via a user-needs analysis and expert advisory group. I describe the successful design, development and assessment of three virtual world scenarios for multidisciplinary major incident training in the context of a bomb blast. Face and content validity is demonstrated and performance assessed in both technical and non-technical skills. Finally, I determine the feasibility of utilising a virtual trauma scenario for long-distance training between the UK, Canada and Southern Africa.

The thesis concludes with an overall discussion of the pertinent findings, limitations and implications for future practice and research.

LIST OF PRESENTATIONS AND PUBLICATIONS

Prize

1. Global Trauma Team Leader Training and Assessment using Virtual Worlds: a Feasibility and Reliability Study across 3 Continents.
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3. Cohen D, Sevdalis N, Taylor D, Kerr K, Heys M, Willett K, Batrick N, Darzi A. Emergency preparedness in the 21st century: Training and preparation modules in virtual environments. Resuscitation. 2013 Jan;84(1):78-84.
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3. Cohen D, Sevdalis N, Taylor D, Batrick N, Darzi A. MISSIVE: Major Incident Scenario Simulation In Virtual Environments. Health Protection Agency Annual Conference, Sep 2011.
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5. Cohen D, Sevdalis N; Taylor D; Batrick N; Darzi A. Virtual worlds training for trauma and major incidents. London Trauma Conference, Research Forum, June 2011
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7. Cohen D, Sevdalis N, Taylor D, Batrick N, Darzi A. Virtual simulation of major incidents. Games for Health Europe. Amsterdam, 2011
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1. Association of Anaesthetists of Great Britain and Ireland (AAGBI), Dublin, 2013.
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2. Surgical Grand Rounds, McGill University and MUHC, Montreal, Canada, Feb 2012
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3. Aerospace, Defence, Security Training and Simulation Event, Bristol 2011.
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4. National Defence University, Washington DC, May 2011. (Federal Consortium of Virtual Worlds). Cohen D and Taylor D. Major incident casualty simulation in Second Life.
5. The Royal United Services Institute, April 2011. Cohen D, Sevdalis N, Taylor D, Batrick N, Darzi A. MISSIVE – Major Incident Scenario Simulation In Virtual Environments.
6. Emergency Planning Group, HPA, UK. July 2011 Cohen D, Sevdalis N, Taylor D, Batrick N, Darzi A. The potential of Virtual Worlds in Emergency Planning.
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PREFACE

High-performing healthcare institutions across the globe have clinician leaders and managers in positions of significant influence. Therefore, clinicians in the modern NHS are expected to be more than just physicians or surgeons; positions of leadership, management and strategy are aspired to and expected. Part of the key to success in a changing NHS is the ability to innovate within and learn from innovation elsewhere, to adopt new technologies and ways of working and encourage diffusion locally and further afield; clinical leaders have a significant role in this regard.

I was keen to apply those principles to this thesis, by applying novel, innovative techniques to enhance performance in clinical and non-clinical fields, and provide an evidence-base for further development and adoption in the future. As a trainee urological surgeon, I wanted to develop my knowledge and skill-base outside of the field of clinical urology, in order to acquire a wider skill set that could be of value in my future career, relevant to clinical practice, research, leadership and management.

I am extremely fortunate to have had the opportunity to research and write this thesis. I have been given incredible opportunities to travel and present, to collaborate globally, to learn from world experts and to try to innovate in a system that is often resistant to new ideas. Throughout I have developed a deeper understanding of research methodology and the ability to think critically, and, most importantly, my own strengths and weaknesses. I am certain that these experiences and skills will be hugely beneficial in my future career.

1 INTRODUCTION

“Simulation is a technique to replace or amplify real-life experiences with guided experiences, artificially contrived, that evokes or replicates substantial aspects of the real world in a fully interactive manner.” *Society for Simulation in Healthcare, 2009*

1.1 Overview

In this introductory chapter I will outline the history of simulation in healthcare and the rationale for its use, at operational to strategic levels, the modalities currently used and the evidence behind them, and describe the novel approaches that that are to be investigated further.

1.2 Simulation in healthcare

Simulation has been demonstrated to provide an effective mechanism for education, evaluation and forward planning at strategic, tactical and operational levels in a variety of professional fields, including the military, economics, aviation and business.¹⁻⁵ Within the healthcare sector, a number of key drivers have improved the uptake of simulation for training and assessment purposes in the past decade, including growing concerns for patient safety, medical errors and a desire to optimise shortened training times for doctors.⁶ The simulation environment can consist of nothing more than a standard conference room to a high fidelity computerised simulator and may be targeted can be individuals, teams or systems, focusing on either or both technical and non-technical skills.⁷ However, there is scope for innovative approaches to simulation to further enhance healthcare.

Prominent reports from the Department of Health and Global Health Policy Forum have identified innovation as being key to improving health services around the world.^{8,9} This thesis seeks to examine two innovative methods of simulation across the organisational spectrum of the healthcare sector, from a strategic or systems level to a service delivery, operational and skills level. The potential for these innovative techniques to improve skills, system understanding and decision-making in healthcare will be explored.

Simulation can be classified on three hierarchical levels, defined by Arora and Sevdalis.¹⁰ Macro-simulation involves simulation of a strategy or system, which could be within or among institutions, involving multiple teams, disciplines and processes. By contrast, a Micro-simulation is an individual training tool that focuses on key operational skill competencies; a simple example would be tying of a surgical suture. Meso-simulation encompasses all that is between Micro and Macro-simulations; it involves groups or teams, enacting a tactical response to a defined strategic purpose. Meso-simulations largely focus on non-technical skills, such as communication, whilst assuming technical skill competency. However technical skill competency is situational and therefore can be developed and tested in a meso-simulation as well as a micro-simulation.

1.3 History of simulation in healthcare

At an operational level, simulation has been used in healthcare for centuries. In antiquity, clay and stone figures were used to demonstrate the effects of disease on humans and models were used in some cultures to aid diagnosis, allowing female patients to consult male doctors yet adhering to cultural modesty laws.¹¹ In more recent times, simulation has been utilised to enable deliberate practice of a skill, whether as an individual or a team, in an environment where it is safe to make mistakes, and consequently learn from them.¹² In the 1960s, Dr Peter

Safar collaborated with Laerdal, a Norwegian plastic toy manufacturer, to create Resusci-Anne, the first cardiopulmonary resuscitation mannequin (Figure 1).¹³ This revolutionised medical training, promoting mouth to mouth breathing, jaw thrust and hyperextension of the neck in resuscitation scenarios on a scale not previously possible. High-fidelity simulation was introduced in the 1970s with the creation of Harvey, the cardiology patient simulator, a combined task trainer and computer enhanced mannequin simulator which enabled reproduction of common and rare cardiac diseases.¹⁴ The educational effectiveness of Harvey was demonstrated in a multicentre study of 208 senior medical students; 116 were simulator trained and 92 received only traditional teaching. In subsequent evaluations using both Harvey and real patients, the simulator-trained group performed significantly better than traditionally trained students.¹⁵



Figure 1: Resuscitation training using Resusci-Anne (reproduced with permission from Elsevier)¹⁶

1.4 Simulation in industries other than healthcare

The development of simulation in healthcare languished behind other disciplines. For example, military organisations around the world have a long history of utilising simulation for training, planning and prediction of events. Nearly 30 years ago the war gaming model “Joint Theatre-Level Simulation” was created by the United States Military, and has now been utilised by numerous agencies worldwide to aid planning and intelligence of multi-force events.¹⁷ Many businesses have honed skills using management games.¹⁸

The airline industry has been especially influential. Pilots have been improving their flight skills by simulating the operation of aircraft in hazardous conditions since the 1920s and now train regularly in high fidelity simulators as part of their training.^{5,19} The airline industry also recognised the importance of human factors contributing to adverse flight incidents, by developing simulation-based crew resource management training (CRM). The CRM approach recognises that team performance and safety is dependent not only on technical skills, but on human factors (or non-technical skills training), especially communication and teamwork, to enhance technical skills and improve airline safety; up to 70% of aviation accidents involve an element of human error.^{20 21,22} By contrast, these human factors, or non-technical skills, are not normally acquired or required during medical education.²³ Within medicine, crew resource management was first recognised by the anaesthetic community for its potential to improve the safety of medical practice. In the early 1990s, a crisis resource management programme was developed by a group of American anaesthesiologists and similar simulation-based programmes have since been established in other parts of the world.

24,25

1.5 The stimulus in healthcare

1.5.1 Operational level stimulus

There are three factors that have progressed the development and uptake of simulation in healthcare at an Operational Level. Firstly and perhaps most importantly, the Institute of Medicine published a seminal report in 2000 “To err is human.” This well publicised report revealed that up to 98000 deaths occur in the USA each year as a result of medical error.²⁶ A report by the Department of Health revealed that adverse events occur in 10% of patients, a rate of over 850000 per year.²⁷ These reports, and others from around the world, have prompted clinicians and educators to seek novel methods of improving patient safety. Secondly, the implementation of working time directives in the United Kingdom has reduced clinical exposure and training times for junior doctors. Simulation can provide alternative exposure to compensate for the reduced patient contact time. Thirdly, healthcare relies upon a multidisciplinary team to deliver high quality care, especially in those patients with serious illness. It has been estimated that up to two-thirds of medical errors occur due to communication problems within and between teams.²⁶ Therefore, team simulation is utilised to improve communication and collaboration skills.¹⁹

The three system-level factors identified above have contributed hugely to the advancement and uptake of simulation in healthcare, in order that patients are not exposed to preventable errors.

1.5.2 Systems level stimulus

Economic and political factors have also driven the use of simulation in the field of health policy. The multi-level and complex nature of healthcare systems means that a change in

health policy can have potentially unintended consequences, resulting in adverse outcomes both economically and for patient care.²⁸ In order to minimise unintended consequences and promote wider understanding of the issues at stake, an evidence-based approach to formulating and implementing decisions at all organisational levels is increasingly being sought. Computer-modelling techniques such as Discrete Event Simulation and System Dynamics aim to provide evidence on the effects of a change in policy at a systems level. Such simulations are complex to create and understand, and the values of such models are not fully understood.²⁹ Another approach is to use participatory or behavioural simulations. The simulations require participants to assume the role of key players in a simulated system, and act as they would should the simulated circumstance be reality.³⁰ Such simulations are believed to be valuable in policy prediction and have educational benefit for participants.^{30,31} A more detailed discussion of health policy simulation follows in chapter 2.

1.6 Current uses of simulation in healthcare

A desire to improve patient safety and professional training, prevent medical error and increasing economic challenges has resulted in the uptake of various modalities of simulation in all areas of healthcare. Nursing, paramedical, medical and surgical specialties have all increased the quantity of simulation-based training in the last decade. Despite this, a recent expert review has stated that “simulation science is still a relatively new concept in healthcare and must be viewed as being in its infancy.”³²

The use of simulation for training and assessment is expanding, allowing trainee exposure to cover not only core clinical competencies, but also rare events.³³ Simulations can cover technical and/or non-technical skills, be individual, team or systems-structured and can take place in a home office environment, a computer or any simulated clinical environment. An

important distinction to make is between the *simulators* versus the *simulation*. A simulation attempts to recreate a clinical or system event, whereas the simulator involves a single or a group of tasks, and will be central to a simulation.⁶ Simulators range from low-fidelity to high fidelity. The *fidelity* of a simulator is determined by the extent to which it provides realism through characteristics such as visual cues, tactile features, feedback capabilities and interaction with the participants.³⁴

1.7 Technical skills simulators

1.7.1 Task Trainers

Technical Skills training is most predominant in surgical specialties, but widely used throughout healthcare. Possibly the earliest example of a technical skill (or task) trainer is the desktop knot-tying set. This wooden/plastic string set is cheap, low fidelity, portable and can be used to train an essential surgical skill. Honing such skills outside of the operating room has clear benefits; junior surgeons take longer over operations than their senior colleagues.³⁵ A US study estimated that the average costs of this increased operating time was \$12000 USD per resident per year.³⁶ Similarly low-tech task trainers are used for venepuncture and central venous line insertion.^{37,38}

The advent of new surgical techniques has added to the demand for technical skills training facilities.¹² Laparoscopic surgery requires a different skill set to that of open surgery, and traditionally has a steep learning curve. As a result, such surgery is associated with greater complications and longer operating times until sufficient competency is achieved.³⁹ The most basic laparoscopic trainers are video desktop boxes, where two laparoscopic

instruments are inserted and a set camera displays the picture on a screen. The interior of the boxes can be modified to train specific technical skills, such as knot tying or tissue dissection. The use of artificial or cadaveric tissue has increased the realism of such simulations (Figure 2).⁴⁰ The most widely used box trainer is part of the Fundamentals of Laparoscopic Surgery (FLS) program developed by the Society of Gastrointestinal and Surgery (SAGES).

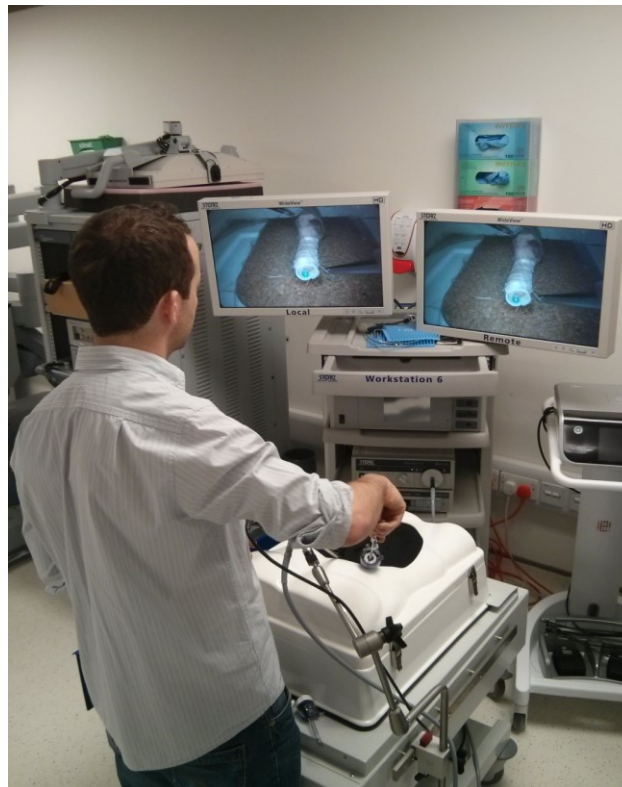


Figure 2: A laparoscopic task trainer; the surgical trainee in this picture is practicing laparoscopic suturing using a pig trachea (personal photograph)

1.7.2 Virtual Reality Simulators

Advanced laparoscopic surgery is more challenging and less suited to simple video box trainers due to the need to work in multiple quadrants, dissect bulkier tissues and perform

delicate anastamotic procedures.⁴¹ To address these requirements, Virtual-reality (VR) simulators have been developed and are now commercially available. The Minimally Invasive Surgery Trainer Virtual Reality (MIST-VR) (Mentice, Gothenburg, Sweden) system was one of the first VR simulators, using simple graphic imagery to train basic laparoscopic tasks. In 2005, 61% of surgical residency programmes in the United States that had a VR trainer had used MIST-VR.⁴²

1.7.3 Screen-based simulators

Screen-based simulators utilise a web-based or CD-ROM programme. Simulators such as Triage Trainer (Figure 3) can provide a relatively inexpensive method for users to train and assess clinical decisions in real-time, in a relatively low-cost and easily accessible setting.⁴³ Other screen-based simulators have been developed for anaesthetic trainees and medical students.^{44,45} There are however limitations with the fidelity which may limit the extent of learning possible.¹⁹

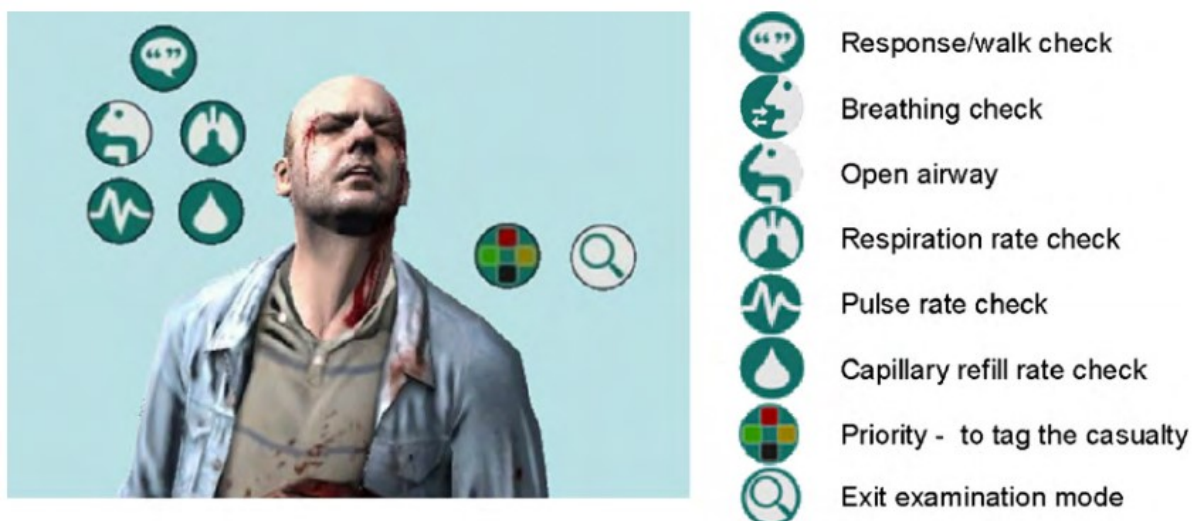


Figure 3: Triage trainer: A casualty undergoing assessment (TruSim/Blitz Games Ltd, UK; reproduced with permission from Elsevier)⁴³

Interactive virtual environments are a more recent development, allowing users to interact in a virtual space in real time, regardless of geographical constraints. Such environments have been successfully utilised in healthcare education for both the public and professionals.⁴⁶⁻⁴⁸ Virtual environments have also been utilised to help visualise proposed changes in healthcare structure and health policy. For example the 2006 report “Healthcare for London; A Framework for Action,” proposed changes in the physical structure of healthcare services across London.⁴⁹ The development of community polyclinics, increased care at home and centralised specialist care facilities were central to the plans for improving healthcare. Examples of the new facilities and structures, together with information videos, were developed in a freely accessible virtual environment, allowing public and professionals to tour the physical environments and engage with policymakers.⁵⁰ The use of virtual environments is a major focus of this thesis and is discussed further in this chapter and in chapters 5-8.

1.7.4 High-fidelity simulators

High fidelity simulators change and respond to the user. Three broad categories of high-fidelity simulators have been defined.²³ Three dimensional, procedure based simulators, such as the percutaneous iliosacral screw insertion simulator described by Tonetti, enable practice of a procedure using real equipment and models or cadaveric specimens close to that of a real patient.⁵¹ Interactive mannequin-based simulators, such as Sim Man (Laerdal, Stavanger, Norway) allow individuals and teams to practice resuscitation manoeuvres on a mannequin with realistic anatomy and changeable physiology (Figure 4). Such mannequins can be programmed to provide cardiovascular, respiratory and neurological signs, and respond appropriately to interventions such as airway management, drugs or intravenous

fluids.¹⁹ Lastly, higher-fidelity virtual reality simulators such as the LAP Mentor (Simbionix, Cleveland, USA) have highly realistic graphical fidelity and haptic feedback, allowing multiple and complex surgical procedures to be performed in entirety.⁵²



Figure 4: A simulated resuscitation using Sim Man (reproduced with permission from Laerdal)

1.7.5 Standardised patients

Standardised patients are actors who are trained to convey the characteristics of a specific patient, either mimicking or with realistic physical examination findings.⁵³ Standardised patients are utilised with increasing frequency by undergraduate and postgraduate medical educators for training and assessment of history taking, physical examination and non-technical skills.

1.8 Non-technical skills and simulation

Simulation exercises, which incorporate a clinical or system event together with one or more simulators, invariably incorporate non-technical skills. Non-technical skills can be defined as “the cognitive, social and personal resource skills that complement technical skills, and contribute to safe and efficient task performance.”⁵⁴ Patient outcome is recognised to be a function of multiple factors, not only the technical skills of the team and the risk factors of the patient, but also the clinical environment and nontechnical skills of the individuals and team members involved in clinical care.^{55,56} Proficiency in nontechnical skills improves overall clinical performance, including technical skills, related to a procedure or operation.²⁵ However, the high frequency of teamwork failures, notably in the operating room, indicates that the informal and unstructured manner in which non-technical skills are acquired is ineffective.⁵⁷

The increased interest in human factors performance within the healthcare sector has led to the development and validation of both individual and team nontechnical skills assessments, the first of which was the Anaesthetists Non-Technical Skills system (ANTS).⁵⁸ This system, based in part on the NOTECHS assessments of European airline pilots, assesses the behavioural aspects of the anaesthetist in clinical scenarios. Areas of development identified by ANTS have prompted the creation of a crisis avoidance and resource management course (CARMA) at the Scottish Clinical Simulation Centre.²²

1.9 Combining Technical and Non-technical elements in a simulated environment

Whilst technical skills such as cannula insertion or knot tying can be trained or assessed outside of a clinical environment, non-technical skills generally require a realistic,

immersive, contextualised setting for skills assessment. Furthermore, contextualising technical skills into an appropriate environment enables more realistic skills assessment. A number of approaches have been developed to facilitate this, utilising the above simulators in a range of simulated environments.

Hybrid simulation is a concept allowing actors or standardised patients to have inanimate models attached to them, such as a strap-on suture pad. Participants must interact with the patient whilst performing the suturing procedure, thus allowing technical and nontechnical skills assessment in an integrated setting.⁶ Hybrid simulations can take place in clinical or non-clinical environments at varying levels of complexity.⁵⁹ Such physical simulated clinical environments can provide a contextualised, immersive environment for individual or team training and assessment, utilising any of standardised patients, mannequin simulators or virtual reality simulators. Simulated operating theatres have been successfully designed and utilised for this purpose, and more recently a portable distributed simulator has been developed and construct validated, allowing a similarly immersive and realistic environment to be recreated at a lower cost whilst improving accessibility (Figure 5).^{60,61} However, a skilled faculty is still required to run and analyse simulation performance. Simulated training environments have been created for individuals and teams in intensive care, acute medicine, resuscitation and trauma environments.^{62,63}



Figure 5: Distributed simulation – the blow-up operating theatre (reproduced with permission from Wolters Kluwer)⁶⁴

1.10 Healthcare simulations on a larger scale – macrosimulation

1.10.1 Live Exercises

The simulation modalities described can be expanded, at considerable cost, to create larger-scale “live” simulated exercises for healthcare professionals, in pre-hospital and hospital environments (Figure 6). Perhaps the most striking permanent facility is the UK military centre in Strensall, Yorkshire, where HOSPEX takes place. HOSPEX is a fully simulated military hospital at which all military medical staff undergo repeated mandatory training prior to operational activity.⁶⁵ Scenarios of differing complexity and length are played out, utilising low and high fidelity simulators, patient simulators (including “Amputees in Action”), animal tissue and realistic simulation paperwork. The setting allows for both individual and team-training and assessment in technical and non-technical skills, and facilitates the familiarisation of new or changing protocols and systems by operational staff.

Furthermore, the simulation enables higher-level strategic and tactical-level personnel to establish the efficiency and capability of current response plans and protocols.⁶⁶



Figure 6: A major incident exercise for pre-hospital responders. Actors from amputees in action can be seen (personal photograph)

Larger-scale, multi-disciplinary simulation exercises are also carried out by emergency services and acute responders either as part of routine training or to prepared for specific, high-risk events. For example, prior to the 2012 London Olympics, large-scale multi-disciplinary preparation exercises were carried out by emergency services across London, utilising both actors and high-fidelity mannequins, together with real-life communications, personal protective and medical equipment.⁶⁷ The largest live exercise ever carried out in the UK, Operation Watermark, took place over a week in 2011 to assess the readiness of flood response plans across the UK. Over 20000 participants took part in 75 different scenarios, which successfully demonstrated the capability of the UK emergency services to respond to a major flood.⁶⁸ These live exercises enabled both systems and operational level

response to be examined, with resulting learning outcomes developed for clinicians, administrators and managers.

1.10.2 Tabletop exercises

Due to the expense and logistical difficulties of large-scale, live simulation exercises, lower-fidelity “tabletop” exercises are often substituted (Figure 7). Tabletop exercises are scalable, interactive group discussions that may use media or computer-based inputs to add realism or content. Participants are expected to fulfil specific simulation-defined roles, interacting with fellow participants to play out a scenario. Such exercises are widely used in healthcare and emergency planning, primarily to assess existing response capability and structure of an organisation or organisations, as well as providing an opportunity for the participants to learn from their participation. For example, Galloway et al used a tabletop exercise to assess a single hospital plan for coping with an acute blood shortage.⁶⁹ On a larger scale, Dausey et al developed 31 exercises to assess regional public health preparedness for biological threats occurring in the USA.⁷⁰ Larger scale local and regional exercises have been developed to assess hospital evacuation. For example, Exercises Philpott was designed to simulate the process and consequences of a forced hospital evacuation in northwest London, involving healthcare providers, the local community and other partner agencies.⁷¹ 75 participants representing 17 organisations spent a day analysing command structures, communications and business continuity plans of the hospital and its partner organisations, aiming to identify weaknesses and areas of improvement necessary to ensure a safe response.

Tabletop exercises can also be developed for both operational and strategic testing and analysis. In the context of policy development, tabletop-style “behavioural” simulations are especially useful in complex strategic changes involving multiple individuals or

organizations, where identification of learning needs, development of solutions, implementation of change processes and outcomes are dependent on multiple behavioural interactions.⁷² Examples of behavioural simulations in the healthcare sector include the Windmill series and those developed by the King's Fund – a summary of healthcare-related simulations is found in chapter two, figure 10.^{28,73} The use of behavioural simulations to aid policy development and understanding is a major focus of this thesis; the rationale is discussed later in this chapter, and a review of behavioural simulation is presented in chapter two.



Figure 7: A tabletop exercise for major incident preparation at Imperial College Healthcare NHS Trust (photograph reproduced with permission of Mr P. Pucher)

1.11 What is the evidence for effectiveness of simulations as an educational tool?

The first study to prove the benefit of high-fidelity virtual reality training on actual operating theatre performance was described in a randomised, double-blinded study in 2002.⁷⁴ Subsequent studies have replicated these findings and additionally demonstrated improved economy of movement, shorter operating times, faster skill acquisition and better

performance scores in groups that used the VR trainer.^{39,75,76} However, the effectiveness of individual simulators compared with one another, measured by the *transfer effectiveness ratio*, is not known.⁷⁷ Low-fidelity simulators have also been validated for surgical skills training.⁷⁷ A recent review of urological simulators concluded that whilst there was clear evidence for the effectiveness and validity of simulators for trainees, there was a gap in simulator training for more advanced procedures and higher level trainees.⁷⁸ Trauma team scenario simulation with targeted debriefing has also resulted in improvements in non-technical skills, both for individuals in leadership and communication, and the team performance in general.⁶²

Non-surgical specialties such as anaesthesia, respiratory medicine and critical care medicine have also demonstrated the effectiveness of simulation in education. Studies have shown improvements in performance of endotracheal intubation, bronchoscopy and central line insertion when simulators are used for training and deliberate practice.⁷⁹⁻⁸² Trainees can also acquire higher than expected skill levels for their stage of training when using simulators.¹⁹ Simulation also facilitates long-term retention of newly-acquired knowledge, and is at least equal or superior to traditional methods of teaching, such as lectures or problem-based learning sessions.¹⁹

Simulation has also been validated as an appropriate and useful learning method in nursing education. A systematic review of simulation in nursing carried out in 2010 showed that simulation conferred additional benefits in knowledge, critical thinking ability and confidence when using medium or high-fidelity simulators.⁸³ In 2007, The Nursing and Midwifery council in the United Kingdom stated that up to 300 hours of simulation experience could be substituted for the equivalent amount of clinical exposure for a nurse in training.⁸⁴

1.12 Simulation for assessment and revalidation

Simulation is widely used for assessment in medical practice, as it provides a low risk, safe, reliable environment for both practitioners and patients. In medical school and postgraduate assessments, standardised patients are utilised in the *observed structured clinical examination* (OSCE). These patients or actors have or imitate certain medical conditions or signs in order that a candidate can be assessed consistently and objectively compared to his or her peer group.⁸⁵ The candidate may have to take a history, examine the patient, order and interpret appropriate investigations, create management plans and communicate appropriately with the patient.³² Thus, the OSCE provides an environment for both formative and summative assessment of cognitive and non-cognitive skills domains.⁸⁵

Technical skills simulators are also used for assessment. The Fundamentals of Laparoscopic Surgery (FLS) program developed by the Society of Gastrointestinal and Endoscopic Surgery (SAGES) was developed to teach a standard set of cognitive and psychomotor skills to laparoscopic surgeons.⁸⁶ FLS certification is now a prerequisite to certification by the American Board of Surgery.⁴¹

Simulation is also being used in maintenance of certification. For example, The American Board of Anaesthesiology allows candidates to demonstrate “practice ability” at an accredited simulation centre rather than undergo assessment in clinical practice.⁸⁷

Furthermore, anaesthetists are required to undergo and complete two practice assessment and performance improvement activities in a ten year cycle. Given the need for practice and improvement as teams in high risk environments, the simulated setting offers the ability to assess complex skills.⁸⁷

1.12.1 Assessment metrics

Metrics have been developed and validated to aid objective assessment and define areas that require further development in healthcare. For example, Objective Structured Assessment of Technical Skills (OSATS) allows measurement of technical skills competence by experts in a simulated environment.⁸⁸ Subsequent skill deficiencies can be identified and trained either in simulated or real-life environments. Non-technical skills assessments are currently available or in development for surgeons, operating theatre teams, resuscitation teams, anaesthetists and trauma teams.⁸⁹⁻⁹² Non technical skills are not commonly taught or examined in undergraduate or postgraduate health professional education, yet their importance is being increasingly understood.^{93,94} Specific non-technical skills training can be targeted once areas of development are identified.

1.13 Discussion

1.13.1 The need for novel applications of simulation in healthcare

The review to this point has reviewed the types of simulators and simulations used in healthcare, contextualising their use in both operational skills training and assessment, across the range of micro, meso and macro simulation concepts. However, certain areas of practice do not have anything approaching optimal simulation solutions, be they are centred on cost, accessibility or scalability. Other areas require simulation approaches to improve participant or organisational education, future performance and prediction of future system response. The application of existing knowledge on simulation and training, together with the growing understanding of skills training and assessment, can be utilised to create innovative approaches to simulation in the field of healthcare. This thesis will explore two innovative approaches to simulation that may assist healthcare professionals and

policymakers to enhance practice in two areas that have had a major impact on healthcare and policy in the past decade: major incident management and health service policy change.

1.13.2 Innovative approaches

1.13.2.1 Behavioural Simulation

Simulations for leadership and organisational development are acknowledged to be an under-researched area of healthcare practice.⁹⁵ In addition, simulations to evaluate prospective changes in policy or strategy are also under-utilised.⁹⁶ Behavioural simulation offers promise in addressing both areas, and is the first simulation methodology to be explored in this thesis. The first prominent behavioural simulations in the UK were developed and run by the Office for Public Management in association with the East Anglian regional health authority. The simulations, known as the “Rubber Windmill” aimed to see how a change in health policy – the introduction of internal markets – would impact on health services in the future.⁷³ The concept was popularised further by the Windmill simulations run by the King’s Fund in 2007 and 2009, and others have been run in the UK, Europe and USA, reporting educational benefits for participants and changes in organisational planning and strategy as a direct result of simulation processes and outcomes.⁹⁷⁻⁹⁹

In a Behavioural Simulation, participants have similar roles to those in real life and the content reflects real-life or predicted circumstances. There are no rules in the simulations – participants are encouraged to act as they would in reality, responding to a particular challenge using the information available. The processes and consequences of the interactions between the participants determine the simulation outcomes.

The majority of behavioural simulations are published in the grey literature, and have little detail on design, methodology or data collection mechanisms. Furthermore, there is little formal evidence of the value of the simulations, either to individuals and organisations. This thesis will seek to address these areas systematically, by developing an evidence-based framework for design, implementation and analysis of behavioural simulations in healthcare, building on previous knowledge and suggested best practice from the fields of education, gaming and policy research. In addition, the development and analysis of two simulations examining changes in NHS structure and practice will be described and discussed.

1.13.2.2 Virtual World Environments

Virtual worlds are the second simulation methodology to be explored in this thesis. Virtual worlds are internet-based, multi-user, immersive environments that are used for both social and educational activities. The most popular virtual world is Second Life, which has over 18 million members worldwide. Each user is represented by an avatar, and can interact with other users by text or voice. The built virtual environment can be based on fantasy or reality. To date, the feasibility of virtual worlds to train and evaluate health professionals and students has been investigated in a number of areas, including in cardio-pulmonary resuscitation training, operating theatre induction, decision making skills, diabetes management and teamwork in emergency situations.¹⁰⁰⁻¹⁰⁴ The Virtual Association of Surgeons also held a conference in the virtual world, attended by members from five countries (Figure 8).¹⁰⁵ The increasing availability of low-cost and open-source software has greatly reduced the cost of virtual world development in recent years. Furthermore, the increasing use of the world wide web, improving internet speeds and improved specification of computers has made virtual environments more accessible and feasible to use.

Virtual worlds offer theoretical advantages to current modalities of training for healthcare professionals. Scenarios can be developed and tailored to suit individual or team requirements for multiple healthcare disciplines. Entire scenarios can be recorded, which may enable improved feedback and performance analytics. Virtual scenarios can be modelled to any physical environment, potentially enabling training in situations that would otherwise be difficult to access, unsafe or disruptive, and scenarios can be rerun easily, conferring a potential cost benefit.

Major incident preparation is one area in which the advantages of virtual environment training could be utilised; preparation for such incidents is challenging at individual, team and organisational levels. Reports from the London Bombings of July 7th 2005 have raised concerns about ongoing multidisciplinary preparedness, communications and senior leadership training in future major incidents.^{106,107} Chapters 5-8 of this thesis will systematically explore the potential for virtual environment simulations to address some of the concerns raised in these and other reports, at a tactical and operational level, in multi-user and multi-disciplinary contexts.

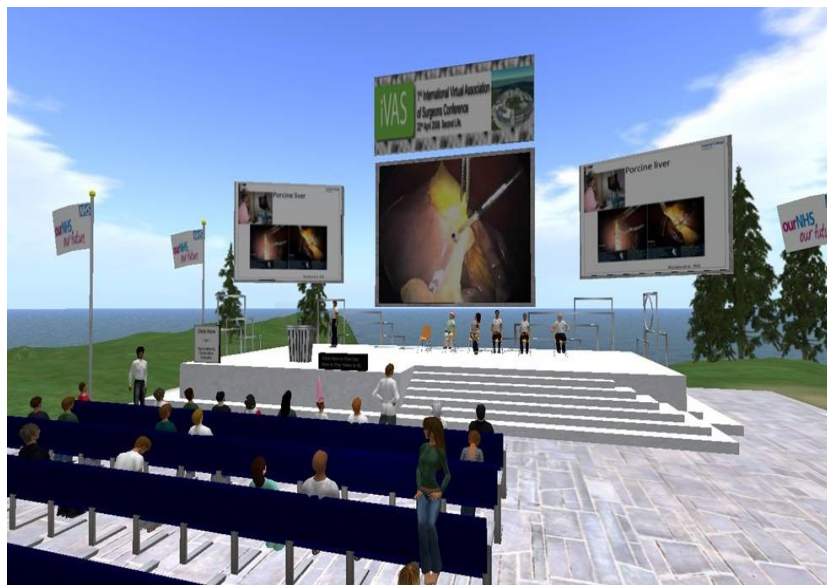


Figure 8: A surgical conference in Second Life.

1.14 Thesis Aims and Objectives

The aims of this thesis are:

1. To review the evidence base for behavioural simulations in healthcare and determine the how future simulations may be structured and assessed for educational value and behaviour change. (Chapter 2)
2. To further examine the feasibility and acceptability of utilising behavioural simulations in the healthcare sector. (Chapters 3 and 4)
3. To determine whether behavioural simulations can improve knowledge, skills and behaviours in a healthcare context. (Chapters 3 and 4)
4. To review the current status of major incident preparedness and assess the views of current trainers and responders as to how virtual world environments may enhance current practice.(Chapter 5)
5. To examine the feasibility of a designing and running major incident exercises in a virtual environment (Chapters 6 and 8)
6. To examine the feasibility of skills assessment in a virtual environment, in the context of a major incident (Chapters 7 and 8)
7. To examine the potential for using virtual world simulations across lower, middle and higher income countries for healthcare professional education. (Chapter 8)

2 BEHAVIOURAL SIMULATIONS IN HEALTHCARE AND HEALTH POLICY

2.1 Overview

This chapter reviews the evidence for the use of simulation and gaming in healthcare and health policy. A proposed methodology based on best evidence for design, implementation and evaluation of future simulations and participants is discussed. The chapter concludes by suggesting future developments and research areas in this important and expanding field.

2.2 Introduction

This chapter represents the start of the first section of the thesis, where I review Behavioural Simulation. In the introduction I described how virtual environments enable access to immersive simulated clinical training which would otherwise be difficult to access by other means. By contrast, behavioural simulation does not require detailed environments to function – a suitably sized room with chairs and tables is adequate - and is therefore more suited to policy or systems development and understanding. However, like the virtual environments there has been limited utility of this type of simulation to date in the healthcare setting.

2.2.1 The rationale for policy simulation

Healthcare systems are complex and have many social, economic and political forces acting at the same time, often with competing interests. It is therefore unsurprising that a change in

health policy may not achieve the intended outcomes and may result in undesirable consequences for the health system and patient care quality; policymakers are not the same people that implement the policy on the ground and those that do implement a policy may not fully understand the complexities of the system.

There have been numerous occasions of unintended consequences resulting from a change in health policy in the UK.¹⁰⁸ In 2004, a new contract was implemented for General Practitioners (GPs) in the UK. The aims of the contract have been partly fulfilled, in that there has been a significant recruitment of GPs, especially in deprived areas, and there has been an increase in the number of consultations in GP practices. However, in the first three years of the contract, PCTs spent £1.76 billion more than anticipated on GP services, largely due to an underestimate of achievement levels on the Quality and Outcomes Framework and additional costs of providing out of hours care.¹⁰⁹

Unforeseen consequences of a policy can adversely impact healthcare quality as a result of the effects of the policy on a system. For example, target-setting policies to see new outpatients in secondary care (such as the NHS Plan 13 week target) have in some cases have been achieved at the expense of considerable delay and cancellation of follow-up appointments, resulting in adverse patient consequences.¹¹⁰ Two such cases were reported to the House of Commons Public Administration Select Committee in 2002/3.¹¹¹ A further example is provided by the 2005 directive that 98% of Emergency Department patients be treated and either discharged or admitted within 4 hours. This directive improved patient satisfaction and was achieved despite increasing use of emergency services during that period.¹¹² However, the consequences of not meeting the target led some NHS trusts to

deliberately keep patients waiting in ambulances when the department was busy, until there was a clear window in which to treat the patient and meet the target.¹¹³ These issues are not confined to the UK. The Netherlands, Australia, New Zealand and the USA have also documented adverse consequences of healthcare policy change.¹¹⁴⁻¹¹⁶

The above examples indicate clearly that the intentions of policymakers to provide improvements in healthcare have, in some cases, had unintentional consequences both financially and on patient experience and outcomes.

2.2.2 Could the unintended consequences have been predicted by policymakers?

One method of potentially foreseeing the consequences of a change in policy is to run simulations of the healthcare system in which the change is scheduled to take place.

Theoretically, simulations can be utilised to improve policy awareness and understanding, predict implementation strategies, and also test policy outcomes.¹¹⁷ Politicians have utilized simulations to strengthen their political position or to act against current or future policy.¹¹⁸

2.3 Method – literature review

I sought to find relevant articles published in English that detailed the theory and practice of healthcare simulation exercises in both the academic and grey literature. Medline, Embase, PsycINFO, Web of Science and Google Scholar databases were explored. The references within initial search results were further explored to obtain material from academic and grey literature, including newspaper articles, books and websites.

2.3.1 Computer-Based Simulations

Computer-based simulations for modelling healthcare systems have been utilized since the 1960s, but have been more prominent in the last two decades as computing power, accessibility and graphical ability has developed. Three levels of simulation have been defined.¹¹⁹ Level one (“Human Body”) focuses on individual health including disease and behaviour, for example the spread of disease or impact of a behavioural change on a population. Level two simulations (“Operational”) are characterized by the visualization of patient flows through a system, and can be used for resource, process and capacity planning. Finally, level three models (“Strategic”) aim to predict long-term responses to health system change.

The two most popular approaches are *discrete event simulation* (DES) and *system dynamics*, although *monte-carlo simulations* and *agent-based modelling* have been used.¹²⁰ The DES method can be used to model real-world systems that can be decomposed into a set of logically separate processes which autonomously progress through a system over time, which is akin to a patient travelling through a healthcare system.^{29,121} DES is usually used for modelling simulation at levels 1 and 2. By contrast, system dynamics usually models healthcare systems on a larger, more strategic scale (level 3) by looking at feedback and unanticipated effects of the relationships between elements of a system.¹²² System dynamics requires an understanding of the relationships between agents in the simulated system for the model to run. Both DES and system dynamics are increasing in popularity, however the key challenge is to create packages that are accessible, understandable and useable for clinicians and healthcare managers, although experts concede that this scenario is a long way off.¹²²

The major flaw with computer-based simulations is that they are only as reliable as the data and process rules that are put into the system. If assumptions about the behaviour of the agents in the model are incorrect, future interpretations could be misleading.¹²³

Unfortunately, behaviour where policy-making and implementation is concerned may not be rational and comprehensive but can be unpredictable and erratic.^{118,124} Therefore, capturing and understanding the behaviours and relationships in a system is all-important in enabling accurate future prediction. Past behaviours can serve as a guide, but to better understand what future behaviour might be, behavioural simulations offer the potential to predict the responses and relationships of people, systems and organizations.

2.3.2 Behavioural Simulation

“Participatory” or “Behavioural” simulation are terms that encompass a variety of non-computer based simulations or gaming methodologies that place participants into a contextualised, interactive simulation environment and asking them to respond to a given set of circumstances, such as a change in policy. The processes and outcomes are driven by the actions and interactions of the participants and not by chance, allowing participants to see the consequences of their actions in a safe environment – i.e. without real-world consequence.^{125,126} Simulations are especially useful in complex strategic or policy changes involving multiple individuals or organizations, where identification of learning needs, development of solutions, implementation of change processes and outcomes are dependent on multiple behavioural interactions. Geurts et al noted five criteria for successful policy design and implementation, all of which could be addressed in a behavioural simulation (figure 9).⁷²

Policy simulations are acknowledged to have their origins in military strategy games that were popularized by German and Japanese forces around the time of World War Two.¹²⁷ Concurrently, organizations such as RAND in the USA promoted the use of similar exercises, initially for military purposes and later for domestic policies.^{118,128} Since then, various nomenclatures have been used by proponents, such as free-form gaming, policy exercises, or open, participatory or behavioural simulation. Simulations of this type have been widely utilized by higher education institutes, businesses and industry.^{129,130} Figure 10 lists prominent behavioural simulations, the majority of which are non-peer reviewed publications.

2.3.3 Behavioural Simulation in Healthcare

The use of behavioural simulation in healthcare was popularized in the UK by the Rubber Windmill Simulation in 1990.⁷³ This simulation, designed and run by the Office for Public Management in association with East Anglian Regional Health Authority, aimed to see how the behaviour and interactions of healthcare stakeholders would alter when internal market forces were introduced.⁷³ The simulation “collapsed” on the third day, due to conflicting financial and competitive pressures. Since then, numerous other healthcare simulations have taken place, although many reports are not publically available. Notable UK publications include those by the Kings Fund, including the Windmill reports and a commissioning simulation exercise run by NHS Lincolnshire in 2010.^{28,98,131}

The Five C's of policy gaming – why might a policy simulation be useful?

Complexity	Development of a systems perspective for complex, multi-factorial problems, whose outcome depends on behaviours from multiple people, who may work at different strategic levels.
Communication	Simulation encourages multiple communication modalities, including open discussion, visual aids and computer generated information, enabling improved communication between all participants
Creativity	Experiential learning in a safe environment and ability to see how consequences play out allows for creative and experimental thinking and rapid maturation of new ideas
Consensus	A safe environment allows for debate, negotiation and understanding of shared interests. Positions can be clarified. Allows identification of “win-win” outcomes.
Commitment	Simulation generates confidence and trust between participants. Outcomes reveal learning needs and potential future failings. There must be a commitment to action for future success based on simulation outcomes.

Figure 9: The 5 C's: areas desirable for policy success that can be addressed by a simulation – adapted from Geurts et al.⁷²

Key sources of information on Behavioural (non-computer-based) Simulation:	
Books	The following books detail the theory of gaming and simulation: • Duke R, Geurts J. <i>Policy Games for Strategic Management</i>. Amsterdam: Dutch University Press, 2004 • Duke, R. <i>Gaming: the future's language</i>. New York: Sage Publications, 1974 • Hertel JP, Millis BJ. <i>Using simulations to promote learning in higher education : an introduction</i>. Sterling, Va: Stylus Pub., 2002 • Klabbers JHG. <i>The Magic Circle: Principles of Gaming and Simulation</i>. 3rd Edition. Rotterdam, Sense Publishers. 2009 • Shubik M. <i>Games for society, business and war: towards a theory of gaming</i>. New York: Elsevier, 1975
Simulation descriptions and reports	Netherlands: • Geurts J, Duke R, Vermeulen P. Policy Gaming for Strategy and Change. <i>Long Range Planning</i> 2007;40:535-58. • Heyne G, Geurts J, Vermaas J. DIAGNOST; a microworld in healthcare for elderly people. <i>Proceedings of the 1994 International System Dynamics Conference</i>. Stirling Scotland, 1994. • Joldersma C. Policy learning through simulation/gaming. In: D Saunders, Smalley N, editors. <i>The International Simulation and Gaming Research Yearbook: Simulations and Games for Transition and Change</i>. London: Kogan Page, 1998:77-85. USA: • Greenblatt C. The design and redesign of gaming simulations on health care issues. <i>Simulation and Gaming</i> 2001;32(3):315-30. • Kahan J, Greenwood P, Rydell C, Schwabe W, Williams B. Can gaming of social policy issues help translate good intentions into change? Santa Monica, CA: RAND Drug Policy Research Centre, 1993. UK: • Office for public management. <i>The Rubber Windmill</i>: East Anglian Regional Health Authority, 1990. • South West Thames Regional Health Authority and Office for Public Management Care Kaleidoscope: futures for community care. London. Office for Public Management, 1991 • East Anglian Regional Health Authority and Office for Public Management. <i>The Rubber Windmill '92: planning to achieve health gain</i>. Cambridge : East Anglian RHA, 1992 • Office for Public Management. <i>Mapping the maze : a report of two behavioural simulations that explored the future of change in acute health services</i>. London : OPM, 1995 • Office for Public Management. <i>Beyond the looking glass: the future for community NHS trusts: reporting the findings of a simulation event, February 1995; and new reflections on the community providers</i>. London : OPM, 1995

	• Harvey S, McMahon L. HealthMetro: report of a simulation about the future of primary care. London : OPM, 1996 • Office for Public Management and West Sussex Health Authority. Facing the future: report of a simulation-based event to explore future relationships amongst health care organisations in West Sussex. London : OPM, 1997 • Office for Public Management. GPower : the impact of locality commissioning : report of an open simulation for Wakefield Health Authority. London : Office for Public Management, 1997 • Office for Public Management. Ground work: the market management simulation: report of a simulation designed and run by the Office for Public Management for the NHS Executive West Midlands. London : OPM, 1997 • Smith J, Ham C. Local commissioning in dentistry: report of a simulation exercise held in Birmingham in March 1997. Birmingham : HSMC, 1997 • NHS Executive: P.H.O.E.N.I.X. Agenda Programme (Primary Healthcare Organisations Exchanging New Ideas for eXcellence) Simulation model for primary care groups. Leeds: DoH. 1999 • McMahon L. Creating the climate: health futures for Wales. London: OPM, 2001 • Herbert G, Breen S. Introducing reimbursement for delayed discharge: a simulation and search for ways forward: report of a workshop hosted by North Yorkshire County Council on 18th November 2002. Leeds : Nuffield Institute for Health, 2002 • Office for Public Management. Levers, contracts and choice: the future of primary care: report of the Utilising the Contracts simulation. London : OPM, 2005 • Harvey S, Liddell A, McMahon L. <i>Windmill 2007: the future of health care reforms in England</i>. London: King's Fund, 2007. • Harvey S, McMahon L. Shifting the balance of healthcare to local settings: the seesaw report. London: King's Fund, 2008 • Harvey S, McMahon L. Staffscope: understanding the future needs for London's health and social care workforce—a 'soft' futures approach. London, NHS London, June 2008 • Harvey S, Liddell A, McMahon L. <i>Windmill 2009: NHS response to the financial storm</i>. London: King's Fund, 2009. • Harvey S, McMahon L, Humphries R. Routes for social and health care: a simulation exercise. The King's Fund, London, 2011 • Imison C, Curry N, McShane M. Commissioning for the future. Learning from a simulation of the health system in 2013/14. London: The King's Fund, 2011. • University of Birmingham. Steering or Rowing: report from a simulation event testing how CCGs might utilise CSSs. NHS Clinical Commissioners (2012) • Bury E, Horn J, Meredith D. How to use war games as a strategic tool in health care. <i>Health International (McInsey Consulting)</i> 2011;11:28-37.
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Figure 10: A list of key sources on simulation related to policy, as identified by the literature search.

2.3.4 Educational Benefits

The major educational benefit of behavioural simulations lies in the ability for participants to apply knowledge and problem-solve in contextualised, complex environments, allowing both individuals and organizations to better understand their current working processes and systems, and those that may be introduced in the future.^{28,98,126,131-133} By allowing participants to see the consequences of their actions in an authentic environment, existing knowledge assumptions are be questioned, new mental models can be established and behaviour changed.⁷² This “paradigm breaking” model, set out in the theory of Double-Loop learning, is essential for fundamental individual and organizational change.¹³⁴

Although formal evaluation of policy simulations is not commonly published, there is limited evidence of their educational effectiveness in the healthcare sector. Geurts and colleagues ran a simulation based on a real Dutch hospital to explore new policy options.¹²⁵ Participants reported that they learned about the problems in the hospital and gained insight into their colleagues’ behaviour. Heyne and colleagues developed DIAGNOST, which allowed participants to explore the consequences of elderly healthcare reform, and evaluate and react to the changes. Participants reported that they gained insight into relevant issues concerning policy change, and demonstrated the importance of different stake-holders working together.¹³³ The Windmill simulation of 2009 explored the consequences of drastic funding cuts in the UK National Health Service.⁹⁸ Although there was no published formal evaluation describing the educational benefits of the simulation for participants, a commentary in the British Medical Journal described the simulation as “stunningly real to those involved.”³⁰ The experience of taking part in similar simulations seems to have influenced the future behaviour of participants.^{135,136} There is now an increasing demand

from healthcare staff to utilize policy simulation to provide an evidence-based approach to issues such as healthcare rationing and formulation of future policy.¹³⁷⁻¹³⁹

2.3.5 Policy prediction in healthcare

The potential to accurately predict the implementation process and outcome of a change in policy has not been formally assessed, although some simulation outcomes have replicated future real-life events. For example, the results of the Windmill 2007 simulation exercise examining the consequences of NHS reforms mirrored some of the real-life outcomes when the policies were implemented.¹⁴⁰ Similarly, some of the processes and outcomes of the Windmill 2009 simulation predicted events later that year.³⁰

2.3.6 Political influence of simulations

Simulations have had undoubted influence on health policy formulation in both the UK and USA, although again publication of results and change processes has been limited. In the 1970's, two simulations on the care of haemophilia patients in the United States were developed by Greenblatt and Gagnon in association with the National Heart and Lung Institute and the National Haemophilia Foundation. Participants included expert clinicians, providers and researchers. The simulations increased awareness of haemophilia among policymakers and healthcare personnel, and became influential in redesigning health policy on haemophilia care in the United States.¹⁴¹ In the UK, the Rubber Windmill simulation of 1990 demonstrated potential failures of proposed internal market reforms. The results were eagerly sought by the government and attracted a debate in the House of Lords.^{142,143} In response to criticisms of the policy, many of which were based on the Rubber Windmill

outcomes, Kenneth Clarke, Secretary of State for Health at the time, was quoted as saying: “I am not in the business of playing the role of the Grand Old Duke of York marching the NHS up the hill in preparing for the new system only to march it down again.”¹⁴⁴ Although the direction of the reforms remained the same, a softer approach to implementation occurred.¹⁴⁵ In the USA a gaming simulation run by the RAND Drug Policy Research Centre did influence the future direction of community drug services in Miami, and a simulation to explore health policy options in a Dutch Hospital influenced hospital directors when revising hospital policy.^{125,146} More recently, McKinsey and Company have run healthcare simulations in the UK and USA that they claim are influencing new health policy formulation and implementation.¹⁴⁷

2.4 Methodology of behavioural simulation

Whilst the above findings support the use of behavioural simulations in healthcare, there is no commonly used validated framework in healthcare literature for the design and implementation of simulations. Furthermore, it is not possible to determine the true accuracy of the simulation output, as few studies detail the processes used. It is possible therefore that design, reporting and publication bias is present in these simulations, and consequently the findings and recommendations must be interpreted cautiously.

In order to demonstrate the validity of simulations in policy education and development, clear and reproducible simulation methodologies need to be defined, based on best practice. I present some brief recommendations on simulation design, structure and analysis – based on the literature review, existing practice and evidence from around the world.

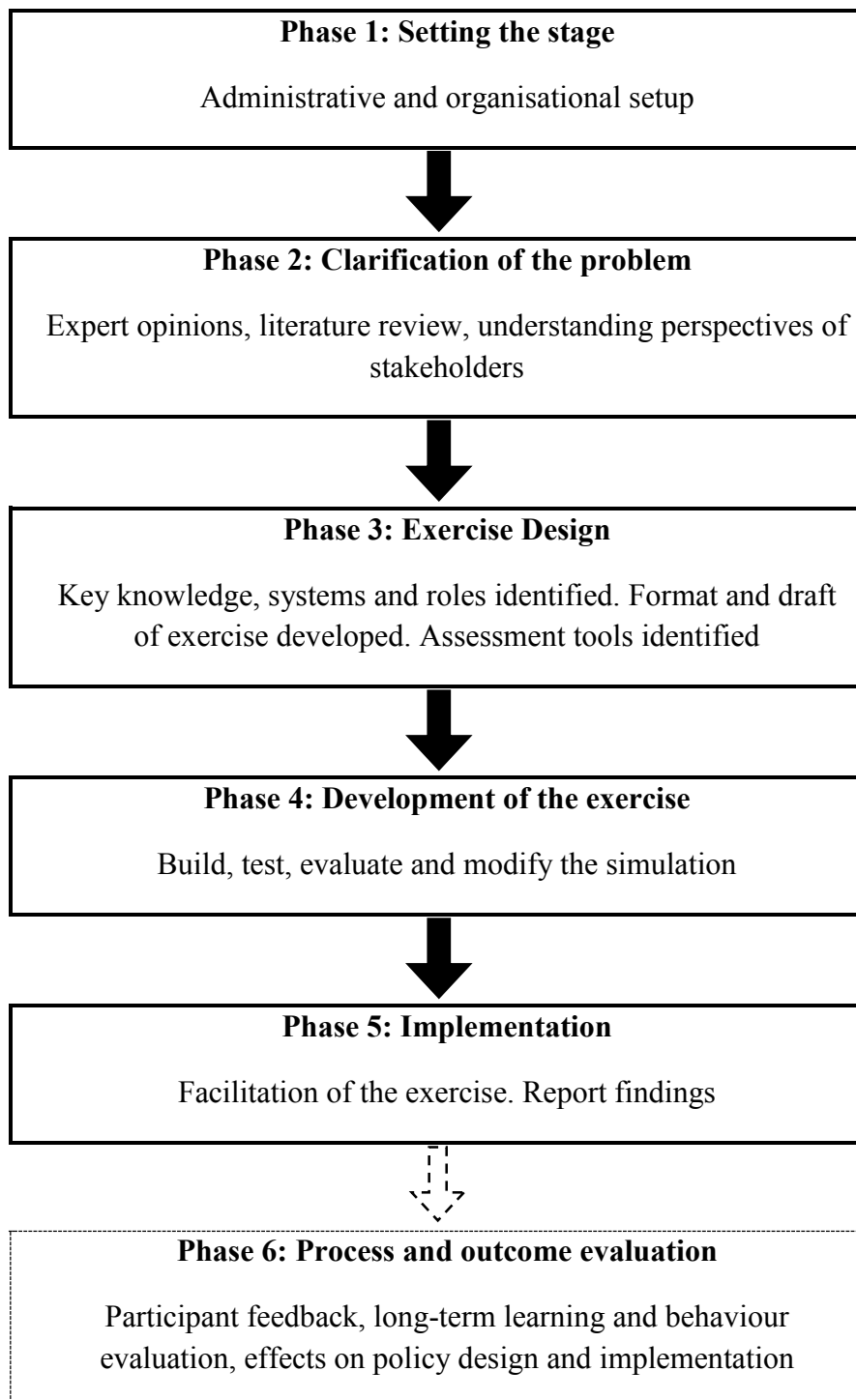


Figure 11: The design of a policy simulation exercise (adapted from Duke and Geurts 2004, p277)(127). The identification of assessment tools during the design phase has been added to Phase 3. Phase 6 has been added to reflect the importance of evaluation in the simulation design.

2.4.1 Design and setup of a simulation

Whilst each simulation has unique background, issues and objectives, it is important that the framework on which it is designed has face and content validity and has taken into account the major issues and drivers at stake. Furthermore, the way in which a simulation is designed and implemented must allow participants to demonstrate achievement of the simulation aims either during the scenario or debriefing session.¹²⁹ A comprehensive guide to simulation design and delivery has been described by Duke and Geurts.¹²⁷ They describe a replicable, five-stage approach based on their experience of conducting large numbers of simulations over the past four decades (Figure 11). This design is transferrable and applicable to healthcare policy issues. However, this approach does not reflect the need for evaluation of process and outcomes as part of the design process, which is discussed further below.

2.4.2 Implementation of a simulation

A successful simulation exercises requires consideration of four key factors.¹⁴⁸⁻¹⁵⁰ Firstly, if participants are motivated by the policy topic, they will actively engage in the simulation and fulfil the responsibilities of their role in a professional manner.¹⁵¹ Secondly, participants must be actively involved; passive contributions results in reduced interactions, debate and negotiation opportunities and a poorer experience for other participants. Thirdly, the simulation context and content must be factually correct and flow in a true-to-life sequence, in order that participants experience “reality of function.” Lastly, the simulation will fail unless group interaction takes place and sufficient time is allocated to complete the tasks. The above factors all encourage deep, rather than superficial understanding of the key policy issues and organizational challenges.¹⁴⁹

2.5 Outputs and Analysis

2.5.1 Debriefing

From an educational perspective, a debriefing after a simulation is the most valuable aspect.¹⁵² There is a wide consensus that debriefing should take at least a quarter of the total simulation time, and encompass all participants either as a group or individually. The debriefing generates valuable qualitative data that can provide important insights into the knowledge, behaviour and attitude changes that may have taken place during the exercise, together with the perceived consequences of a policy change, and suggest future directions for policy strategy and implementation.

2.5.2 Observational Output

The data generated from a behavioural simulation may be quantitative and/or qualitative in nature. Qualitative data is much more commonly generated, the recording and analysis of which is entirely dependent on the skills and contextual understanding of facilitators. This has led some observers to question the validity of the qualitative approach in the policy arena, especially as those interpreting the data may have political bias.^{153,154} Indeed, the lack of a widely accepted feedback and debriefing culture is recognized as a major flaw of gaming and simulation.¹⁵² There has been a move recently for policy simulations to be created and assessed by two different groups, to try to reduce any reporting bias.¹³¹ Quantitative data could include, for example, the financial ramifications of a policy simulation, changes in job numbers or projected number of patients treated, depending on the nature of the simulation. There is potential to further the validity of the findings by

triangulating different data sets together, for example written and verbal self-reported outcomes together with observer-collected data.¹⁵⁵

2.6 Participant analysis – how effective are the simulations?

Demonstrating the effectiveness of simulations educationally is desirable and economically necessary; ultimately employers need to know that the high costs of (often high-level) staff participation are worthwhile, both to the individuals taking part and the organisation as a whole. I propose that the knowledge, skills, behaviours, attitudes acquired and developed during the simulation could be formally assessed, using established metrics. Some areas may be assessed pre and post simulation by participant self-assessment, although more long term-changes would require workplace-based assessments by both the individual and co-workers, or evaluation in future simulations.

2.6.1 Simulation Learning

Simulation learning can be evaluated according to the criteria defined by Kirkpatrick.¹⁵⁶ Although the Kirkpatrick model is critiqued due to implied linearity, the emphasis on self-feedback and the absence of return on investment, it represents an understandable and replicable starting point for simulation analysis. *Feedback* and *learning* can be quantified by written or verbal means, either by self, peer or observer rating. Haller et al provides the necessary survey methodology, which is a 10-item questionnaire (using 4 point Likert scale) on satisfaction with course organisation, course content (objectives, expectations met, content adequate, learning adequate), group dynamic (number of participants, interaction,

group composition, method and technical support).¹⁵⁷ However, for this to be successful, learning outcomes must be clarified whilst designing the simulation.

2.6.2 Negotiation

The process of negotiation between individuals and organisations will be key to many outcomes. The negotiation literature offers various options for measuring how simulation participants interact, including transcription and coding of negotiations.¹⁵⁸ I suggest that analysis of simulation data will benefit from distinguishing between *outcome measures* and *process measures*.^{159,160} Outcomes can be classified according to the type of agreement.¹⁶¹ For example, integrative rather than distributive negotiation will have all of the following characteristics: (a) focus on commonalities rather than differences; (b) attempt to address needs and interests, not positions; and (c) commit to meeting the needs of all involved parties. Furthermore, intra-simulation metrics, such as negotiation processes, could be analysed (e.g. using content analysis¹⁵⁹) and correlated to negotiation outcomes, providing valuable personal and group feedback and development opportunities.^{160,162}

2.6.3 Interpersonal and team skills

Simulators can also test whether interaction with other participants in the simulation will affect the relationship with similar agents in the real-world system. *Interpersonal attractiveness* is measured with a 3 item scale anchored, for example, by comfortable/uncomfortable.¹⁵⁹ *Trust* level is known to affect negotiations and can be measured between individuals and professional groups.¹⁶³ *Team quality* is another interpersonal variable, which can be measured post-simulation using the following

subscales from an existing health-safety attitudes questionnaire: teamwork climate, perceptions of management, and working conditions.¹⁶⁴ Simulations might also result in lower *power-distance* between participants, which is “the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally.”¹⁶⁵ For example, junior clinicians may be less likely to communicate ideas that promote change if it brings them into conflict with a more senior clinician.

2.6.4 Simulation Impact

The *impact* of the simulation on future behaviour change is more difficult to assess, requiring long-term follow up of the participants, although attitudinal shift and intention to change behaviour can be explored using structured, well validated theories such as those of Ajzen’s Theory of Planned Behaviour.¹⁶⁶ In addition, attitudes such as *conservatism* and *openness to change* can be measured using Schwartz’s value inventory, and changes in *risk propensity* can be measured in individuals and groups.^{167 168} Control beliefs, such as self-efficacy, perception of personal ability to perform actions and to achieve outcomes, and perceived ability to inflict change can be assessed pre and post simulation using documented scales.^{169 170} Leadership style may also change as a result of learning during the simulation, for example, ‘direct’ leaders can become ‘distributive’ leaders, and existing instruments can measure such transitions.¹⁷¹ Measurement of these domains and others, such as leadership skills and social and communication skills, may help accurately document the benefits of such simulations in healthcare policy learning.^{158,164}

The final phase of Kirkpatrick's criteria is evidence of *change in the output* of the organization concerned as a consequence of the simulation. The cases of the haemophilia care and the RAND Drug centre study mentioned previously provide evidence that this can be achieved, but practically it would be extremely difficult to follow each simulation in this way.

2.7 Conclusions

Behavioural simulation has been successfully utilized for educational, political and policy purposes in both Europe and the USA. Such simulations have the potential to address policy challenges that cannot otherwise be explored prior to real-life implementation, which can result in unforeseen, undesirable consequences. However, most reports do not describe the methodology in sufficient detail to determine its validity, nor has the process of analysis been described sufficiently to be certain that conclusions were balanced and reflective of the proceedings. The use and clear description of a transparent methodology and analysis framework, including triangulation of evidence and assessment scales, could provide a reliable evidence-base upon which policy makers and stakeholders act. In turn, the educational benefits and potential to explore consequences of policy change will ensure the wider appreciation of this important research methodology in the health policy literature.

The following chapter builds on this analysis, as the need for a behavioural simulation is identified and then designed to address a complex educational issue related to health policy.

3 THE CRUCIBLE SIMULATION

3.1 Overview

This chapter describes the design and implementation of a simulation designed to enhance clinical leadership in the context of the reshaped health system in London following the implementation of the Health and Social Care Act 2012. The design of analytic metrics is described, along with participant feedback and educational attainment. A phased overview of the simulation, according to the steps described in Chapter 2, is shown in Figure 12.

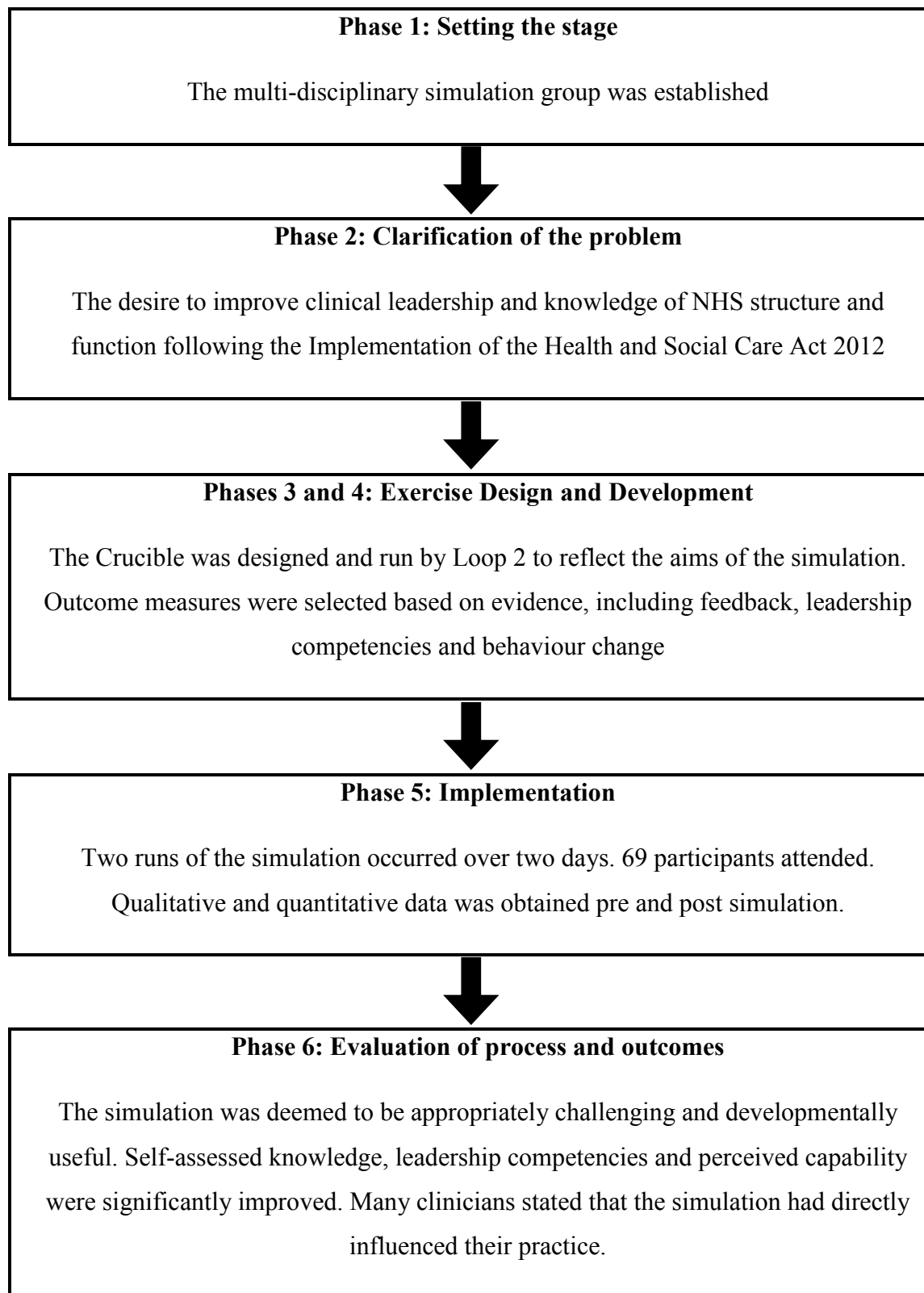


Figure 12: A phased overview of the Crucible simulation according to the design methodology adapted from Duke and Geurts, described in chapter two.

3.2 Introduction

The previous chapter explored the concept and previous utilisation of behavioural simulations in healthcare. What previous simulations have lacked, from an academic perspective, is transparency of simulation design and methodology, together with analysis of validity and effectiveness. When designing a simulation, the topic or subject should, according to the criteria set out by Geurts et al, be cognitively complex, call for creativity and consensus to formulate strategy, and require open communication and a commitment to action for future success.⁷² Addressing these criteria is desirable to successfully implement healthcare reform.

3.2.1 The Health and Social Care Act

During the course of this thesis, the foremost health policy issue in the United Kingdom has been the implementation of the Health and Social Care Act 2012.¹⁷² With over 2000 amendments from its original form and after 50 days of debate in parliament, the Act now details the largest and most complex set of reforms to the NHS since its inception by Aneurin Bevan in 1948.¹⁷³ The Act details a number of legislative changes, including the abolition of primary care trusts and strategic health authorities; establishment of Health and Wellbeing boards and Monitor, as the new regulator, and also creation of 211 new Clinical Commissioning Groups (CCGs).¹⁷⁴ There are a number of highly-debated elements in the Act. Commissioning has attracted a great deal of controversy due to the emphasis on competition; proponents argue that this will drive up service quality, whilst critics claim that increasing commercial sector involvement will lead to NHS privatisation, fragmentation of care and undermining of core services.^{172,175} Furthermore, an investigation of the CCG boards found that one third of GP members had a conflict of interest due to financial

relationships with private healthcare providers.¹⁷⁶ The complexity and rules of the new system have also been identified as a cause for concern, causing confusion amongst commissioners and providers needing to develop understanding of the relationships between the new and existing bodies.^{173,177 178} The Act has also been implemented at a time of unprecedented austerity in the NHS budget, leading to concerns from clinicians and politicians.¹⁷⁹ Estimations are that the NHS needs to improve efficiency by 4% per year until 2015 to preserve existing levels of healthcare, although such savings have never been successfully demonstrated in any health system globally.^{180,181}

3.2.2 Clinical Leadership

What is commonly agreed however is the need for strong and effective clinical leadership to improve quality of care and implement the reforms.^{173,182} The Oxford English Dictionary defines leadership as “the actions of a leading group of people, or an organisation; or the ability to do this.” Clinical leadership as a concept has no accepted definition, but is widely acknowledged as being essential to the day-to-day running of, and implementing change in, a high-performing healthcare organisation.¹⁸³ The rationale for clinical leadership is simple; clinicians are at the core of providing high-quality healthcare and are therefore ideally placed to identify opportunities for service development and lead organisational change. Kaiser Permanente and the Veterans Health Administrations (VHA) in the USA are well known examples of clinical leadership-centric organisation, which run economically efficient models of integrated care, with high clinical quality and high patient satisfaction.¹⁸⁴ Both Kaiser and VHA were struggling with poor clinical and financial performance prior to the clinical leadership model being developed. Lessons from Kaiser and VHA have been adapted by clinicians in the UK. For example, the successful design of integrated

community orthopaedic and vascular services in north-east Birmingham was lead by clinicians in primary and secondary care, achieving high levels of patient satisfaction and cost-efficiencies.¹⁸⁵ Such examples demonstrate the potential benefits of integration between clinicians and managers, which will be essential for the NHS reforms to succeed.¹⁸⁶ Unfortunately, failures of clinical leadership can have serious consequences, as highlighted by the deficiencies in care seen at Mid Staffordshire, Alder Hey, Bristol and Maidstone and Tunbridge Wells NHS Trusts.¹⁸⁷⁻¹⁹⁰

Clinical leadership is not a new concept. Thirty years ago, the Griffiths report identified a lack of general management as the main weakness of the NHS and recommended that “hospital doctors must accept the managerial responsibility that comes with clinical freedom.”¹⁹¹ However the greatest drive to clinical leadership came in the mid to late 2000s, with the publications of Healthcare for London and the Next Stage Review, both led by Lord Darzi, which encouraged clinical leadership to promote high quality care.^{49,192} A further report, Doctors in Society, published by The Royal College of Physicians, stated that “leadership in medicine today is seriously failing,” and recommended that each doctor developed leadership and management skills, regardless of their current role.¹⁹³

3.2.3 Leadership challenges and training

Despite these reports, there are significant barriers to taking on leadership roles within the NHS. Mountford and Webb identified three challenges, including scepticism from clinicians as to the value of spending time on leadership, a lack of financial or professional incentive for taking on leadership roles, and a lack of training and development opportunities.¹⁹⁴ If

clinical leadership is to become of a higher standard and more widely practiced, all clinicians need to develop a greater understanding of the “physiology” of the NHS, including structures, organisations, funding and governance, together with the influential internal and external forces.¹⁹⁵ Clinicians who wish to acquire a more significant leadership role will need to acquire a broader range of leadership skills and styles in order to exact more influence on the system. Such training is difficult to define and deliver in an appropriate setting, especially for trainee and junior clinicians, for whom there is a lack of accessible training opportunities at both undergraduate and postgraduate levels.^{186,195} ¹⁹⁶ A recent survey 1479 junior doctors identified lack of time working with managers and a perception of being poorly valued by their organisation as barriers to promoting their own leadership.¹⁹⁶ Furthermore, a survey by the Kings Fund found that newly-appointed clinical directors typically felt under-prepared for their leadership role; concerns over budgeting and service change could perhaps have been addressed with suitable training earlier in their careers.¹⁹⁷

Warren and Carnall have summarised the multiple leadership training modalities utilised in the NHS.¹⁹⁵ The most common are schemes or courses, typically lasting under a week, which can be especially beneficial if the material is immersive or relevant to current practice. Mentoring can provide benefits for both the mentor and mentee, although such relationships are difficult to form and sustain. Coaching is utilised usually by more senior clinicians to enhance specific skills on a one to one basis. Networking with peers or senior leaders can provide a platform to develop a wide variety of skills by becoming involved with projects or areas of practice in different healthcare sectors. For example, clinicians in North-West England have set up an accessible network of clinical leadership forums for junior doctors.¹⁹⁸ Finally, experiential learning gives clinicians the opportunity to work in

an area of management or policy for a defined period of time, either alongside existing clinical commitments or as an out-of-training experience. Such schemes include the NHS medical director's clinical fellow scheme, Prepare to Lead and Darzi Fellowships.^{186,199} None of the above schemes form a compulsory part of medical training and, in practice, only those with an interest in clinical leadership or management are likely to apply to partake.

This chapter seeks to address the issues reviewed above, by determining whether a behavioural simulation is an acceptable and effective modality to improve clinical leadership capability and the understanding of reforms described in the health and social care Act 2012.

3.3 Method

3.3.1 Background

In 2011 NHS London (NHSL) met with representatives from the Division of Surgery at Imperial College London to discuss the ongoing proposals for the NHS reform being tabled by the then Secretary of State for Health, Andrew Lansley, and how it might affect the future of healthcare in London. NHSL were particularly concerned that there was a significant gap in the clinical leadership skills in the group of senior registrars and newly-appointed consultants who would, over the next few years, be required to help lead their organisations through the period of unprecedented change. NHSL and Imperial College made a commitment to collaborate and commissioned Loop2 to run a behavioural simulation in this context.

Loop 2 are a healthcare consultancy run by Laurie McMahon (LM) and Sarah Harvey (SH). LM and SH have previously designed and run many health policy-related simulations in conjunction with the King's Fund and Office for Public Management, including the Windmill series.^{28,73,98} Loop2 designed a day-long simulation programme ("The Crucible") for 40 clinicians to help develop their clinical leadership skills and understanding of the new NHS structure. The simulation would run twice, enabling around 80 clinicians to take part. The simulation process followed the modified protocol established by Geurts, detailed in Chapter two and presented in figure 12.⁷²

3.3.2 The Crucible simulation: Health Economy

The Crucible simulation was based on two adjoining fictitious geographical areas – Barnden and Hambridge, which are located in the north-east of Capital City in 2015. With a combined population of 800,000, both areas have a wide variety of socio-economic deprivation and health needs, including a doubling of diabetes rates in five years; together they have an increasing population and an above-average birth rate. Barnden has a large commercial area with office blocks serving large corporations and governmental bodies. Hambridge has a more mixed economy. Both areas contain a mixture of social housing and top-end residential properties. The details of the healthcare institutions and stakeholders are detailed in Figure 13.

The Crucible: Healthcare organisations and stakeholders

There are a number of healthcare facilities in the boroughs. A large teaching hospital, **Barnden Hospital NHS Foundation Trust**, sits on the border between the two boroughs. The hospital has a private finance initiative tower block, and was until recently performing well financially although it is now struggling to meet the efficiency savings targets. The trust leadership are concerned about competition and strategic advances made by private companies and the neighbouring **St Charles University Hospital Trust**, which sits in a neighbouring borough. Internally, there are ideological divisions between the directorates. Mental Health and Community Health services are provided by the **Barnden and Hambridge Partnership Foundation Trust**. The trust is keen to promote a more integrated approach to community treatment, given the increasing life expectancy and complex long-term care needs of its patients, but is concerned that investment may not be forthcoming.

Lucro Healthcare is a private provider which is being increasingly utilised to provide diagnostic, day-case and ambulatory medical care to NHS patients.

Primary care is provided by a range of practices, from small, poorly funded single handed practices, to larger groups in modern centres. Performance is variable; some are innovative and provide high quality services, others less so.

WeCare Limited are the largest social care provider in the boroughs, supporting both self-paying and state-funded home help for over one-third of the market. Voluntary sector organisations are also represented in the boroughs.

Barnden and Hambridge CCG commissions the majority of NHS care in the boroughs. It is led by GPs and two-lay members. The CCG has detailed plans to achieve £12million in efficiency savings in the next two years using a six-point plan consisting of; reducing the range of CCG-funded procedures; encouraging primary care to provide certain invasive procedures; reducing A+E attendances; quality-checking of GP referrals;

reducing outpatient follow-up appointments and delivering long-term care in the community or at home.

The local branch of the **NHS Commissioning Board** is responsible for commissioning specialist services not covered by the CCG. In addition, the board have expressed concerns as to the viability of the CCG plans summarised above.

In the boroughs of Barnden and Hambridge, the performance of healthcare providers is regulated during the simulation by the **Combined regulator**, which covers the roles of the Care Quality Commission and Monitor. The regulator is concerned that Barnden NHS Foundation Trust has not addressed the CCG commissioning plan and may become financially unviable within two years.

The borough councils of Barnden and Hambridge have established objectives to halve adult and childhood obesity within 5 years, utilising health, leisure and social care providers to achieve this. They councils have also commissioned a combined

Healthwatch organisation to serve both boroughs; this contract was won by a voluntary organisation supporting minority groups with a focus on community support.

Figure 13: The healthcare providers and stakeholders in The Crucible simulation.

(Reproduced with permission from Loop2)

3.3.3 The Crucible: Issues and Challenges

Participants are told in their briefing pack that the poor performance of health services in the boroughs has been highlighted in a recent television documentary. During the documentary, each of the stakeholders was interviewed to provide a synopsis of current tensions and challenges facing healthcare in the region. These statements are reproduced in figure 14. The local council and health groups are keen that this escalating situation is

resolved and plans to improve healthcare delivery are developed; this is the setting for the Crucible simulation.

The NHS Commissioning Board

“The CCG needs to reassure us that they have sign up from their GPs, patients and the public to make this plan work. We also want to see evidence that the CCG is working with doctors in Barnden Hospital to make sure their plans do not compromise patient access to essential services. As a member of the Health and Wellbeing Board we strongly support the focus on tackling obesity to reduce demands on the NHS in the future – we think it is essential that the council plays its part in using public health and other resources to tackle the root causes of the problem – poor diet and lack of exercise.”

The Quality and Economic regulator

“We want to see Barnden hospitals develop a long term plan that takes account of the local commissioning intentions and the CCG’s intention to see more healthcare delivered outside hospital. A strategy based on maintaining the current volume of work in the hospital is unrealistic. Service line management is an important principle but we now expect Foundation Trusts to consider how clinical businesses can influence the overheads that are charged to their budgets. As a quality and economic regulator we are concerned that commissioners seem unwilling to test the market for delivering healthcare - this could be a means of providing more choice of care for patients and securing productivity gains.”

The Health and Wellbeing Boards

“We have been broadly supportive of the CCG’s commissioning intentions – the NHS has to live within its budget. But we would be strongly against any actions that threaten emergency services for our most vulnerable residents or reduce jobs for local people

which are an important contribution to health and wellbeing. We want Barnden and Hambridge's health services to stay under local management (so we can keep an eye on them). We have to tackle the expanding waistlines of our citizens and stop the diabetes epidemic as soon as possible. Medical treatments such as drugs and surgery can't be overlooked as they can work far quicker than diets and keep fit regimes which don't always work, particularly for the poorer sections of our community."

Barnden and Hambridge Councils

"We have been delighted to take on the new responsibility for public health but it's important to subject this investment to the same rigour as we apply to other investments. With elections coming up we are conscious that much of the health promotion work was not going to deliver quick results. Our priority is to keep demands on council spending to a minimum - we have had to reduce our adult social care budget by 25% over the last 3 years and that has gone too far. If more people are to be cared for out of hospital this will increase demands for home support further. We need to get some commitments from the NHS – CCGs and providers – to contribute to social care support - particularly for those citizens that have high levels of need but who would not be eligible for council support."

The Clinical Commissioning Group

"We have set out our plans and involved a handful of GPs and physicians in its development. It's an uncomfortable position but we have to save money. We are not responsible for the long term viability of Barnden Hospital although we want services to continue to be available for local people. We don't want to spend any more money on community services - the providers need to come up with ideas about how they integrate their services better or provide the same or better quality more cheaply. Our contracts with Barnden Hospital and Barnden and Hambridge Partnership Trust account for 70% of our commissioning budget and will need renegotiation over the next few months – we

have to see better productivity and better outcomes from the money we spend. We expect the Trusts to come up with some creative ways of using the vast amounts of money that they get from us to reduce their risks.”

Barnden Hospital NHS Foundation Trust Board

“The CCG’s proposals for ‘localisation’ of services make the Trust unviable in its current form. We might have to think of ways of providing our services in community settings if we want to hold onto the work and the income stream. We want to stop this nonsense about restricting GP’s freedoms to refer patients and expecting them to do more and more work when it’s our urgent care services that end up meeting the bill - not all of our local GPs are up to the job. In the medium term we may have to consider whether we partner with the teaching hospital or community health services or both – an integrated approach to care might offer more opportunities to improve quality and productivity. We are concerned about the colonising tendencies of St Charles however. We are apprehensive about whether the commissioners intend to invite other healthcare providers into providing services to people in Barnden and Hambridge. This could be the final straw and would damage the collaborative relationship with commissioners that we have endeavoured to foster. Barnden Hospital has a great future and we are here for the long term for local people, whatever it takes.”

The Barnden Hospital Clinical Senate

“Some of us support what the CCG is trying to do in principle and were involved in some of the discussions – our physicians feel it could relieve some of the pressure on beds and allow us to focus on the more complex work where our skills are best used. Now we understand the impact on the Trust we feel the implementation of the proposals needs further discussion. Consultants are not happy about providing outpatients in community settings or doing more home based visits – we tried this about 10 years ago and waiting

times went up – it's just not as efficient as a hospital based outpatients department and consultants seemed to spend half their time driving from one place to another. If they want us to deliver more care in the community the CCG will have to pay more for it and we will need more doctors. We don't feel the public have been told the whole story by the CCG. For example, the reasons we can't meet our efficiency targets this year is weak GPs referring too many patients and the lack of responsiveness from community services – the CCG seems very reluctant to tackle that problem head on. We have good networks with the University Hospital and feel there is a real opportunity for us to develop some shared services by pooling our clinical resources.”

Barden and Hambridge Partnership Trust Board

“The CCGs commissioning plan is a real opportunity to expand therapies and home based care for people with long term conditions but the CCG has to face up to the fact that it needs to pay more to keep abreast of the growing number of people with increasing dependency and multiple conditions. Benchmark analysis shows that we are in the lowest decile of per capita spending on both mental health and community services in the country, yet with one of the highest levels of pathology. We want to work more closely with Barnden Hospital to integrate our services – we could help them lower their costs by providing more assertive discharge planning and admission avoidance schemes. This will be difficult to achieve if we have to get involved in a tendering exercise for community services.”

Barnden and Hambridge Partnership Trust Community Services

“It has been difficult losing our freedom and becoming part of this big mental health trust. We don't seem to be on the same wavelength. We would like more autonomy to make deals with commissioners and GPs without having to go through the layers of corporate decision making. We should be organising our services around GPs and trying to form

virtual teams but this is not the way that specialist mental health services are organised. We would like to work more closely with Barnfield Hospital to join up pathways of care but the way that contracts are set and how the money flows makes this really difficult. If our commissioners gave us some incentives to collaborate - acute, mental health and community services working together - we could improve care for people with long term conditions and make some savings for the NHS. Many of our clients are overweight or obese – our community nurses, health visitors and therapists could also do a lot more opportunistic work to support weight reduction and fitness with our clients but we are so stretched that we just don't have time. If the commissioners won't pay more for community services then perhaps our own Board needs to think about how it can help.”

Barnden and Hambridge GPs

“We thought that the CCG would be on our side but it has been a massive disappointment. The cost of going to all these meetings to discuss commissioning has become prohibitive without additional payments. Most of us want to stop the restrictions on our referral behaviour and simple blanket bans– we understand the financial realities but we also know our patients: if the CCG allowed us to manage the budgets at practice level rather than coming up with these abstract rules we would make judgements about what our patients need and balance the books. They need to trust us not control us. We would like to trust the CCG more to look after our interests.”

WeCare

“The NHS continues to have a very traditional approach to care – we have a lot more freedom to tailor our workforce to what patients need. WeCare employs nurses, therapists and a large workforce of care assistants. We can train our assistants very quickly to work with people with different health conditions, including dementia and people in the end stage of their lives. We could provide Barnden Hospital with some innovative ways of

taking a greater share of that home based care – our highly trained care assistants working with their doctors. Our staff can also provide help with social care tasks such as washing, dressing and help in preparing meals. But the bigger prize is if the CCG put community and home based care out to the market – that would really open up the opportunity for us to show our innovative ideas for supporting frail older people and people with long term conditions.”

Lucro Healthcare

“We have the highest patient satisfaction ratings of any provider in Capital – great care environment, good outcomes and top marks for dignity and respect – the food’s not bad either! It’s not right to restrict these benefits to just a few people in Barnden and Hambridge who can afford to pay for our diagnostic and planned care services. We want the CCG to either open up diagnostic and home based care services to any qualified provider. The CCG also needs to recognise that not all GPs can take on the work that the CCG has withheld from secondary care. We have access to capital to invest in the latest diagnostic and non-invasive equipment - we can provide services such as minor surgery and basic treatments better and cheaper than most GPs and hospitals, provided we get a long enough contract to cover our costs. Unfortunately, many GPs locally seem to be rather prejudiced against any private sector involvement in the NHS.”

Healthwatch

“Our citizens really don’t understand why the CCG is taking this hard line on rationing NHS care – some individuals are quite poorly and need constant monitoring by hospital doctors. We are going to campaign against the commissioning plan and the impact it will have on our local hospital – it won’t survive this further layer of cost cutting. We support care for people with long term conditions at home but there has to be enough resource invested to make this a reality. Compared with other places Hambridge and Barnden

citizens have very little choice of where they get their care – the CCG seem to want to restrict the opportunities further by refusing to pay for some treatments in hospital – we think it is against the NHS Constitution and hope that the NHS Commissioning Board and regulators will stop it from going ahead.”

Figure 14: Statements from stakeholders describing their positions and concerns prior to the Crucible meeting (reproduced with permission from Loop2)

3.3.4 Recruitment and organisation

The Medical Director of NHS London (AM) wrote to the Clinical Director of each of the London NHS trusts to recommend senior registrars and newly-appointed consultants who would benefit from attending the simulation. Participation was entirely voluntary. The simulation was funded by NHS London; participants were able to attend free of charge. The simulations took place at a dedicated venue in central London, in one large room with tables, chairs and presentation facilities. Refreshments and Lunch were provided for participants.

Participants were asked to confirm their preferred date of attendance by email. One week prior to the simulation, an email was sent to each participant containing a briefing pack detailing the simulation structure and objectives, together with details of the simulation health economy and demography. (I requested approval from Loop2 to attach this as a formal thesis appendix, but permission was declined due to their concern that other researchers may utilise the documents to copy their methods, and do so poorly, thus undermining their skills. Whilst understandable, it does reflect potential business-academia tensions that may be encountered when outsourcing this type of work that could hinder future academic research.)

The Medical Director of NHS London (AM) deemed the project and all allied research to be for educational purposes and, on his advice, formal ethical approval was not deemed necessary.

3.3.5 The simulation day

The day was facilitated by LM and SH. Participants were given two lecture-style presentations from the AM and LM, introducing the background of NHS reform and introducing the Crucible concept. Participants were then assigned to roles working as part one of the key stakeholder groups in the simulation. Field coaches were introduced – these were experts who worked in similar roles in real life and could pass on advice and expertise to the participants. The Council leader (played by SH) started the simulation by detailing her expectation – that the Crucible would enable stakeholders to come to agreements as to how the healthcare challenges in Barnden and Hambridge could be met. There was no set structure in the discussions; groups and individuals were free to talk with who they wished, at any time. The simulation itself ran for approximately 3 hours, before each group presented outcomes and conclusions.

3.3.6 Data collection and analysis

Participants were assessed according to the well-established multi-method approach set out by Kirkpatrick.¹⁵⁶ Feedback and reaction was captured by a paper questionnaire completed immediately following the end of the simulation, based on a previously published 5 point Likert scale (1- strongly disagree, 5- strongly agree) (Appendix 1).¹⁵⁷ Perceived knowledge and learning were evaluated using two self assessment questionnaires. The initial seven-

item questionnaire examined knowledge of the healthcare system in the UK, using a five-point scale. The second questionnaire was developed using the domains established in The Medical Leadership Competency Framework. Developed jointly by NHS Institute for Innovation and Improvement and the Academy of Medical Royal Colleges, this framework details the leadership competencies that clinicians need to fulfil in order to effectively partake in the planning, delivery and transformation of health services.²⁰⁰ Five competency areas are described, each with four subsections; participants self-assessed their competency using a seven-point likert scale on each of the 20 areas (1-poor, to 7 excellent). Intention to change behaviour was investigated using established principles published by Ajzen in The Theory of Planned Behaviour.¹⁶⁶ 24 Questions were modified by DC and reviewed by IV, a behavioural economist and experimental psychologist. Each question was grouped into categories of Intentions (2), Attitudes (6), Subjective Norms (4), Capability (6) and Opportunity (6). Questions were rated using a seven-point likert-scale (1-strongly disagree, to 7 – strongly agree) Internal consistency of the scale was evaluated using cronbach's alpha. Self efficacy in clinical leadership was also measured as a separate construct using the previously validated General Self Efficacy scale, created by Schwarzer and Jerusalem.²⁰¹ The questions were assessed on a likert scale (1-disagree to 5 agree). Participants were asked to fill in the scale relating to challenges that they faced in clinical leadership.

Qualitative feedback was also captured; participants were asked four questions which could be completed either online or on paper:

- What do you feels are the benefits of using this type of simulation for education?

- Could another method have been more effective in conveying the knowledge, skills and behaviours?
- Did attending the simulation event you more aware of your developmental and leadership needs? If so, how?
- Have you taken any learning from the simulation into your practice so far?

In order to establish baseline levels, the questionnaires evaluating knowledge and behaviour were distributed by email link one week prior to the simulation using an online questionnaire programme (docs.google.com). Participants who did not complete the questionnaires prior to the simulation were asked to fill in a paper version on the day of the simulation, before the event started. Changes in perceived knowledge and behaviour were assessed using identical questionnaires which were sent out by email to all participants 2 weeks post-simulation, with a reminder email at 4 weeks, using the same methodology. Participants were actively encouraged to complete the surveys – NHS London would only release the certificate of attendance once the surveys had been completed.

All questionnaires are reproduced in Appendix 1.

3.3.7 Statistical analysis

All analyses were carried out using SPSS version 19.0 (SPSS, Inc, Chicago, IL). The non-parametric Wilcoxon signed rank test was used to determine the significance of difference pre-test and post-test mean scores. For all analyses, statistical significance was set at $P < 0.05$ or lower. IV provided statistical advice.

3.4 Results

86 doctors from 17 London-area healthcare organisations accepted the invitation to attend one of the two simulation dates; 42 for April 2012 and 44 for May 2012. 6 other doctors were put on a reserve list. 16 doctors declined the invitation.

Of the 86 accepted invites, there were a significant number of cancellations either on the day or in the week leading up to the simulation. 69 participants attended in total; 36 in the first run, and 33 in the second. Of the 69 participants, 32 were currently working at consultant grade and 35 at Registrar grade. 2 participants did not identify their current grade. Participants came from a wide range of specialties, including medicine, surgery, public health, dentistry, psychiatry and anaesthetics.

3.4.1 Feedback

65 participants completed the feedback questionnaire, summarised in table 1. Mean responses to all questions were between 4 (agree) and 5 (strongly agree). The feedback was categorised into three sections. The highest scores in the Participation and Content section were for active involvement and event organisation (4.66 and 4.71). The level of immersion felt by participants was also apparent in the qualitative feedback; *“we were all very engaged...more so than in other methods of training”* (Participant 19) and *“I was put into a real-life situation and used skills I didn’t even know that I had (P30).”* The relevance of the simulation was also commented upon *“It was a brilliant introduction to the reality (P50)”* as was the contextualisation of the issues *“it really encourages active learning and understanding (P54)”*.

	Mean	SD
Participation and Content		
The course was well organised	4.71	.49
I understood the aims and objectives of the simulation	4.28	.65
I was appropriately challenged by the material	4.46	.50
I found the course content to be realistic	4.12	.88
I found the course content to be relevant	4.52	.59
I was actively involved in the simulation	4.66	.48
I felt engaged by the simulation topic	4.51	.53
Educational benefit		
I found this method of learning to be useful	4.42	.79
The presence of field coaches enhanced the simulation learning	4.51	.81
I have a better understanding of the structure and organisation of the health system following the simulation	4.55	.56
The simulation has increased my awareness of issues facing the NHS	4.60	.58
Future actions		
The simulation will help me address important issues facing the NHS	4.29	.63
The simulation has made me more aware of my current/future roles and responsibilities	4.23	.61
Learning from the simulation will help me deliver better long term care to my patients	4.02	.87
I recommend this simulation to colleagues at my professional stage	4.50	.77
I would like to take part in similar simulation events in future	4.51	.66

Table 1: Participant feedback from the crucible simulation (n=65)

The educational feedback was also very positive, with participants scoring all categories highly. The understanding of NHS structure and organisation, together with current issues scored the highest (4.55 and 4.60). Feedback from participants was also positive; *“(it gave a) flavour of the real world. (one can) appreciate the plethora of players with vested interests. (P42)”* and *“this was an excellent way to understand a complex system” (P9).*

Although the presence of field coaches was rated highly, there was some negative feedback *“we did not have enough time with the field coach (P29)”* and one participant felt that their coach was not helpful: *“it is important to have experts who know the job...sadly ours did not (P46).”*

In the final section, participants were keen to recommend the simulation to colleagues and participate in future simulations. The feedback scores for the other three questions, which focused more on leadership, were less effusive however, although all scored over 4. The Leadership element is explored in more detail later in the chapter.

3.4.2 Knowledge and Learning

58 of 69 participants completed the seven knowledge status questions both pre and post simulation. In all seven areas, (regulation of healthcare providers, role of patient organisations, organisational accountability, role of local authorities, financial climate, roles and responsibilities of commissioners and care providers) there was a significant ($P < 0.05$) improvement in perceived knowledge scores. The mean of the total knowledge scores per participant are presented in table 2.

	Wilcoxon signed-rank test				
	Pre simulation mean	Post simulation mean	z score	P value	r value
Perceived knowledge	2.84	4.05	-6.242	<0.001	-0.867
Demonstrating Personal Qualities	4.95	5.87	-3.597	<0.001	-0.499
Setting Direction	3.75	4.89	-5.004	<0.001	-0.694
Managing Services	4.6	5.48	-4.052	<0.001	-0.562
Improving Services	4.04	5.30	-6.203	<0.001	-0.860
Working with Others	4.94	5.70	-2.914	0.004	-0.404

Table 2: Pre and Post simulation self-assessed scores for knowledge and MLCF attributes.

The five attributes from the medical leadership competency framework are presented in Table 3. 52 participants completed both pre- and post-simulation questionnaires. All competencies were self-assessed as being significantly higher post-simulation, and all except “Working with others” had a Cohen r value of 0.50 or higher, representing a large change. The lowest scoring area both pre and post simulation was in “Setting Direction,” whilst “improving services” showed the biggest change.

3.4.3 Behaviour change

3.4.3.1 Internal consistency of questionnaire

A Cronbach's alpha value of 0.70 or above is generally accepted as a good measure of scale reliability.²⁰² The questions for intentions, attitudes, norms and opportunity all scored over 0.70, indicating good internal consistency (Table 3). For the Subjective norms, this was improved to 0.777 after deletion of one question. However, the questions for capability scored lower at 0.642. Sequential removal of two of the six questions with lowest reliability improved this to 0.677, which indicates reasonable reliability.

Behavioural construct (questions)	Internal consistency (Cronbach's alpha)
Intentions (i1-2)	0.721
Attitudes (a1-6)	0.732
Subjective Norms (n1-4)	0.703 to 0.777 (after deletion of n3)
Capability (c1-6)	0.642 to 0.677 (after deletion of c1 and c4)
Opportunity (o1-6)	0.812

Table 3: Internal consistency of behavioural questionnaire

3.4.3.2 Changes in Behaviour post simulation

47 participants completed the behaviour questionnaires in full pre and post simulation (table 4). Capability was the only construct that demonstrated a large and significant change post simulation ($p < 0.001$, Cohen's $r = -0.619$). There was a moderate but significant change in Behavioural Intentions, Attitudes and Subjective Norms post simulation, although there was no significant change detectable in Opportunity.

	Wilcoxon signed-rank test				
	Pre simulation mean	Post simulation mean	z score	P value	r value
Intentions	5.15	5.64	-2.276	0.023	-0.331
Attitude	5.67	6.00	-1.999	0.046	-0.291
Subjective norms	5.52	5.69	-2.151	0.030	-0.314
Capability	4.57	5.08	-4.247	<0.001	-0.619
Opportunity	4.36	4.55	-1.113	0.266	-0.162

Table 4: Perceived Behaviour pre and post simulation

3.4.4 Self efficacy in clinical leadership

46 participants completed the General Self Efficacy scale both pre and post simulation.

There was an increase in perceived self-efficacy post-simulation (mean score pre simulation 3.87 to post-simulation 4.08). This difference was significant $P < 0.005$, but only at medium levels of impact (Cohen's $r = -0.43$, z value -2.794).

3.4.5 Qualitative analysis

56 participants provided qualitative feedback in the free text boxes on the electronic and paper questionnaires.

3.4.5.1 What do you feel are the benefits of using this type of simulation?

The interactive and immersive nature of the simulation was frequently mentioned as being beneficial; *“it allows for a rare “hands-on” approach (P4),” “direct engagement (P45) ”* and *“Immersing participants into a realistic scenario but in a 'safe' (non-real) setting naturally brings out behaviours and attitudes that would not come out through reading, lectures, group discussion or perhaps through coaching (P11).”* Participants also reflected on the simulation enabling them to experience the complexity of the NHS and the current reforms; *“(the simulation enabled) exposure to real life situations allowing me to understand how NHS changes could work (P23)”* and *“experiential learning using simulation is very helpful to understand depth and nuance of relationships within complex systems (P25).”* In addition, participants commented on the simulation increasing their awareness of the roles and challenges faced by different stakeholders *“...Opening up a different perspective of looking at a problem. Appreciating the roles and responsibilities of other stakeholders (P35).”* The value of having multiple specialties and field coaches was also commented upon; *“I met people from different backgrounds and could learn from their experience (P53).*

3.4.5.2 Could another method have been as effective?

Participants could not identify another learning method that they felt would have been more effective. However, some commented that they required and wanted real-life experience to build on their simulation learning; *“in-house involvement with our trusts will be a useful learning opportunity (P8).”* Overall, the feedback was very positive; *“Having the live experience is invaluable as we live out as real the sort of conversations and difficulties that*

are faced leading these organisations. Absolutely brilliant! Would love to attend a further event like this in the future (P5)."

3.4.5.3 Did attending the simulation event make you more aware of your leadership development needs?

Out of the 56 participants, 52 stated that participation in the simulation had increased awareness of their development needs. Participants provided multiple examples of their learning needs; *"Realised leadership skills are essential and need more training (P39)"* and *"it made me evaluate personal strengths and weaknesses in negotiating (P38)."* Participants also focused in on the NHS reforms covered in the simulation *"I now intend to crystallise my knowledge of NHS reforms and management in some way and perhaps attend a formal management course (P20)"* and also the lack of understanding of the future changes *"I think the simulation exposed my lack of knowledge of the forthcoming NHS bill and highlighted the need to stay fully in tune with the changes that will be taking place and the forthcoming tender process (P26)."*

3.4.5.4 Have you taken any learning from the simulation into your practice so far?

In the short time between the simulation and feedback, 22 clinicians stated that their experiences in the Crucible simulation had directly influenced their leadership practice. For example, one participant explained how understanding integrated care had directly impacted; *"As a community paediatrician, I am now keen to be part of the discharge planning process for children with neuro-disability and enable a seamless transfer of care closer to home (P30)."* Others expressed that they were able to contribute more to

departmental strategy; *“I feel more confident that I understand NHS changes, and that many of my colleagues are unlikely to have more knowledge than me. This has given me confidence in expressing my views in management meetings.(P24)”*

Participants also reported increased willingness to engage colleagues and allied healthcare professionals in service change; *“I engage more junior staff not just medics but MDT (multidisciplinary) staff more, (and) work on pull factors for service delivery change (P6)”*

Further evidence of leadership development provided in conflict resolution and future relationships; *“Yes, in terms of team development and conflict within my current team. I am also actively trying to develop my service so the knowledge of the likely future scenarios with GPs/ Commissioners will come in very handy (P11).”*

3.5 Discussion

Improving clinical leadership and furthering the understanding of NHS reforms are key to providing high quality healthcare, especially in the present financial climate. To improve leadership and understanding, it is important that further provision is made for training, which has traditionally been challenging to deliver in both undergraduate and postgraduate settings.^{195,199,203} The behavioural simulation described in this chapter is a unique concept in this regard, addressing both leadership and system factors for a mixed group of clinicians. Participants on the whole found the simulation to be immersive and relevant, enabling learning in a safe, non-threatening environment with support and guidance from peers and experts, and allowing participants to play out the consequences of their actions.

This is the first time, to my knowledge, that a behavioural simulation has been systematically evaluated for participant satisfaction, learning and intention to change behaviour. The findings demonstrate significant perceived improvements in knowledge and behaviours following a single day programme. Importantly, participants rated their capability and self-efficacy to be significantly improved, both of which act as enablers to improve clinical leadership. Furthermore, within two weeks of the simulation, a number of clinicians had already implemented knowledge and skills gained from the Crucible simulation to demonstrable effect in their NHS trusts. These findings build on the reports of previous simulations which have reported educational benefit to individuals, groups and institutions, as well as influencing future behaviour, but without any formal analysis.^{30,125,133,135,136}

One of the key points of the simulation was the ability to demonstrate marked improvements in all areas of the Medical Leadership Competencies Framework (MLCF). The domains outlined in the MLCF are expected to be attained by every doctor, regardless of whether they wish to pursue a senior leadership role. Indeed, the MLCF has been adopted by the General Medical Council's undergraduate competency document ("Tomorrow's Doctors") and also into the postgraduate syllabus of the Royal Colleges.²⁰⁴ This reflects the growing recognition and understanding that for successful system development and promotion of high quality care, clinicians at all levels require significant leadership skills, not just those who aspire to senior leader roles.¹⁹⁵

This simulation was run for the benefit of senior registrars and newly appointed consultants, but could in future be run for more junior doctors, allied healthcare professionals and

hospital managers; indeed a mixture of all the above may enhance the multidisciplinary learning and understanding that comes from the simulation.¹⁹⁸ Junior doctors in particular have an increasingly recognised role in leading quality improvement in the NHS, although they are not always empowered or engaged to do so; simulations such as this may help, but senior leaders and managers must become more receptive to their junior colleagues.

196,199,203 205

3.6 Limitations

There are a number of limitations to this study that merit further discussion. The Crucible simulation was run over one day and did not have any direct opportunities for ongoing associated learning, such as participant-facilitator discussion forums, or a link into a relevant leadership opportunity/mentor at the participants own trust, such as a paired-learning scheme.²⁰⁶ Both of these would have been relatively easy to implement and may have contributed to ongoing workplace learning and development. Further studies are required to investigate the longer-term impact of the simulation.

It should be noted that the participants in the Crucible came from a wide variety of hospital Trust and clinical backgrounds. Unfortunately, no General Practitioners took part, as the budget did not allow for them to be recruited, which given the increasingly important role of GPs as both commissioners and providers, was unfortunate. No participant commented upon the lack of GPs; this may imply that it was not significant, but I feel that it is more likely that participants were simply not aware of their absence, perhaps reflecting the difficult relationship between primary and secondary care in real-life.

Expert assessment of performance would have been prohibitively challenging and costly, so all the data collected in the simulation was provided by self-assessment. The accuracy of this is unknown, but in the leadership field, self assessment is increasingly practiced.^{207,208} Indeed, the NHS Leadership Academy actively encourages self assessment of leadership skills for clinicians, and has links to self assessment tools based on the MLCF available online.²⁰⁹

Prior to taking part in the Crucible, participants were informed that they would be expected to provide feedback and assessments for analysis, which would be kept confidentially by Imperial College London and not passed on to NHS London before being anonymised. Despite this, response rates were suboptimal, with only two-thirds responding to all questions. One contributing factor may have been the lack of anonymity of the data collection process – participants were easily identifiable on their electronic and paper questionnaires, and this may have discouraged some responders. In addition, lack of anonymity may have encouraged more positive feedback to be given and perhaps inaccuracies in self-reporting knowledge or behaviours.

3.7 Conclusion

Despite the limitations discussed, this chapter has demonstrated the effective use of a behavioural simulation for educational purposes in the fields of clinical leadership and understanding of NHS reform. The intention of the collaborators is to make the simulation freely available for future cohorts of clinicians throughout the UK, who, with an appropriately trained facilitator, could benefit from the Crucible.

In the next chapter I describe a second behavioural simulation, in which I made significant contributions to the design and development. The simulation, “Lateral Play,” was designed, developed and run “in-house” within the Centre for Health Policy, Imperial College London.

4 THE LATERAL PLAY SIMULATION

4.1 Overview

The previous chapter described and discussed the Crucible simulation, which was designed to improve the clinical leadership skills and understanding of the health system in a cohort of senior registrar and junior consultant-level secondary care clinicians, in the context of proposed NHS changes in the Health and Social Care Act 2012.

This chapter describes the Lateral Play simulation, which was designed to improve collaboration and shared decision-making amongst members of the newly-formed Imperial College Health Partners in North-West London.

Figure 15 provides an overview of the Lateral play simulation according to the design methodology described in chapter two.

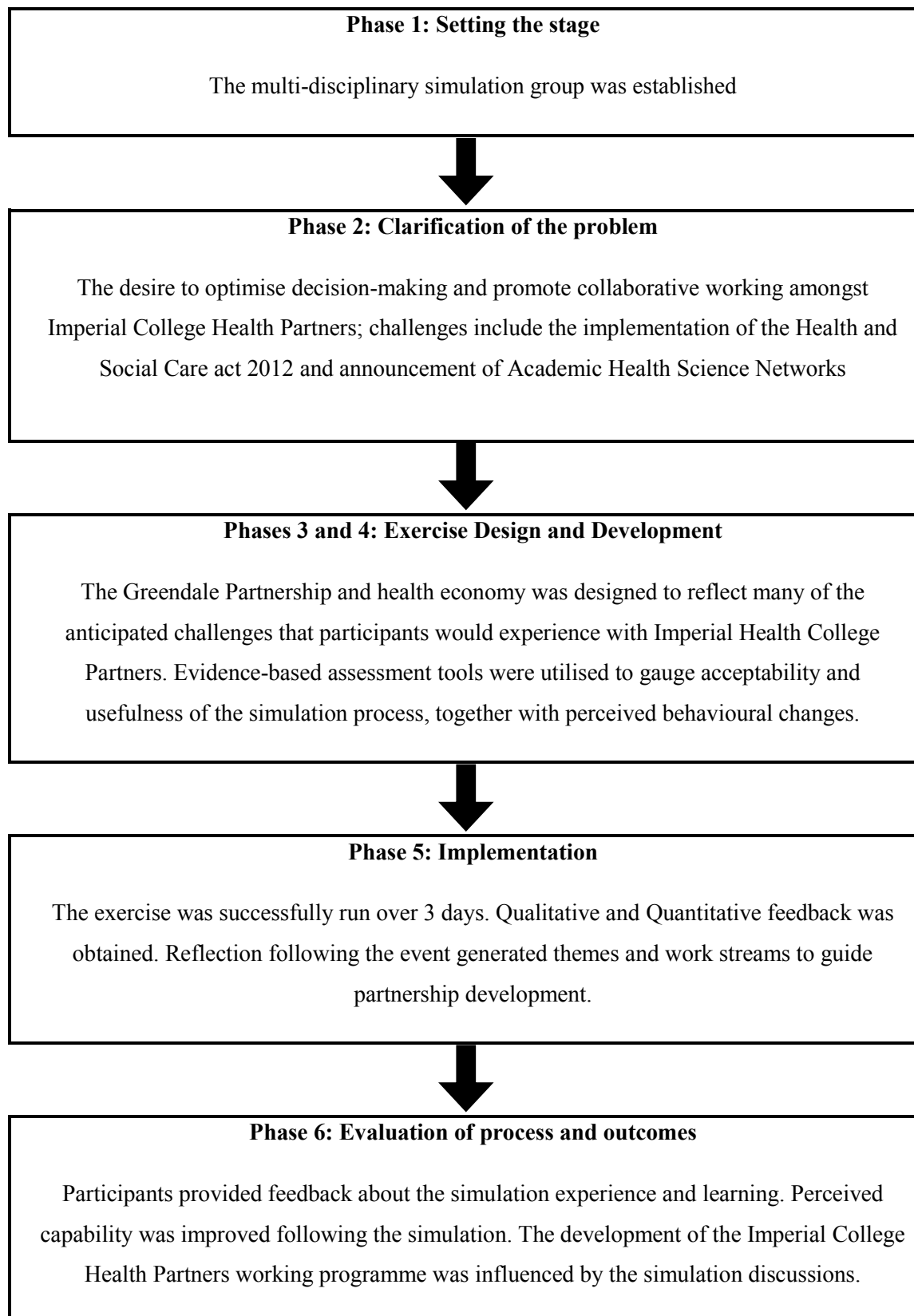


Figure 15: A phased overview of the Lateral play simulation according to the design methodology adapted from Duke and Geurts, described in chapter two.

4.2 Introduction

The Crucible simulation, described in the previous chapter, focused on developing the leadership skills and system understanding in a diverse group of clinicians who were not as yet in established leadership or managerial roles within their organisations. This chapter describes a different simulation – Lateral Play – which, although similar in terms of the simulation methodology, has an altogether different aim; to improve collaborative working between organisations forming part of the Imperial College Health Partners. The rationale, background and design of the simulation are reported below, before the simulation results and discussion are presented.

4.3 Background

Imperial College Health Partners was established in 2012, as a partnership between health and academic organisations in North West London.²¹⁰ The case for the partnership was set out by Lord Darzi in his Academic Health Sciences Review, where he stated that the purpose of the partnership was “the pursuit of innovation and improvement at scale ... in order to improve the health and care of the 1.9 million population of north-west London.”²¹¹ Lord Darzi envisaged greater collaborative working, a population-based approach to healthcare and raised clinical standards across North West London, in addition to improved research and training opportunities.²¹¹ A transitional partnership board, consisting of leaders from local academic and NHS organisations was set up to develop the partnership proposal further, together with a small executive committee funded by each of the partners.²¹²

The board of the new partnership faced multiple challenges. Firstly, promotion of effective communication and collaboration between all the organisations, many of whom had never worked together previously, who would have to balance the needs of their individual institutions with the health needs of the population as a whole. Secondly, changes in NHS structure and organisation due to the Health and Social Care Act 2012 created uncertainty amongst providers and commissioners, including the creation of new organisations from scratch, including clinical commissioning groups. Thirdly, the partnership was formed at a time of unprecedented financial challenges facing the NHS. Finally, during the setup period of the partnership, the Department of Health announced the creation of regional Academic Health Science Networks (AHSNs).^{8,213} Imperial College Health Partners wished to apply for AHSN status, which, if successful, would deliver significant financial benefits to the sector.²¹⁴ The designated “core objectives” of AHSNs were broadly in line with those laid out by Lord Darzi in his preliminary vision for Imperial College Health Partners, namely: A focus on the health needs of local populations whilst promoting health equality and best practice; A culture of partnership and collaboration; To improve the adoption of innovation in the NHS to improve outcomes; and finally, Creation of wealth in the sector from design and adoption of new products and services.²¹³ These broad objectives were further divided into seven subsections before being adopted as interim objectives by the partnership board (Figure 16).

Interim partnership objectives prior to Lateral Play simulation
Improve research participation
Translate research into practice
Achieve service improvement
Collaborate on education and training
Better use of information
Foster wealth creation
Achieve wider population health benefit

Figure 16: Interim objectives of partnership prior to Lateral Play Simulation

Given the challenges outlined above, and the desire to avoid any unintended consequences, the partnership board were keen to commission a behavioural simulation to optimise decision-making and promote collaborative working amongst the new partners. The overall goal would be for 30-35 system members to collectively agree on what system objectives and behaviours should be, in order to avoid blind pursuit of the individual organisational interests that could result in poorer system-wide performance. As with the Crucible simulation, the processes and outcomes would be driven by the actions and interactions of the participants and not by chance, therefore allowing participants to see the consequences of their actions in a safe environment – without blame or negative real-world consequences. The outcome of the simulation is much less important than the facilitated reflection on what happened during the simulation, which would be the basis for setting an organisational development plan for ICHP. In addition, the board were keen to receive feedback from

participants on their perception of the simulation process, in order to inform the use of possible further simulations in the future.

The Centre for Health Policy at Imperial College London was invited to design and run the simulation – this is what I report in this chapter. The group were keen to build on the aims and objectives of the simulation stipulated by ICHP, and further the understanding of whether behavioural simulations could result in a behaviour change amongst participants. The design of the simulation, together with description of assessment and feedback metrics is described in the next section.

4.4 Method

4.4.1 The simulation design and facilitation team

The initial phase of planning the simulation was carried out by a group from The Centre for Health Policy at Imperial College London, of which I was a member. The group was advised and led by Greg Parston (GP) and Alasdair Liddell (AL). GP had vast experience of designing and running simulations for both healthcare and industry as a the chair of the Office for Public Management, including the Rubber Windmill simulations of the 1990s (for AL, as the client) and Fast Forward simulation for the BBC in 1992.^{73,215,216} AL had significant experience in the healthcare sector; including his previous role as Director of Planning at the Department of Health and a co-author of the report “Innovation, Health and Wealth” which described the formation of AHSNs in the NHS. Alasdair sadly passed away before the simulation was completed and run. The group also contained Axel Heitmueller (Interim Director of ICHP) and Rachel Davies, who were instrumental in setting up

Imperial College Health Partnership under the leadership of Ara Darzi. Their role was crucial in determining the validity of the simulation design and content for the intended audience.

The simulation was designed to reflect the process described by Duke and Geurts (2004) and adapted in chapter 2 (see Figures 11 and 15).

4.4.2 The simulation geography - Greendale

Through an iterative process, the group designed an immersive, realistic, simulated health economy that could be used for the purposes of the simulation. Dry runs of the simulation were carried out by the group to optimise the simulation, to determine that the artificial environment was supported by realistic data, thus enabling participants to work out actual policy and organisational changes.

The simulated area – Greendale – is seen in Figure 17. The Greendale map was formed by modifying an inverted map of the West Midlands and adding a coastline.

4.4.3 The simulation organisations

The simulated environment: Greendale

Greendale covers an urban area in England with a population of approximately 2 million.

The population is centred on the mid-west of the geographic area. The Greendale Academic Health Science Partnership is formed of a large University in the centre of the urban area (with approximately 15,000 students). There are seven provider NHS Trusts within the Greendale Partnership (A-G, figure 35):

- Appleton - a large trust linked to the Medical School,
- Blackstone – a District General Hospital (DGH) and Foundation Trust (FT),
- Chrysalis – a large Acute trust with community status,
- Davenport - Acute NHS Trust
- Essen - Acute NHS FT
- Frontier - Community Trust
- Gateway – a Mental Health Trust

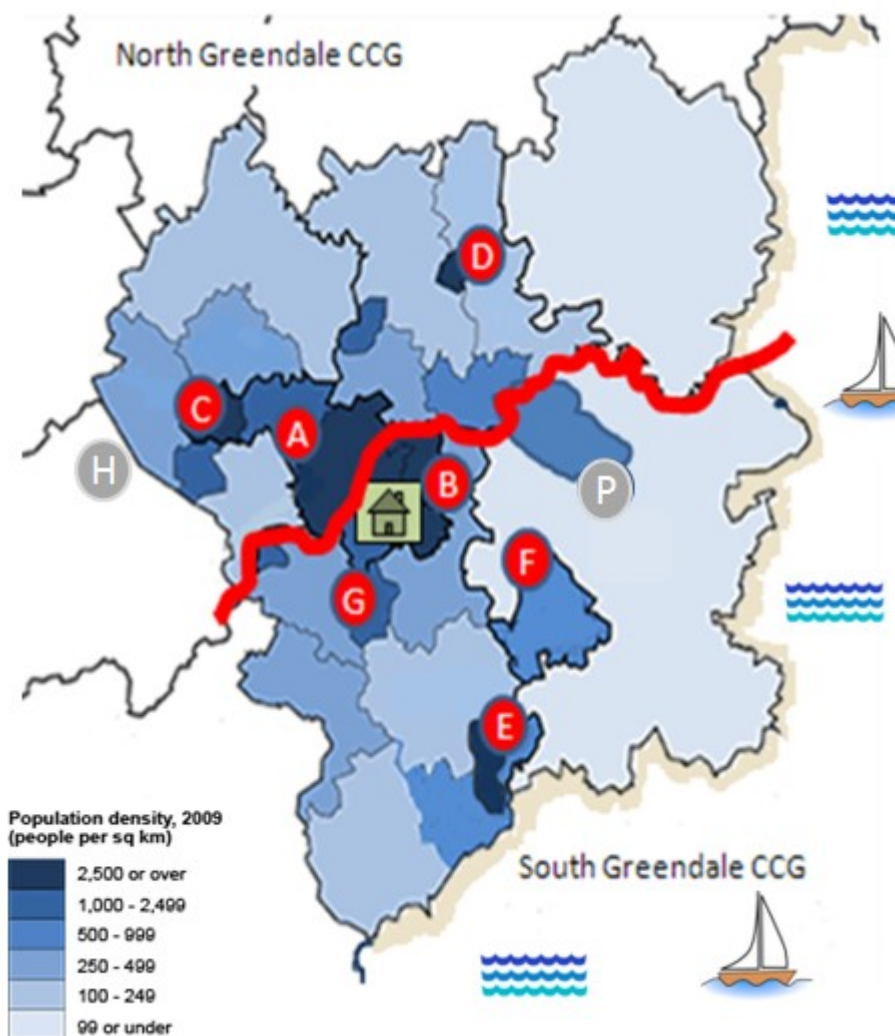


Figure 37: The simulation patch - Greendale

There are also two Clinical Commissioning Groups (CCGs) in simulation patch – one covering North Greendale; the other, South Greendale. In addition, there is a regulatory agency, CORE (Clinical and Organisational Research and Education). Provident, a private hospital, and Howston, an NHS Trust outside but adjacent to the area, are also potential key players (P & H, figure 35). These providers all have different and unique characteristics to represent the capability, economic and geographical diversity of organisations present in North West London, and reflect some of the issues that would be faced by the partners – these are discussed further below. Finally, there was the Greendale Partnership, a corporate collaboration between Greendale providers and commissioners, modelled on ICHP.

The organisations within Greendale were developed to reflect the diversity of North West London. The artificial environment was supported by realistic data to enhance face and content validity; each organisation was based on a real healthcare provider taken from around the United Kingdom with information about that provider adapted from the Hospital Episodes Statistics database, Patient Reported Outcome Measures database, Dr Foster and the provider website. In addition, each trust was given overall ratings for research, care quality, public transport and ambulance times, financial status and training numbers.

Development of the data set was very time consuming. While based on real sites, data were modified throughout subsequent design stages to reflect the problems that we built into Lateral Play. The dataset of each trust was also assessed by AH, RD and GP to ensure integrity and realism.

The detailed data for each Greendale organisation is in Appendix 2; these were available within each trust to share at their discretion and at others' requests. A summary of financial

and patient activity and demographics is shown in Figure 18, and a descriptive summary of the organisations is provided in Figure 19. The summary data of each trust were provided to all simulation participants.

Organisation	Appleton	Blackstone	Chrysalis	Davenport	Essen	Frontier	Gateway	Greendale total
Total activity (per annum)	402,082	421,649	251,897	299,185	258,896	39,336	418,645	2,091,720
Outpatient activity (p/a)	314,277	332,199	190,553	236,291	193,374	35,019	415,700	1,717,412
Day case activity (p/a)	20,605	27,953	20,598	25,923	18,090	243		113,412
Inpatient activity (p/a)	87,805	89,451	61,344	62,893	65,523	4,347	2,945	374,308
Bed capacity	750	550	300	400	400	94	601	3,145
Bed occupancy (%)	84	88	92	78	93	82	91	87
Staff	4,729	3,838	2,011	2,249	3,709	2,576	3,153	22,265
Spend (£million p/a)	328	214	123	132	243	104	154	1,299
Net surplus (deficit)	(£5.4m)	£3.9m	(£5.3m)	(£5.8m)	£8.3m	(£3.1m)	(£8.4m)	

Figure 18: Activity and demographic data for each Greendale Trust.

Greendale University is situated in the centre of the urban area. It has a population of 150,000 students and forms an Academic Health Sciences Centre with Appleton Trust.

Appleton is the largest Trust in the partnership and is linked to the medical school.

Although not a Foundation Trust (FT), it does form an AHSC with Greendale University.

Appleton is within the North Greendale CCG area; it employs almost 5,000 staff and has over 400,000 patient episodes per annum. The buildings and facilities at Appleton are relatively new and the trust performs well in quality and service indicators. However, it has a poor financial position.

Blackstone is an FT, it is a large DGH and is a busy, modern Acute Trust working with both CCGs. Blackstone has almost 4,000 staff and 550 beds. It has excellent transport links and profitable orthopaedic and maternity services, but poor quality indicators and limited academic activity.

Chrysalis is an Acute and Community Trust with a PFI commitment– it is not an FT. It has recently invested in new facilities and buildings and is sited close to a new business district within the area. Chrysalis employs just over 2,000 staff and handles over 250,000 patients episodes p.a.

Davenport is an Acute Trust but not an FT. It is a similar size of hospital to Chrysalis and Essen. Davenport is sited in the middle of the North Greendale CCG area – but

outside of the main urban centre. Davenport has almost 300,000 patient episodes p.a., has 400 patient beds and just over 2,200 staff.

Essen is an Acute FT – it is a busy, high performing Trust and works closely with other organisations outside the partnership given its location on the southern boundary of the area. Essen has annual activity levels of approx. 250,000 patient episodes, employs almost 4,000 staff and has 400 patient beds.

Frontier is a large Community Trust covering the South Greendale area. It is not an FT and discussions on an applicable FT pathway have been constrained by a deficit budget and limited evidence of growth. As a Community Trust, Frontier does not offer mental health services, but has a focus on low risk day case activity and outpatients, with inpatient episodes accounting for only 10% of activity.

Gateway is the only Mental Health Trust in the partnership – it has yet to reach FT status. Gateway has over 600 patient beds and almost 3,000 staff. It doesn't have any community based services, but is a national pioneer in online CBT. The CCGs across the Partnership have agreed to adopt new integrated tariff arrangements covering Community and Mental Health services. This will have an impact on Gateway finances and may threaten the current FT pathway.

In addition are **Provident**, a private hospital and **Howston**, an NHS FT outside the partnership providing community based services to North Greendale CCG.

Figure 19: A summary of each Greendale organisation

Each of the simulated organisation included senior staff roles. Each provider had a Chief Executive, a Medical Lead and a Chief Operating/Financial Officer. Each of the CCGs had a Chair and a GP. The CORE (Clinical and Organisational Research and Education) had the Dean of the Medical School, The Chief Executive of Greendale Local Education and Training Board (LETB) and a representative from the local Collaborations for Leadership in Applied Health Research and Care alliance (CLAHRC). The Greendale Partnership Board, which comprised all NHS provider CEOs and CCG Chairs, had a Chair and a Managing Director. In total, the design of Lateral Play entailed 30 roles staffing 11 organisations (not including Provident and Howston).

4.4.4 The challenges in Greendale – working groups

Five different issues were created for the participants to consider and reflected some of the real-life issues in north-west London and nationally. The scenarios were designed to foster collaboration and communication, while posing real service delivery and reconfiguration problems, and to enable participants to play out the consequences of their actions, seeing some of the impact of their decisions both on their own organisations and the partnership as a whole. Each issue was to be developed by a pre-designated working group within the simulation, who would be responsible for formulating and enacting plans. Working group members were not given any extra information regarding the individual organisations, other than the information that they had from their own organisation. The working groups are described below.

4.4.4.1 Working group 1: Orthopaedic reconfiguration in Greendale

There is pressure from the two CCGs for reconfiguration of orthopaedic services within Greendale. In the simulated environment, this working group has already submitted proposals for redesign of orthopaedic services at a previous board meeting. The partnership board has accepted the proposals to rationalise service capacity across three sites rather than the five at which orthopaedics services are provided at present. The large sites, Appleton and Blackstone, should retain their services. The next phase of analysis by the working group should consider which two trusts, from Chrysalis, Davenport and Essen, will have to reconfigure their services in order to decant orthopaedics to other sites. The group must liaise with existing units and consider existing service quality, patient accessibility, financial consequences, training opportunities and research contributions of the current units. The outcome should be the best for the partnership as a whole and have agreement of the CCGs, the Medical School and CLARHC.

4.4.4.2 Working group 2: Redesign of maternity services

Ongoing concerns around quality and the impact of private providers has led the Greendale board to convene a working group to redesign maternity services in the sector. The board wish the group to examine financial pressures, patient experience and clinical quality. The CCG has also expressed an interest in commissioning a midwifery-led unit and is actively working with consultants at Davenport and Appleton AHSC, as well as undertaking discussions with the private sector. After discussion with the relevant trusts, the working group is required to put forward proposals for the redesign of maternity services in line with the specification from the CCG. The proposal requires agreement from the CCGs, Medical School and CLARHC before being presented to the board.

4.4.4.3 Working group 3: Development of virtual ward solutions

A US healthcare provider (Mountain Health) wishes to collaborate on a pilot for virtual wards, prior to a rollout to other European countries. This is a competitive process, as Mountain Health has approached other NHS providers as potential partners. Should Greendale AHSP be successful, it could have significant commercial and research benefits for the sector. The working group is required to develop a response to this approach, outlining options and formulating a business case for consideration by the board to develop virtual wards and the impact this could have on closure of real-ward beds in the sector. The working group also needs to consider which organisation within the partnership should lead the bid and manage relations with Mountain Health. Again, the group must seek agreement from CCGs, the Medical School and CLAHRC.

4.4.4.4 Working group 4: Development of a model for accountable care

The Department of Health has offered funding to the Greendale Partnership to develop a new service delivery model based on the concept of the “accountable care organisation.” Accountable care is a concept by which primary and secondary care is integrated within one financial pathway to provide healthcare for an agreed set of health needs for a set population. The partnership board would like the working group to develop a proposal for Care for the Elderly to be the focus of a new accountable care initiative in Greendale. The Working Group is to give consideration to the target population, the range of outcome measures that should be used, the role of social care, management and accountability of participating partners and issue of patient choice. Central to the model will be the contractual framework for participating providers, the formula for sharing savings, losses

and risk, and how a lead provider arrangement will be structured to provide assurance to others within the Partnership. Agreement must be sought with the CCGs.

4.4.4.5 Working group 5: Development of community and mental health services

Frontier is a large Community Trust covering the South Greendale area only. It is not an FT and discussions about an FT pathway have been constrained by a deficit budget and limited evidence of growth. Gateway is the only Mental Health Trust in the partnership and provides services across the entire area. It is not an FT and currently is in sound financial shape. Both Greendale CCGs have agreed to adopt new integrated tariff arrangements covering both community and mental health services, which could have a detrimental financial impact on Gateway and undermine any FT application. There is no Greendale Partnership Community Trust service in North Greendale, except for minor provision at Chrysalis as part of its acute pathways. North Greendale CCG is about to re-tender for both community and mental health services. Howston Foundation Trust, which is outside the Partnership in an adjacent geographic area, currently provides community services in North Greendale and North Greendale CCG has recently been approached by Howston with an offer which in line with the new tariff arrangements, combines community and mental health provision. The group is asked to work together to agree on plans for dealing with these issues and to highlight opportunities for the Partnership that could come from closer collaboration between Frontier and Gateway Trusts.

4.4.5 Simulation Participants

Each of the organisations who had signed up to Imperial College Health Partners at the time of the simulation was invited to take part. Given the aims of promoting collaboration and integration at strategic level within the organisations, senior personnel were invited, including the Chairpersons, Chief Executives, Chief Operating Officers, Medical Directors and Financial Directors of NHS Trusts; representatives of CCGs, Local Education and Training Boards, North West London CLAHRC (Collaborations for Leadership in Applied Health Research and Care) and Imperial College London. All participants were approved by the partnership board and all invitations came from the acting Chair, Lord Darzi. All participants were allocated roles within the Greendale Partnership organisations that were similar to their real-life role. Appendix 3 contains anonymised details of simulation and real-life roles.

4.4.6 Simulation Moderators

Five simulation moderators were invited to take part, representing a wide range of health services expertise: political, economic, policy and public health. All moderators were invited by personal invitation from AD and GP. Moderators had three roles. Firstly, they were available as ‘consultants’ to all participants and working groups during the simulation, and also to the simulation facilitators to plan ad hoc interventions or spur activity. Secondly, moderators were asked by the simulation leaders to take on ad hoc roles during the simulation (e.g. a Secretary of State or a local authority official), which became necessary when participants wished to speak with an official or political leader that was not already represented by one of the key players - for example, the Secretary of State or an official from the local Health and Wellbeing Board. Thirdly, the moderators were asked to monitor

progress and alert the simulation leaders of any difficulties or interpersonal problems that emerged during the course of the simulation play. One moderator, Nick Timmins, had a specific role to produce the local newspaper (The Greendale Courier) and other media publications during the simulation.

The simulation moderators were:

- The Rt. Hon. Stephen Dorrell MP - Chairman of Health Select Committee and Previous Secretary of State for Health
- Professor Paul Corrigan CBE – Previous special advisor on health to the Prime Minister and to the Secretary of State for Health
- Professor John Appleby – Chief Economist, The King’s Fund
- Professor Sheila Adam – Previous Deputy Chief Medical Officer, NHS
- Nick Timmins – Senior Fellow, The King’s Fund and former Public Policy Editor, Financial Times



Figure 20: The simulation moderators during the first board meeting (personal photograph)

4.4.7 Simulation Facilitators

The Simulation was led on all days by Greg Parston. As discussed earlier, Greg has a huge amount of experience running similar events and commands respect from those he works with. This was felt to be of utmost importance given the seniority of the participants and the matter at hand. Greg was assisted on the day by the moderators, and other facilitators; Axel Heitmueller, Rachel Davies, Fiona Rennie (Programme Support, Centre for Health Policy), Daniel Ramirez (Research Associate, Centre for Health Policy), Ivo Vlaev (Senior Lecturer, Division of Surgery and Cancer), Dr Sue Goss (local government expert) and me.

4.4.8 Three days of simulation

Lateral Play: Day 1

The simulation took place over three days. The first session was a 2 hour briefing given by the simulation facilitators at Imperial College London. The main purpose of the briefing was to introduce the participants to the Greendale health economy and their individual and organisational roles, together with the working group that they were allocated to.

Participants were also given personalised, detailed information about their own organisation and the task(s) that they faced in their working group. The information available to each participant reflected their role and was intended to be of a similar level to that which they would have in real-life should they be in a similar position in a similar organisation.

Participants were expected to read the information packs prior to Day 2 of the simulation, which was eight days later.

Lateral Play: Day 2

The venue for Days 2 and 3 was The Mappin Pavilion at London Zoo, which was identified as having a suitably large single-room conference facility for the simulation, together with adequate car parking and transport access.

Day 2 of Lateral Play was the main simulation event, which ran over a full day. On arrival at the Pavilion, participants were each given colour-coded T-Shirts which indicated the sector of their organisation (blue – acute or community trust; red – primary care or CCG; green – academia, research or education; yellow – chair/MD of Greendale Board; black – moderators and facilitators). Previously successful simulations such as the Windmill series had also utilised the T-Shirt device which served two purposes. Firstly, and most important, it helped underscore the “gaming” nature of the event which, unlike the real world allowed for exploration and mistake without guilt or blame, and secondly, it enabled easy identification of participants to each other.

The timetable for the day is shown in figure 21. This was intended to act as a guide for the facilitators and participants. Each 1 hour of the simulation represented 4 weeks of time in Greendale; in total approximately six months was condensed into a single simulation day.

Timetable for Lateral Play:	
Day 2 (Main event)	
9:00-9:30	Registration
9:30-10:00	Board meeting 1
10:00-12:00	Working group session
12:00-1:30	Board meeting 2 and Lunch
1:30-3:30	Working group session
3:30-4:30	Board meeting 3
4:30-5:00	Final working group session
5:00-5:30	Short wash-up session

Figure 21: The planned timetable for Day 2 of Lateral Play

Three Greendale Partnership Board meetings were scheduled in advance over the six months of play, to punctuate play and to provide time for feedback from working groups. The Chief Executives of each Greendale organisation attended the meetings and provided updates from their working groups; other participants were allowed to observe. The remainder of the day 2 was set aside for meetings and discussions within and between organisations and working groups.

The floor layout was designed by the facilitators in advance of the day to represent the organisational structure of Greendale and is shown in figure 22. Each organisation had its own table, but participants were free to meet up anywhere in the room during the day,

except for the moderators and facilitators tables. The use of a single room meant that any meetings could be observed by all, although meeting participants could raise privacy signs to prevent interruption or intrusion. Refreshments and food were provided throughout the day.

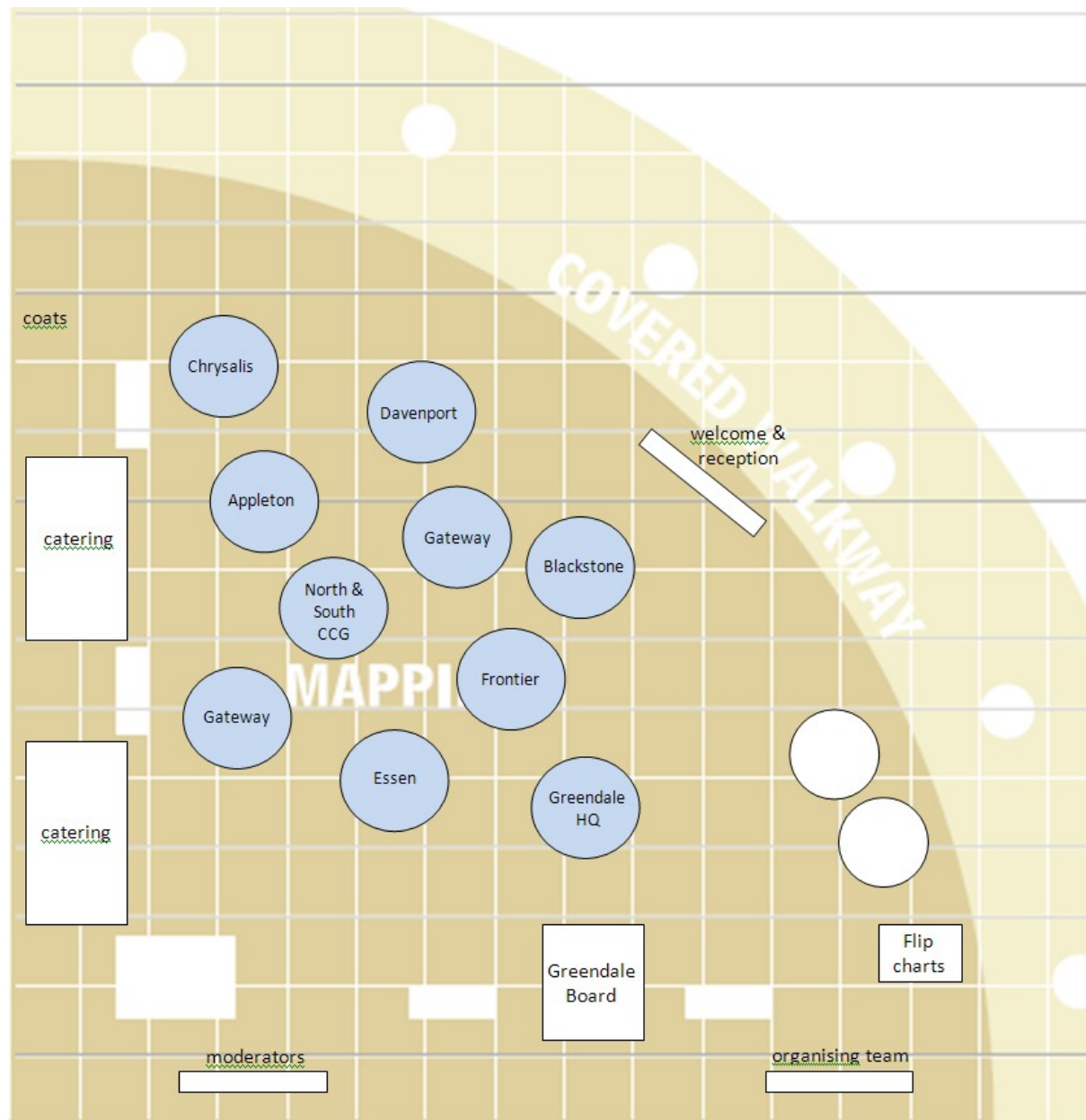


Figure 22: Layout of Mappin Pavilion for Day 2 of Lateral Play

Lateral Play: Day 3

The final day of Lateral Play was a four-hour session, two weeks after the main event, for the simulation participants to reflect on the learning from the simulation and how this might apply to the development of ICHP. The session was split into three facilitated discussions. The first open discussion identified themes that arose in the Lateral Play simulation that were applicable to ICHP. The second discussion focused on reconsidering the aims of the partnership and on identifying potential new development initiatives. The third discussion looked at how the partnership could strengthen and promote collaboration between partners and improve outcomes in North-West London.

4.4.9 Data collection and analysis of the simulation

4.4.9.1 Questionnaires

As with the previously described Crucible simulation, all participants were asked to complete questionnaires pre and post simulation, which would give a broad spectrum of responses across primary and secondary care within the ICHP sector. Three questionnaires were created; all were available to be completed online via an internet-based survey programme (www.surveymonkey.com); all questionnaires are reproduced in Appendix 4. Personalised emails were sent to participants at pre-defined times with links to each of the questionnaires.

The first questionnaire was sent 10 days before the simulation; the third questionnaire was sent 12 months after the simulation. Questionnaires 1 and 3 were identical, other than a free text question at the end of the third questionnaire. Both questionnaires asked participants to

rate their perceptions of the partnership performance on a seven-point Likert scale using the seven interim objectives that were described in figure 34. Change in participant self-assessed behaviour was identified using principles from the “Behaviour Change Wheel.”²¹⁷ This review, authored by Michie et al, was published in the time period between the Crucible and Lateral Play simulations, and builds on the concepts described by Ajzen and utilised in The Crucible.^{166,217} The authors describe how the factors of Capability, Opportunity and Motivation are necessary conditions for behaviour to occur; this simplified concept enabled a shorter and more succinct questionnaire to be developed for the Lateral Play Participants. After being given definitions for each of Capability, Opportunity and Motivation, participants were asked to rate their own perceived personal Capability, Opportunity and Motivation, based on the seven interim objectives as above, using a seven-point Likert scale (1- strongly disagree to 7- strongly agree). Participants were also invited to provide qualitative feedback in the third questionnaire, in the following question:

- Thinking back to the Lateral Play simulation, do you think that the simulation had a positive, negative or a neutral impact on the development and progression of the partnership?

The second questionnaire, sent out 2 weeks after the simulation, asked participants to provide feedback and reaction to the simulation itself on a Likert scale, as described in the Crucible simulation previously. In addition, participants were also asked to rate their understanding of the ICHP objectives, their own roles and responsibilities, the issues facing the partnership and their ability to address those issues, following Lateral Play, using a seven-point Likert scale. Finally, three free-text questions were set:

- What do you think are the benefits of using this type of simulation?

- If you hadn't attended the simulation, how else would you have learned about the issues covered?
- Has the Lateral Play simulation made you more aware of your collaboration and cooperation needs within ICHP? If so, how?

Reminder emails to complete the questionnaires were sent out two weeks after the initial email.

4.4.9.2 Observer-collected data

Days two and three of Lateral Play involved a huge amount of interaction between participants. The facilitators were able to sit amongst the groups and take short written notes during the discussions, and observe the board meetings (figure 23). Some sessions on days two and three utilised flipcharts; these were also utilised as a data source. The facilitator and flipchart notes were collated and recorded at the end of each session by DC and FR. All facilitators reviewed the notes to ensure consensus.

4.4.9.3 Statistical analysis

All analyses were carried out using SPSS version 19.0 (SPSS, Inc, Chicago, IL). The Wilcoxon signed rank test was used to determine the significance of difference pre-test and post-test mean scores. For all analyses, statistical significance was set at $P < 0.05$ or lower.



Figure 23: A board meeting during Lateral Play. Observers include non-chief executive participants, moderators and facilitators.

4.5 Results

4.5.1 Attendance

30 participants attended the main simulation event. From the Acute and Community Trusts these consisted of 7 Chief Executives, 2 Directors of Strategy, 6 Clinical/Medical Directors, 3 Clinical/Medical Leads, 1 Chairperson and 1 Chief Financial Officer; from Primary care 2 CCG/PCT Chairpersons and 2 other local GPs; from Academia the Principal of the Faculty of Medicine at Imperial College London; the Head of Operations at CLAHRC; and both the acting Chairman and Managing Director at Imperial College Health Partners. At the time of the simulation, all organisations that had signed up to ICHP had at least one representative, with the exception of one trust.

4.5.2 Observer-collected data

4.5.2.1 Day 2: Working group outcomes - afternoon:

During the second Greendale Partnership Board meeting of day 2 (i.e. the main simulation event), the lead of each working group presented an overview of developments during the day. The following is a summary:

Afternoon: Working group 1: Orthopaedic reconfiguration in Greendale

The working group engaged at length with the Trusts, Commissioners and CORE which shaped their proposals. The group admitted to “difficult and heated discussions” with trusts who felt as though they were “winning or losing” if faced with closure. The unanimous working group decision was to close services at Chrysalis and Essen; those trusts were not in agreement and threatened to make the discussions public and speak to the local press. The CORE group commented that the working group had not adequately considered the research or teaching implications of their decision. The working group therefore considered utilising a consultancy to independently appraise the options further, but were wary of the financial cost.

Given the lack of agreement between Trusts, the group proposed to the board that they liaise with other working groups to see how their recommendation affected other services. The group also asked for more time to explore virtual ward solutions and develop a new proposal for split elective and emergency orthopaedic services across Greendale.

Afternoon: Working group 2: Redesign of maternity services

The working group stated that the current service was fragmented and not sustainable; current resources were not being well utilised. Therefore, the group proposed “major changes” to the current configuration. Their proposal was for a single provider-run, centrally located, consultant-led hub with attached midwife-led unit, and two further midwife-led units in the north and south of Greendale at Davenport and Essen. The location of the central hub could be either Appleton, which has a strong research and academic base, or Blackstone, which is a Foundation Trust. Chrysalis maternity unit would close. The group proposed development of a private maternity service in the hub to increase income. The new model was agreed as a joint venture between all existing units who would share the financial risks and benefits. The CCGs were also supportive. The group accepted that they had not managed to discuss the proposals with any groups representing the end-users. During the consultations, the local media published a report of an acutely unwell pregnant patient dying after being redirected from a full maternity unit (Chrysalis) to another in the region.

Afternoon: Working group 3: Development of virtual ward solutions

The working group, together with the CCG, were unsure whether the virtual ward concept would be worthwhile after reviewing the costs and benefits. Furthermore, the consequences of closing hospital beds in association with an overseas company projected poorly in the media (see figure 24) and therefore may have adverse longer-term political consequences in terms of public acceptance of the partnership. However, there were arguments in favour of potential longer-term benefits, especially if developed within an Accountable care model and alongside working group 4. The group had concerns about working with Mountain

Health and felt that, if going ahead, the Greendale partnership should develop the concept “in-house.” Communication and integration with primary care and the public was felt to be key in any future project.

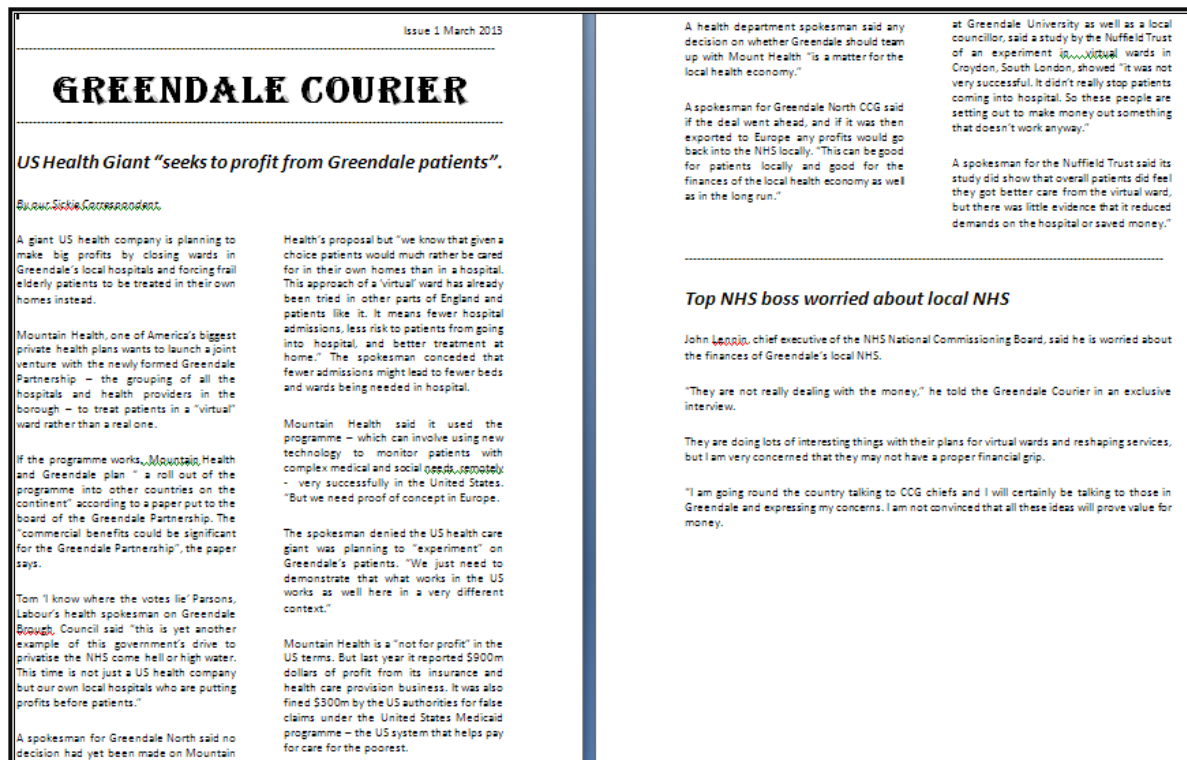


Figure 24: The first issue of the “Greendale Courier” – the local newspaper – was published shortly after the discussions with Mountain Health began (full version in Appendix 5).

Afternoon: Working group 4: Development of a model for accountable care

The working group liaised with Department of Health representatives during the simulation, and established that the Government was open to options regarding specific projects and the governance arrangements. The group discussed the need for the pilot to start with a specific

group of high risk patients and focus on dual aims of improving outcomes and lowering care costs. The working group felt that a future bid should be led by the Greendale Partnership, rather than an individual institution, as an Accountable care model would require an amalgamation of existing information systems, high levels of commissioning support and innovative delivery. Shared governance between all stakeholders and perhaps the Department of Health would be needed. The working group did also discuss the possibility of exploring the concept of Virtual Wards and felt that there could be significant areas of overlap between working groups 3 and 4. The group felt that there were significant educational opportunities in change management that could involve Greendale University.

Afternoon: Working group 5: Development of community and mental health services

Working group 5 recognised the alternative proposition from Howston and brought in CCGs, Public Health and Local Authority representatives into the discussion early on. The group proposed a merger of the Frontier and Gateway trusts to create a combined mental and community health provider. The merger was felt to offer a platform for the formation of an integrated care organisation which would be sustainable in the longer term, address the interface between health and social care, and comply with the proposed single tariff arrangements. Furthermore, the new organisation could be a hub for the accountable care model developed in working group 4. The group did have concerns about the involvement of primary care, which would have to increase capacity and capability (with appropriate financial reward) for the new integrated care organisation to be successful.

4.5.2.2 Working group outcomes – close of play day 2

Following the working group presentations at the mid-day board meeting there was a consensus amongst the board members that progress could be enhanced by wider communication and collaboration between the working groups and trusts. The discussion that followed focused on two statements made by board members; “why are we here?” and “what are the problems that we need to solve?” – and in both cases the follow-on dialogue referred to both the simulated Greendale environment and the real-world of Imperial College Health Partners. The lead facilitator allowed the discussion to continue for a short time before prompting the Greendale Chair to restore the simulation.

Working group outcomes – close of play day 2

1. Creation of an accountable care organisation

Working groups 3, 4 and 5 amalgamated to discuss formation of an accountable care organisation to provide an effective integrated care process, using pooled budgets between health and social care. Given the importance of primary care in any integrated care process, the working group proposed that a newly formed body of GPs, Greendale Medical Associates, would oversee the development and running of the organisation. The group remained committed to the merger of Frontier and Gateway trusts. However, the group remained cautious about the benefits of virtual wards, suggesting a formal trial to assess effectiveness, for example in preventing serial admissions to acute services in higher-risk and/or high-end user patients.

2. Developing acute care in Greendale

After prompting from the Chair and MD of the Greendale Partnership, Groups 1 and 2 amalgamated to jointly discuss development of acute care in Greendale. Two potential models were proposed. The first proposal was to pick programmes of work and engage where needed – as was described with orthopaedics and maternity services. Although this could improve productivity it would not address configuration issues longer-term. The second proposal was for a more radical “whole-system” approach, where partners adopted a shared investment-disinvestment strategy. Recommendations for acute and elective care would be made using an evidence-based approach to develop new pathways and then suggesting new structures and programmes of delivery. Partners would share the financial benefits and risks; the CCGs were fully supportive of this plan, although, the local media, politicians and public were not, citing poor communication with the Partnership and its members. The Greendale Courier, the local newspaper, ran a headline article which quoted unfavourable comments from local MP, patient groups, and a hospital consultant; the media from the simulation is reproduced in Appendix 5).

4.5.2.3 Moderator Feedback

During the closing session of Day 2, each moderator was invited to give a brief comment. PC commented that the participants had, during the course of the day, altered the agenda of the simulation; the collaborative work empowered them to act collectively and enabled them to take responsibility of the reconfiguration. Patients had to be put first, and local authorities and politicians need to be integrated. His final comment was “*A brilliant set of*

solutions will only be brilliant if you can engage the public and politicians – otherwise they will say ‘no.’”

SD noted that the health service was undertaking a long process of change; patients and staff dislike change, so the case for change and process has to be communicated effectively. SD also noted that the partnership needed to find ways of engaging innovators to speed up adoption and diffusion. Lastly, SD noted the poor representation of GPs which needed improving for the partnership to achieve its full potential.

SA stated that ICHP should promote public health and wellbeing as a primary function. She also agreed with SD, that public engagement was crucial and noted the relative absence of collaboration with local authority services and officials.

JA commented that a strong point of this simulation was the process of healthcare organisations evaluating the costs and benefits of making policy decisions – he felt that not enough of this was being done elsewhere.

NT encouraged the partnership to simplify communications to help engage the public. Finally, he questioned whether decisions made by the partnership had any legitimacy within or outside the partnership.

4.5.3 Day 3: Reflection

The final day of Lateral Play was a four-hour session split into three sections. Each is described below.

4.5.3.1 Section 1: Five key themes arising from the event

The participants and moderators agreed on five key themes emerging from Lateral Play. In small groups and then open discussion, participants expanded on these themes, a summary of which is provided below in bullet-point format.

A. Primary care

- The success of ICHP will depend on engagement and collaboration with primary care, both providers and commissioners.
- There is wide variation in the quality of primary care across the region; GP practices need to be brought up to a minimum level of quality.
- Patients are reluctant to leave secondary care as the quality, mechanisms and infrastructure often is not in place in primary care.
- Participants noted the potential conflict for General Practitioners to act as commissioners and providers in the region.
- Communication with Primary Care is challenging; GPs are not structured to act together outside of CCGs – this requires improvement.
- Care in the community needs more of an evidence-base regarding quality and cost
- The representation of primary care in the simulation reflected a real-life issue – the primary care representatives on the Greendale Partnership Board could not act with executive authority, although other board members could.

B. Need for a level playing field amongst partners

- Operation mechanisms, structures and processes need to be developed within the partnership
- Partnership initiatives must be equitable, so that risks and rewards are shared by all, and all should have some reward within the first three years of ICHP
- How will governors of institutions react when faced with a choice of creating value in ICHP when it might impact negatively on their institution? Clear and consistent communication from the ICHP board will be vital.
- Providers must have a mechanism (perhaps the partnership board or subgroup) to develop “blue-sky” thinking to shape healthcare agendas, rather than the current model which is reactive to higher-level or commissioner “dictats” (which providers currently have no opportunity to influence); commissioners should work with the partnership to develop solutions.
- ICHP should try to develop strategic coherence and alignment between partners to avoid “tripping each other up” and may empower clinicians to drive healthcare agenda (example of London Cancer Alliance was cited as a successful model).

C. Public and Local government engagement

- There is a pressing need to work more closely with local authorities and the public – perhaps the public give the partnership a mandate to act.
- ICHP needs to be clear with the public regarding the current/future problems, potential solutions and the trade-offs that may occur. However, the public need high quality evidence to make informed decisions (example of the North West London Stroke pathway cited)

- During Lateral Play the involvement with politicians was poor – this must improve in ICHP

D. Room to create consistent responses

- All partners are currently engaged in transformation of one sort or another
- Identify key champions – i.e. function leaders from within the network to lead on their specialty areas
- Focus perhaps on an initial achievable project that will generate a “feel-good” factor, rather than a reconfiguration which may lead to winners and losers.
- “Feel” of partnership is important – needs sense of autonomy from partners to drive agenda, rather than “dictat” from above.

E. Value creation and legitimacy

- The public trust clinicians and therefore getting the public on side is critical.
- Participants questioned whether the partnership has legitimacy to act at all, and whether the public could give the partnership a mandate.
- The partnership must try to set the agenda rather than merely being reactive to it
- Initial focus on shared challenges between primary and secondary care could help improve relations; for example on chronic disease, mental health and elderly care.
- The partnership could have a role in bringing together local authorities and CCGs.

4.5.3.2 Section 2: Why are we here?

“Why are we here?” was the central question that arose at the Greendale board meeting.

Partners discussed the reasons and agreed that the “status quo” was unsustainable, in terms of service provision, finance, education and research.

A number of streams were suggested for further development:

- Defining a vision for ICHP that would be understandable to the public
- Academia, Health and Science all need to have a focus, which will be important for highlighting opportunities amongst partners and developing into an Academic Health Sciences Network
- Partners must actively encourage clinicians within their institutions to engage with the principals of the partnership
- A map of healthcare variation should be developed in North West London showing all partners where strengths and weaknesses are and the reasons why; this could inform a multi-year plan for some partners across a clinical area.
- The vision of the partnership should articulate the value and objectives of each of the partners – such openness could foster collaboration and help to find common ground.
- A project, however small, needs to start soon, ideally involving primary and secondary care. Standardised communication/layout of discharge summaries between acute trusts was suggested.

4.5.3.3 Section 3: How can ICHP strengthen collaboration and improve outcomes?

The final discussion focussed on ways by which all commissioners and providers could collaborate to improve healthcare across ICHP. The session was split into the five areas defined in Theme 1.

A. Primary care:

- The partnership could provide an opportunity to engage primary care for research, for example in large-scale patient recruitment for clinical trials.
- The partnership should review local health demographics and performance and investigate how to encourage best practice; participants recognised that this could cause conflict with GPs who have vested financial interests in Primary Care practices.

B. Need for a level playing field amongst partners

- Partners need to be more transparent with each other and less competitive; there was talk of “neutralising” competitiveness.
- The ICHP needs to provide clarity on research and educational opportunities within the sector for all Partners.
- The board needs to ensure that the representation of the partnership involves clinicians in all areas, including NHS, Academia and Private Practice.

C. Public and Local government engagement

- The public must be engaged; ICHP needs to be more creative to involve them.
- Engage with Health and Wellbeing Boards who have already identified many relevant health and healthcare issues

D. Room to create consistent responses

- The agenda of the partnership must be clear.
- The Partnership must recognise that its own agenda may overlap with existing work streams and should therefore act in a complimentary fashion.

E. Value creation and legitimacy

- A big campaign on local excellence, relevant across all sectors, for example on patient safety, could help the public identify with the partnership.
- The links with the University should be promoted and used to create opportunities for education and teaching
- High-resource users could be a target for combined primary/secondary and social care projects.

4.5.4 Self-reported data

4.5.4.1 Participant feedback

16 participants completed the feedback questionnaire, the results of which are in table 5.

The responses were generally positive (mean answer range 3.63 to 4.25). Participants scored the organisation (4.31) and relevance of content highly (4.13); *“the material was relevant and topical and realistic and the organisation and facilitation was very good indeed (P3).”*

Importantly, participants felt actively engaged in the simulation over the three days. The least satisfactory aspect was the realism of the content, which, although positive, scored 3.63. Participants gave a variety of answers when discussing the benefits of the simulation. Team working, relationship-building and networking was mentioned by 9 of the participants

in their unstructured feedback, for example; *“This type of simulation provides an excellent opportunity for leaders in different organisations to work together”* (P6).

The simulation was also reported to promote organisational problem solving in complex settings, and enabling this in a safe environment without real-life consequences *“...in a safe environment, the chance to test out actions and potential responses in a safe and constructive way* (P8)”. Participants also commented that the simulation made them more aware of the issues in the sector; *“It builds a system wide perspective and some sense of responsibility for the regional system not just my organisation* (P13)” and *“Without such a simulation we would never have created the same sense of unity of purpose* (P6).” Lastly, participants found the insight into the behaviour of others useful *“(it was) very informative to see how other participants work (and) understand their perspectives... (P10).*

Participants were asked how they would have learned about the issues covered if they had not attended the simulation. The responses are summarised in table 6, and show the challenges of trying to engage the prospective audience and the timeframe involved. One of the Chief Executives attending summed up his thoughts on the simulation; *“This has done a huge amount to foster relationship-building and will help the partnership move on.”*

	Mean	SD
Participation and Content		
The simulation was well organised	4.31	.60
I understood the aims and objectives of the simulation	4.00	.63
I was appropriately challenged by the material	3.75	.58
I found the course content to be realistic	3.63	.72
I found the course content to be relevant	4.13	.89
I was actively involved in the simulation	4.33	.60
Educational benefit		
I found this method of learning to be useful	4.13	.79
Future actions around ICHP		
I better understand the objectives of the ICHP	3.94	.67
I am more aware of my current/future roles and responsibilities within ICHP	3.87	.72
I am more aware of the issues facing the ICHP	4.25	1.06
I am better able to address important issues facing the ICHP	3.91	.80
Employer relationship with Partnership <i>(1-unimportant to 5-very important)</i>		
How important are the needs of the partnership in your work?	4.06	.85
How important are the needs of your Trust/organisation in comparison to the needs of the partnership?	4.44	.73

Table 5: Participant feedback from the Lateral Play Simulation (n=16)

(All results on scale of 1- strongly disagree to 5 – strongly agree unless stated)

If you hadn't attended the simulation, how else would you have learned about the issues covered?

"Not sure"

"Board meetings"

"Slowly - in real time - and with painful consequences."

"Much more time consuming discussion with individuals involved, but the experiential part would still have been missing"

"Could have read up on it but would not have had the depth (or colour) of the experience"

"Probably through reading - which would not have engaged me as well"

"Would not have had this level of insight"

"No doubt eventually by the usual NHS mechanism of osmosis"

"It isn't so much learning about the issues; it's about the way they are tackled to which the simulation gives insight."

"Significant time would have been spent in learning about peoples' perspectives and expectations, which would have had to be done in a programme of meetings, workshops, etc and would have taken weeks or months."

Table 6: Participant responses to the question "If you hadn't attended the simulation, how else would you have learned about the issues covered?"

Participants generally felt that their understanding of the objectives of ICHP (3.94) and issues facing ICHP (4.25) was enhanced by the simulation. *"It has made me more aware both of the need for collaboration and cooperation but also more aware of the consequences for a huge pool of people of one or two persons not cooperating and seeing the needs of the wider stakeholder group (P5)"* and *"I was already fully aware of the need for collaboration and cooperation – Lateral Play made me more aware of the ways in*

which this must be achieved, and the potential barriers to achieving it (P15).” However, cooperation with Primary Care was noted as being a significant barrier: “*We identified major challenges in trying to "on board" primary care providers given their independent and federated structures (P11).*” Whereas most of the comments were supportive of collaboration, one trust Chief Executive was more guarded, “[...] *need to be so careful about what hands (we) play and how we play them (P3)*” (the name of the Trust has been replaced by [...] to keep anonymity).

4.5.4.2 Change in perception of ICHP performance post simulation at 1 year.

18 participants completed the ICHP performance questionnaire pre simulation and 10 completed post simulation (table 7). The overall performance of ICHP was not deemed to be significantly different in the year following the simulation, based on the seven Interim objectives (3.42 to 3.60, $p=0.176$).

4.5.4.3 Changes in Behaviour 1 year post-simulation

18 participants completed the behaviour questionnaires pre-simulation and 10 completed post-simulation (table 7). Perceived Capability demonstrated a significant change post-simulation, although the effect was only moderate ($p=0.018$, Cohen’s $r -0.439$). Neither Opportunity nor Motivation changed significantly.

4.5.4.4 Further participant qualitative feedback 1 year post-simulation

Seven participants provided feedback at the 1 year stage. Five of the comments were positive in their assessment of the simulation, for example: *“I think it was important because all key players were in the same room - and this is very rare. It did help to increase clarity of thinking (P2).”* Two participants commented on the usefulness of the exercise in relationship-building; for example *“(it) made me think in a different way and meeting and working with colleagues even just for a day fostered better interpersonal relationships (P8),”* *“It had a positive impact, particularly in terms of relationship building and breaking down some of the apparent organisational silos (P5).”* One participant felt that the Lateral Play simulation had a neutral impact on the partnership. Two participants felt that the simulation had not had any positive impact over the year; *“it has had no impact that I have seen (P11),”* and *“I am not sure it has had any impact on the degree of collaboration between the NWL partners at all (P4).”*

	Wilcoxon signed-rank test				
	Pre simulation mean	Post simulation mean	z score	P value	r value
ICHP performance	3.42	3.60	-1.352	0.176	-0.251
Capability	4.68	5.23	-2.366	0.018	-0.439
Opportunity	4.78	4.97	-1.270	0.204	-0.282
Motivation	5.58	5.63	-0.314	0.753	-0.376

Table 7: Changes in perceived performance and behaviour pre and post simulation.

4.5.5 Post-simulation ICHP development

In the months following Lateral Play, ICHP developed a working programme which was heavily influenced by the discussions that took place during and after Lateral Play. The programme, showing the strategic objectives and project areas is shown in figure 25, below. The full plan, detailing project aims and objectives, is presented in Appendix 6.

ICHP strategic objectives	Projects
Enable the discovery of best practice	Alignment and dissemination of research Intelligent use of data Mental Health
Adopt best practice systematically	Patient Safety Evaluation of Whole Systems Integration Chronic Obstructive Pulmonary Disease Cardiovascular rehabilitation Cancer Neuro-rehabilitation
Support wealth creation in the sector and beyond	Overseas development Collaboration with industry

Figure 25: ICHP Working Programme (developed following Lateral Play)

4.6 Discussion

Centrally driven health service reform, continuing financial pressures and the need to improve service quality and outcomes have led local NHS organisations to seek new

collaborations and innovative methods of working. ICHP is one such collaboration; it commissioned the simulation to help optimise decision-making and promote collaborative working amongst the partnership organisations. The feedback of participants indicates that the process of taking part in the simulation, together with the feedback sessions, generated ideas and concepts that were felt to be useful in taking the partnership forward, and improved relationships between partnership individuals and organisations. The development and exploration of the five themes generated by the Lateral Play simulation demonstrated the readiness of the partnership individuals and organisations to work together innovatively. Participants on the whole gave positive feedback and perceptive comments about their experience taking part in Lateral Play, which reinforces the comments provided by participants in the Crucible Simulation described in chapter 3. In addition, participants also demonstrated their perceived capability to be improved following the simulation, which again reinforces the findings of the previous chapter and demonstrates the value of such simulations in health service development. However, further investigation is required to determine why motivation and opportunity were not perceived to be improved.

During the simulation, there was a clear progression towards collaboration by the Greendale organisations and certainly between the working groups. The central event during the simulation was the second board meeting on day 2, where participants effectively reorganised the agenda of the simulation to discuss how the requirements of individual institutions could be balanced against the needs of the partnership and the health of the population. This move towards collaboration was both self-motivated (in the case of working groups three, four and five) and also with prompting from the Partnership MD and Chair (in the case of groups one and two). In both cases, the discussions at the end of day two moved towards acting in the best interests of the partnership and less about individual

institutions; innovative approaches to health care delivery, research and training were proposed. Participants clearly recognised the importance of being open to new ideas and adoption of innovation; failure to do so can be economically damaging and act as a disincentive to investors and staff members, ultimately resulting in poorer health outcomes.²¹⁸ However, whilst collaborative agreements were made, no final decisions were taken to remove or alter services from individual institutions. Such challenging decisions will be encountered by the Imperial College Healthcare Partners in the future and although some of the political and public consequences were displayed in the simulation, the making of, and reaction to, real-life decisions may prove more challenging, as was demonstrated in the proposed closure of emergency departments in North West London in 2013.²¹⁹

During the simulation, the public and politicians had a significant impact on events through the media – for example, the negative reporting of the Mountain Health Virtual Ward proposal led the working group to reconsider their plans. By contrast, the two negative media reports on maternity closures were met with little reaction from the partnership board. With better public and political engagement, the debate may have been more reasoned. Furthermore, there has been little promotion of the AHSN concept by the UK government to the UK public, who are, perhaps, unaware of the potential outcomes, research and financial benefits. This contrasts with the ongoing Government-led promotion of investment in AHSNs and the NHS internationally.²²⁰

However, the learning from this simulation, such as the importance of local authority, political and public involvement, should serve ICHP well in this regard. Furthermore, the recognition that each member organisation has differing strengths and strategic objectives

should enable partners to work together more openly in development of healthcare delivery, research and educational targets, such that redevelopment of an organisation is presented as a positive opportunity, rather than a threat to their identity.

Interaction and commitment to action from primary care was a further challenge that emerged during the simulation. Whilst the CCGs contained representatives from primary care (the CCG leads), they did not have the mandate to act on behalf of General Practitioners in the same way that the trust representatives (the Chief Executives) did with their own organisations. Indeed, the variable organisation, quality and infrastructure of primary care as a whole came under consistent scrutiny by participants, and created difficulties in commissioner and provider planning throughout the simulation, which was felt to reflect the real-life situation. A recent independent report suggests that CCGs and AHSNs have a significant role to play in encouraging the adoption and diffusion of innovation within primary care.²²¹ Unfortunately the simulation did not directly address this report or any potential solutions.

In chapter 2, I discussed how previous simulations had claimed to have predicted some future events, such was their realism. No such conclusions can be drawn from this simulation, as I do not have any follow up specifically on partnership dynamics or policy development since the simulation, other than the previously mentioned feedback and working programme. Such research would be challenging and fraught with methodological difficulty. However, the simulation undoubtedly helped to encourage collaboration and awareness of differing perspectives between individuals and organisations, which should

stand the partnership in good stead to avoid unintended consequences seen in previous healthcare policy changes.²²²

Participants did not perceive the performance of ICHP to be significantly different between the simulation and the one year follow up period. Taken at face value this is an alarming result, suggesting that ICHP has made little progress since the event. However, the designation of the Partnership as an AHSN, together with the new development plan and work streams indicates that progress is being made. The failure to progress in the questionnaire may be due to the relatively low numbers or poor question wording. It is not possible to attribute the small but insignificant rise to Lateral Play or any other factor. Further investigation is required to determine whether this response is a true reflection of participant views, ideally with interview studies to determine the factors undermining the limited change in performance.

Following the simulation, ICHP was designated to be one of the first Academic Health Science Networks in the UK. The success of AHSNs depends on a number of factors; these include strong local leadership and empowerment to change practice according to regional need.²¹⁸ Daniels and Carson discussed the need for common values and robust partnerships, whilst Dzau and colleagues stress the importance of common standards of high quality, integrated medical care between different organisations, together with external partnerships, and new models of care delivery, education and research.^{223,224} It is encouraging for ICHP that the participants of Lateral Play independently highlighted the development of each of these areas during the simulation and reflection sessions. Further prospective evaluation is

required to determine the importance and relevance of each of these factors in the future success or failure of an AHSN.

4.7 Limitations

There are a number of limitations to this study and the findings. Firstly, the response rate for the pre and post simulation questionnaires was low, which may have biased the results. The surveys were deliberately shortened from those used in the Crucible as I felt that they may be inappropriate and too long for this group. In addition, I did not feel that sending more than two reminder emails was appropriate, given the seniority of the participants. A further limitation was the lack of direct follow up with participants following the simulation; on reflection, short interviews in the weeks/months after Lateral Play may have yielded examples of how the experiences of Lateral Play affected individuals and their organisations. One year on, this may be harder to gauge as the Partnership has developed in that time regardless. Furthermore, and again in similarity to the Crucible simulation, the lack of mandate to act within primary care was felt to have adversely affected the simulation by some participants. Whilst this may well be due to the simulation design, personal correspondence since the simulation leads me to believe that it may well be a realistic reflection of the challenges in involvement of primary care in the partnership, which was also debated during a Greendale Board meeting.

Finally, the participant feedback on the simulation, although positive, only rated the realism of the content at 3.63 (maximum of 5). Given the efforts of the group to design a face and content valid simulation, this was disappointing. Unfortunately, no written feedback was

received as to why this score was so low, nor whether the perceived realism of the content adversely affected the simulation.

4.8 Conclusions

This chapter has demonstrated the value of behavioural simulations in organisational development and in improving perceived behavioural constructs amongst participants. In due course, the simulation could be rerun for less senior managers and other clinicians, both within and outside of ICHP, to encourage their development and collaboration, together with enhancing their understanding of Academic Health Science Partnerships and Networks.

The next section of the thesis explores the use of a second simulation methodology, virtual worlds. As previously discussed in chapter 1, virtual world simulations can enable access to contextualised, immersive training environments that would otherwise be challenging to develop. Virtual simulations could, therefore, build on tabletop or behavioural simulations by providing a dynamic, immersive context, which may be beneficial in clinical situations.

5 MAJOR INCIDENT PREPAREDNESS: EXPLORING THE NEED FOR NOVEL SIMULATION METHODOLOGIES

5.1 Overview

In this chapter I explore the need for novel simulation methodologies in the field of major incident preparation in a systematic manner. The concept of a major incident is defined and explored, with examples from high profile incidents from the United Kingdom and abroad. An evidence-based approach is undertaken, utilizing the views of an expert advisory group, trainers and participants in major incident response, and a review of the current literature.

The major incident project was funded by a grant from the Health Protection Agency.

5.2 Major incident response: background

A major incident can be defined as any event whose impact cannot be handled within routine service arrangements, thereby exceeding the capacity of local resources.²²⁵ Although such events typically generate large numbers of casualties, smaller healthcare facilities may encounter a major incident with smaller numbers as local resource capacity is exceeded.²²⁶ Major incidents can be caused by transportation incidents, natural phenomena such as extreme weather or earthquakes, structural or equipment failures or man-made deliberate acts, such as terrorist attacks.^{225,227} Both natural phenomena and man-made incidents can be sudden onset (“the Bing-Bang”) or develop slowly (“the Rising Tide”); both eventualities have capacity to overwhelm and require adequate provision.²²⁵

In the United Kingdom, the Civil Contingencies Act 2004 aims to facilitate an effective response to such incidents.²²⁸ The Act classifies responders as either Category One, who would be involved in most emergencies at a local or national level (including acute hospitals and emergency services) and Category Two, who may be involved depending on the type of emergency (for example, utilities and transport companies). According to the Act, Category One responders are required to maintain plans for emergency prevention and reduction, together with control and mitigation of the effects of an emergency throughout the initial response and recovery phases. The National Resource Framework is a similar piece of legislation in the United States.²²⁹

Due to a number of high profile incidents in the past decade, both terror and non-terror related, major incident preparation has come under focus around the globe. At the time of writing, the threat from international terrorism in the United Kingdom (UK) is graded as “substantial” indicating that “attack is a strong possibility,” and the United States has a similarly high level of vigilance.²³⁰

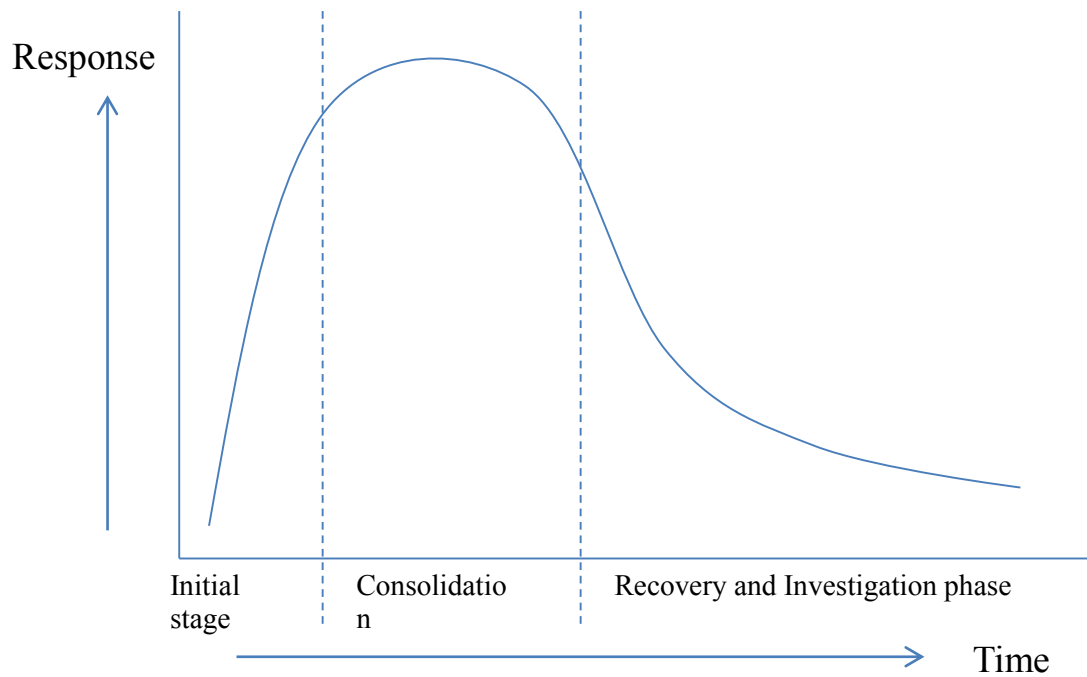


Figure 26: Stages of a major incident response (adapted from London Emergency Services Liaison Panel Manual, 2012)²³¹

Major incidents classically evolve into four overlapping stages, commencing with an initial response, progressing into consolidation and recovery phases, before returning to a stand-by phase (Figure 26). During the latter two stages, restoration of normal procedures resumes, whilst investigation and analysis of the causative factors and response take place. With both sudden and slow onset incidents, the initial response is relatively quick and resource-consuming; the quality of the pre-hospital and hospital response are key to improved outcomes.

5.2.1 The pre-hospital response

Major incidents pose great challenges to pre-hospital emergency responders.²³²⁻²³⁴ The desire to reduce casualty morbidity and mortality comes at the risk of operating in diverse, dangerous, unpredictable and rapidly-changing environments, often working with unfamiliar people and teams in a multiple casualty setting.^{232,233,235} In such high-pressure, stressful environments, many responders fail to make appropriate decisions, which, combined with the environmental risk factors, can have severe consequences for both responders and casualties.^{234,236} Furthermore, communication is challenging both within and between the different groups of responders.²³³

The London Bombings of 2005 can be used as an example to illustrate many of the above points. Three underground bombs exploded almost simultaneously in different parts of London; the fourth explosion was above ground on a bus around one hour later. The direct result was the largest number of traumatic casualties in the United Kingdom since World War II.²³⁷ The exceptional emergency response was achieved despite numerous obstacles, including a lack of cohesion between and amongst emergency services and Transport for London.¹⁰⁷ Specific challenges were noted by commentators; the majority of responders had never worked together before, nor had they been involved in a major incident previously; the mobile telephone networks failed; radio communication proved to be extremely difficult and information gathering and processing at the scenes was hugely variable.¹⁰⁷

Pre-hospital major incident responders have an elevated risk of injury due to unpredictable and hazardous working environments. Causative factors can be man-made or natural, and

can include structural damage, secondary explosive devices and the threat of chemical, biological, nuclear or radiological exposure.^{107,233,235,238,239} Whilst the responders in London faced hazards, none were physically injured. However, at the World Trade Center attacks in New York, USA in 2001, 343 fire fighters and 23 police officers died.²³⁶ In the 1990s, two Sarin gas attacks in Japan resulted in over 6000 members of the public injured; 35% of rescuers were harmed due to secondary contamination.²³⁴

5.2.2 The Acute Hospital response

Following the pre-hospital response, acute hospitals are at the core of a successful major incident response and can potentially be overwhelmed if inadequately prepared. Ensuring an effective and high quality response to a major incident requires adequate skills in hospital personnel, and also organizational preparedness.²⁴⁰ Evidence, however, from both research and real-life events demonstrates that health systems and hospitals in developed countries are poorly prepared to deal with major incidents.^{107,241-244} In addition, staff are not familiar with the major incident plans or confident of their role in an incident.²⁴⁵⁻²⁴⁷ This is particularly true for hospital staff based outside the emergency department.^{244,248-253}

Learning from previous events is hugely important, both in terms of individuals who can lead a response and the implementation of a response system. Bellvue and St Vincents Hospitals in New York, the Royal London and St Mary's Hospitals in London and Shaare Zedek in Jerusalem have all demonstrated the value of having a well-practiced major incident plan, run by experienced clinicians.^{235,254-257} A number of different factors in ensuring a successful hospital response have been described, including expansion of surge

capacity, mobilization of staff into critical areas, cancelling elective surgery and freeing up theatre capacity, rapid discharge of ward and non-critical emergency department patients and ensuring a co-ordinated approach from emergency department clinicians, surgeons, intensivists and anaesthetists.²⁵⁸⁻²⁶¹ However, even with advanced warning and perceived adequate preparation, hospital services can be overwhelmed and further ad-hoc coping strategies need to be implemented.^{260,262}

5.3 Current training and preparation

Due to the relatively rare and unpredictable nature of major incidents, training exercises are a key factor in ensuring an effective hospital response.²⁶³ The United States Federal Emergency Management Agency (FEMA) has described 5 types of such training exercises, which progressively increase in complexity and cost (Figure 27).²⁶⁴ In the UK, NHS organizations are required to run a live exercise every three years, a tabletop exercise every year and a communications test every six months.²²⁵ Full-scale, live exercises are the “gold standard” for both pre- and within hospital response, but are complex to organize, difficult to analyze, disruptive to the physical environment and very expensive. The inherent difficulties in organising live, full-scale exercises has been acknowledged by the UK Department of Health, who have stated that an enhanced tabletop exercise can substitute for live training if necessary.^{265,266}

Orientation seminar: This is a low-stress, informal discussion in a group setting with little or no simulation. It is used to provide information and introduce people to policies, plans, and procedures.

Tabletop exercise: This is a facilitated group analysis of an emergency situation in an informal, stress-free environment. It is designed for examination of operational plans, problem identification, and in-depth problem solving.

Functional exercise: This is a fully simulated interactive exercise that tests the capability of an organization to respond to a simulated event. It takes place in the EOC and focuses on coordination of multiple functions or organizations. Strives for realism, short of actual deployment of equipment and personnel.

Drill: This is a coordinated, supervised exercise used to test a single specific operation or function. It involves deployment of equipment and personnel.

Full-scale exercise: This is a simulated emergency event, as close to reality as possible. It involves all emergency response functions and requires full deployment of equipment and personnel.

Figure 27: The five exercise types as classified by FEMA²⁶⁴

Education and training was recently identified as a research priority by an international group of experts in major incident management.²⁶⁷ Training to work in major incident environments is challenging due to the diversity of incidents, the relatively low frequency of events, the lack of immersive training opportunities, and high resource and cost requirements.^{262,268} In addition, there are few opportunities for the multiple agencies involved in response to train and prepare together; training to enhance inter-agency coordination and communication has been identified as requiring improvement by high-level reports on major incidents around the globe.^{107,269,270}

To address the current training needs, emergency responders worldwide are increasingly exploring the use of simulation for both individual and team-based learning and assessment. The following sections detail the existing approaches for major incident preparation and assessment. Following this short review, the findings of an expert advisory board and user needs analysis are presented.

5.3.1 Tabletop and Functional exercises

Tabletop and functional exercises are widely utilized for evaluation and development of existing plans and training of responders. In the United Kingdom, the Emergotrain system is widely utilized by NHS organisations as a tabletop and functional exercise, and according to Department of Health Guidance, is used as a substitute for live exercises. The Emergotrain system involves participants simulating a major incident response by moving magnetic representations of casualties and resources around a board representing the evolving incident.²⁶⁵ Despite certification of over 900 instructors and use in 29 countries there is limited evidence of validity, educational benefit or improved patient outcomes following training.^{265,271}

There are a growing number of tabletop and functional exercises that have been published in academic literature in the past decade, including in the fields of bioterrorism preparedness, trauma, acute blood shortage and simulation of a hospital disaster plan. These exercises cover local, regional, and national scenarios.^{69,70,272-275} With the aid of computer and internet technology, one tabletop exercise has been carried out between the United States and South Africa to facilitate emergency preparedness for the 2010 FIFA World Cup,

held in South Africa.²⁷⁶ In the UK, the Hospital Major Incident Management System utilises a mixture of clinical and organisational simulations, including tabletop exercises and drills to train participants in hospital major incident response.²⁷⁷ Overall, there is little standardization in these exercises – including content, as well as assessment and feedback protocols for participating personnel. Moreover, the lack of standardization means that there is little ground on which to build systematic, ideally validated assessment and feedback mechanisms for participating personnel.

5.3.2 Drills and Full-scale exercises

Gold standard live exercises are costly, complex to set up and can be hugely disruptive. They range from micro to macro simulations. The Advanced Trauma Life Support course is a micro-simulation, focusing on the skills necessary for acute trauma management, whether in the context of a single or multiple casualties, both in the developed and developing world.^{278,279} Contextualising the skills from ATLS, and other relevant technical and non technical skills, requires a much more complex exercise. The HOSPEX simulation was discussed in the introduction, and is a good example of a macrosimulation that functions as a full-scale exercise. Such a permanent hospital simulator is unique, and no such simulator or simulation exists for preparedness in the civilian pre-hospital or within-hospital setting, and it is unlikely that such simulations will develop anytime soon due to resource constraints. Furthermore, data capture and measurements of performance are challenging although possible, albeit in a highly selected population.²⁸⁰

The Hazardous Area Response Team (HART), a group of highly trained UK paramedics, also have a permanent live training facility in Wiltshire, UK.²⁸¹ Established in 2007, Ambulance HART units ordinarily consist of six to eight pre-hospital clinicians with

extended skills and equipment that enable them to access casualties and support other emergency services within unsafe environments.²⁸² Within their training facility, the variable outdoor terrain consists of empty buildings, vehicles and roads upon which multidisciplinary training and incident preparation can take place without disrupting the general public or emergency services (Figure 28). However, at the time of writing, HART practitioners only access the live course in their final week of training, and may not attend again throughout their working careers. Furthermore, data capture from the exercise is limited, with no formal recording of technical and non-technical skill performance.

On a macro-simulation level, Exercises such as Watermark, Philpott and the Olympics training exercises are further examples of full-scale training and preparedness simulations, carried out at regional and national levels.^{67,68} Such events occur infrequently and analysis is limited by poor data capture and feedback; this is discussed further in this chapter.

The nature of current training and preparation exercises is varied and methodologically disparate. Furthermore, there is little standardisation in approach or data capture, and there is little in the way of academic publications to validate any assessment instruments. In such disparate fields, multiple evidence-gathering methods can be utilised.²⁸³ Therefore, two further approaches, both qualitative, were utilised to enhance the systematic nature of the study.



Figure 28: HART live training exercise: Triaging and evacuating casualties in personal protective equipment (personal photograph)

5.4 The expert advisory board

An expert advisory board was convened to discuss how novel virtual simulation technologies could best enhance future training and preparedness for major incident preparation in the UK, and also comment on the initial study design proposals. Participants

on the advisory board were invited by named invitation from the lead investigator (AD) after discussion with Dr John Simpson, Head of Emergency Preparedness, Health Protection Agency. Participants were not offered any financial incentive to attend the meeting, which was held at Imperial College London in April 2010.

In total, fifteen expert advisors attended from the following organisations/departments; The Olympic Security Directorate, The London Ambulance Service, The Department of Health, The National CBRN Centre (Home Office), The Metropolitan Police, The Hazardous Area Response Team, The Health Protection Agency, The UK Army, Imperial College NHS Trust and Imperial College London. Apologies were received from the London Fire Brigade. A full list of attendees can be found in appendix 7.

A short presentation on virtual worlds was given to inform the board as to the previous and potential uses of the technology and its current limitations. A design proposal for the study was displayed, along with templates for assessment scales in both technical and non-technical skills.

Following a round-table discussion, the following consensus points were reached on development of a feasibility study.

1. There is currently no validated training or assessment tool for individual, team or organisational response to a major incident.
2. Virtual environments have potential to act as an adjunct to current systems of training and preparation: this study was an appropriate platform to further explore the potential as a proof-of concept.

3. There is a need to develop methods of training and assessment for major incident response, especially in relation to non-technical skills and clinical decision-making.
4. The ability to record and re-run scenarios is hugely advantageous over current simulation and training tools.
5. The agreed priorities for the project are to simulate triage, clinical response, clinical decision making and incident management covering both the incident site and receiving hospital at Bronze and Silver Levels.
6. Further work was required to develop the scenarios and the virtual environments.
7. In order to support face and content validity of the virtual major incident environment, members of the advisory board agreed to provide ad-hoc advice and opinion, via themselves or their representatives, regarding scenario content and development in the 12 months following the meeting.
8. The board felt that the pre-hospital work should focus on the Ambulance Hazardous Area Response Teams (HART).

The full minutes can be found in Appendix 7.

Following the expert-advisory board, two larger-scale interview studies were carried out as part of a user-needs analysis to enhance understanding of current training and the potential role for virtual environments in major incident preparation.

5.5 User-needs analysis: Overall study design

Pre-hospital responders and in-hospital responders to major incidents were invited to take part in the user needs analysis. The two user-needs analyses were conducted as prospective, qualitative, semi-structured interview studies, between April and July 2010. Qualitative

approaches are ideal when detailed exploration of complex issues is required and expert opinion and consensus is sought.²⁸⁴ Within qualitative research of this type, sample size is determined by the ‘saturation criterion’: data collection is deemed complete when no new themes arise in participants’ interviews.²⁸⁵

The semi-structured interview protocol was designed by researchers familiar with qualitative research methodology (NS, DC), knowledge of major incident response in the United Kingdom (DC, NB) and expertise in HART operations (MH).

All interviews were carried out by a researcher with training in qualitative data collection and analysis (DC). Interviews were carried out face to face, lasted approximately 30-45 minutes each, were audio-recorded using an Edirol R09HR voice recorder (Roland Corporation, Japan), and subsequently transcribed verbatim into Microsoft Word (Microsoft, USA) for analysis. Participants were assured of anonymity.

5.6 User needs analysis: Pre-hospital response

Expert views were sought on factors that promote effective hazardous area incident response training for pre-hospital ambulance responders. Areas in which novel, virtual simulation technologies can be utilized to augment current training were then explored, to form part of an evidence-based approach to the development of virtual environment simulation.

The interview protocol was divided into four sections:

1. Aims of existing training exercises: what skills are required for successful incident response?
2. What skills are in need of ongoing development following initial training?

3. What factors enable ongoing hazardous environment training?
4. What could novel simulation technologies (Virtual world environments) add to existing training capability?

5.6.1 Participants

For the purposes of this study, HART team clinicians or trainers were recruited by recommendation from senior HART trainers (MH and DB). Participants were given information about the project, including picture representations of virtual environments, at the time of recruitment and provided informed consent prior to data collection. Interviews were carried out either by telephone or face to face in a quiet room, depending on participant preference.

5.6.2 Primary Data Analysis

The interview transcripts were cross-checked with audio recordings to ensure accuracy. All transcripts were then submitted to thematic content analysis carried out by the primary coder (DC) to identify emergent themes. To ensure reliability in the coding, a random sample of interviews were first coded blindly by a second member of the research team (VP) with a background in surgery and medical education. The coding was subsequently discussed with the primary coder and consensus reached. Initial inter-coder agreement in extracted themes was 74%, which improved to 92% after discussion and review of the transcripts. The remaining interviews were then coded by the primary coder, all emergent themes tabulated, and illustrative quotes extracted from the transcripts.

5.6.3 Results

Twelve experts in hazardous environment medical response were interviewed. Thematic saturation was reached at this point, thus alleviating the need for further interviews. Half of those interviewed were senior trainers (of those, three were engaged in active operational HART service at the time of the study); the other half were full-time active HART team members.

Detailed findings are presented below, based on the 4 sections of the interview protocol. All extracted themes are supported by verbatim quotes, to validate and illustrate each theme.

5.6.3.1 Aims of existing training exercises: what skills are required for successful incident response? (Table 8)

Unsurprisingly, all respondents stated that the ability to work in hazardous environments was the single-most important outcome of training. All other skills described in this category are components of a successful hazardous area response. These have been split into (i) technical/operational skills, and (ii) non-technical skills, although there are areas of overlap.

Seven further technical/operational skills were mentioned by participants. Almost all rely on practitioners being clinically competent and being able to utilize their skills in a variety of settings “...it is about transferring those clinical skills into a hazardous environment” (Participant K). The areas mentioned by participants include procedural components, such as command and control and risk assessment, those related to working in a multiple casualty, multi-agency environment, and some related to utilizing specialist equipment.

Non technical skills were mentioned almost as frequently as technical skills, with good teamwork being mentioned by 11 of 12 participants. Teamwork has two components in this setting. Firstly, ambulance personnel in the United Kingdom traditionally work in pairs, so the move to working in a six or eight-person HART team is a change from previous practice. Secondly, there was a big emphasis as working as part of a multi-agency team at an incident “*The background to all the training is teamwork, either with your own HART team or the other agencies*” (Participant D). The other two non-technical skills were mentioned by less than half of participants.

	No. of participants mentioned
Technical / Operational Skills	
• Hazardous environment working	12
• Safe working and Risk Assessment	10
• Multiagency working	9
• Triage and Treatment	8
• Working in a mass casualty environment	8
• Familiarization with equipment	8
• Command and Control	8
Non-technical skills	
• Teamwork	11
• Communication	5
• Leadership	4

Table 8: *What skills must be acquired during training for successful practice?*

5.6.3.2 What skills are in need of ongoing development after initial training? (Table 9)

Eleven participants commented that the ability to effectively triage and treat patients, and work in a mass casualty environment, were the skills most in need of ongoing development. *“Practicing triage on a large scale is difficult...there are limitations with the amount of mannequins and casualties that can be set up”* (Participant D). Participants reflected on real-life experiences in this regard *“...as we’re seeing with 7/7 (London Bombings 2005) people are now coming back and questioning the triage decisions which were made in trying circumstances”* (Participant I). Other participants commented on the approach to multiple-casualty scenarios *“we need more training experience of big incidents where there are lots of casualties...mostly we see smaller numbers”* (Participant A). Command and control together with multiagency training was discussed in some detail *“we can’t always get this multi agency arena to exercise in, so we can’t train often with police and fire... when it does happen the feedback you get from the guys who have done the training on the day is brilliant, I didn’t know the police could do this, we didn’t realize the fire service could do that”* (Participant E). Hazardous environment work was also mentioned as an ongoing training need. Nontechnical skills were mentioned less frequently, although their importance was stressed by those who discussed these areas *“We’ll tend to find when things are going wrong is because they haven’t communicated or they haven’t worked together to achieve an outcome, so this needs to be improved”* (Participant D).

	No. of participants mentioned
Technical / Operational Skills	
• Triage and Treatment	11
• Working in a mass casualty environment	11
• Hazardous environment working	8
• Command and Control	8
• Multiagency training	7
Non-technical skills	
• Teamwork	7
• Communication	6

Table 9: Which skills are most in need of ongoing development after initial training?

5.6.3.3 Factors that promote ongoing learning (Table 10)

Four factors were mentioned that promote ongoing learning. The most commonly mentioned was having a training officer at the team base to facilitate formal and informal learning sessions. Participants also discussed the value of formal, structured debriefing after events or training sessions “*I think having a structured debrief after every event is really helpful...you can learn a lot more from the rest of your team*” (Participant E). Half of participants discussed the availability of resources being essential for many training exercises “*Sometimes it can be difficult to schedule training with other agencies, and then you need to have the equipment available to run an exercise....often it is in use*” (Participant C).

	No. of participants mentioned
• Training officer on site	9
• Structured debriefing after an event or training session	8
• Fixed training timetable	7
• Sufficient access to physical resources (vehicles, equipment, multi-agency partners)	6

Table 10: Factors promoting ongoing learning

5.6.3.4 What could virtual environments add to training? (Table 11)

Participants discussed ten areas of practice that they believed the use of virtual worlds could enhance. The ability for improvements in debriefing was mentioned by eleven participants *“recording the incident will give you a great opportunity to see what you did and how the rest of the team worked...it would be a great asset for debriefing”* (Participant B). Ten participants discussed using virtual worlds to increase exposure to clinical scenarios and in particular the ability to triage large numbers of physiologically changing casualties in real time; *“(it) could show symptoms and signs in a way that is not possible on a live exercise...we don’t have the ability to train with patients whose state changes during a scenario”* (Participant J). Analysis of decision timelines was also felt to be important *“you’d be able to see how long it took for decisions to be made, why this was the case, and the impact that had on the eventual outcome”* (Participant H).

There was a great deal of discussion around the potential for virtual worlds in setting up training scenarios that are difficult to execute in real-life. Examples mentioned included live ammunition firearms scenarios, explosion-related incidents and incidents that cover a large

ground area *“often the live exercises that we do are impeded by physical space. If you could build something that gives you that distance it would be more realistic”* (Participant E).

Eight of the interviewees discussed the potential of virtual worlds to increase accessibility of training. *“Having an opportunity to log on (from the base) and exercise with other paramedics all over the country would be fantastic”* (Participant K). The potential use of intra-agency training was recognized, should there be a mass casualty event *“if the big day comes and we’re all working as mutual aids, we’ll have a better understanding of what we’re doing”* (Participant G). Improving the accessibility of inter-agency training was also mentioned, especially with regards to the command and control aspect of an incident. *“The bit that they don’t get exposure to and is difficult to simulate, is the command and control aspect and therefore for me this (virtual world) is probably the biggest benefit”* (Participant A).

Other benefits cited included risk assessment, the ability to perform a variety of different roles in a scenario and also the potential for virtual worlds be used for assessment purposes; *“It would be really useful to record and play back what you did and didn’t do”* (Participant F).

	No. of participants mentioned
Improved debriefing (peer and trainer-led)	11
Increased exposure to clinical scenarios (including triage)	10
Exercising in inaccessible environments	9
Assessment opportunity	9
Ability to train in a chemical/biological/radiological/nuclear/other hazardous environment	8
Increasing availability of training	8
Multiagency exercises	8
Mass casualty exercises	6
Risk assessments of scene	5
Ability to perform variety of roles	3

Table 11: What could Virtual Worlds environments add to training capability?

5.6.4 Discussion

Pre-hospital major incident responders have to be able to work in a wide variety of stressful and challenging environments, encountering numerous potential hazards and functioning with people and teams that they may not work with on a regular basis. This cohort of the user-needs analysis indicates that pre-hospital hazardous environment response requires a specific and complex set of skills in addition to a standard set of clinical paramedic or ambulance technician competencies. Consensus was evident within the study on the need for high quality, accessible, ongoing training to ensure that these skills are maintained and further developed, with appropriate feedback and debriefing provided to pre-hospital practitioners.

This section of the user-needs analysis highlighted areas of skill development that were required by pre-hospital practitioners on an ongoing basis, many of which were difficult to cover using current training modalities. In this context, virtual technologies were seen as a potential way forward in pre-hospital training. This view is consistent with previous small-scale pilot studies carried out in the UK and USA.^{21, 33, 34} Participants felt that virtual worlds offered potential to meet many of the current training hazardous area training requirements, in addition to the modalities already utilized.

5.7 User needs analysis: In-hospital response

Expert views were sought on factors that promote effective in-hospital training and preparation for major incident response. Areas in which novel, virtual simulation technologies can be utilized to augment current training were then explored, to form part of an evidence-based approach to the development of virtual environment simulation.

The interview protocol was divided into four sections:

1. Aims of existing tabletop exercises: what type of skills are they targeting?
2. Benefits of current tabletop exercises: what are their key strengths?
3. Determinants of success of current tabletop exercises: what makes an exercise useful and what are the barriers to successful tabletop major incident training?
4. Potential for novel simulation technologies to contribute to major incident training: what is the role of virtual worlds?

5.7.1 Participants

Senior clinicians, hospital managers and specialist emergency planners from three major teaching hospitals and NHS Authorities (NHS London, Imperial College Healthcare NHS Trust, The Royal Free London NHS Trust), were contacted in writing by a researcher (DC) and invited to participate. Participants had to have taken part in a tabletop, seminar or orientation major incident exercise in the previous calendar year to be eligible for this study. Participants were given an information sheet, including pictures of virtual environments, at the time of recruitment and provided informed consent prior to data collection.

5.7.2 Primary data analysis was performed as per section 5.6.2.

5.7.3 Results

A total of 14 expert healthcare professionals were interviewed – and theme saturation in the interviews was reached satisfactorily. Six participants had primarily managerial roles (referred to as participants M1-M6) and eight had senior clinical roles (C1-C8). All participants had 5 or more years of experience of working in the UK NHS and had been involved in training and planning for major incidents. All participants had been involved in a major incident response previously (including the London bombings of July 7th, 2005).

Study findings are reported based on the interview protocol, as follows: (1) Aims and benefits of current exercises; (2) Factors that determine the success of an exercise; (3) Potential uses of VW simulation technologies.

5.7.3.1 Aims of current exercises

The aims and benefits were categorized into three major themes; Organizational, Interpersonal and Cognitive (Table 12).

There was a consensus amongst that the aim of current major incident preparation exercises was organizational in nature, aiming to aid planning and preparation of a future response.

“The aim is testing the resilience of the existing plan and you're ability to implement it”

(Participant M6). The main benefit was the ability to see the plan in action, albeit in a simulated environment. Aims varied depending on current local or national guidelines and risk assessments. Ten participants stated that their own hospital major incident plan had been remodelled after a tabletop exercise.

Participants acknowledged that a hospital major incident plan was too big to test or train in its entirety in a single exercise without causing significant disruption to the daily business of the hospital. Therefore, most exercises aim to test specific areas of a plan. *“They try to exercise different parts of the system...they can't do it all at once”* (Participant M5).

Communication systems testing and knowledge was commonly identified as an area of weakness in a response which was thought to be the area which needed the most planning.

“Communication on all levels. That's where we always seem to fall down when it (a major incident) happens. It is very different from everyday practice” (Participant M4). One interviewee said that the need for improving communication was so important that the

underlying aim of every exercise, no matter the size or the context, is always “*Command, Control and Co-ordination*” (Participant M2).

In addition to testing of the current plans, participants commonly mentioned familiarization with major incident documentation and improving patient distribution processes (flows) as being key aims of the exercises. Respondents concurred that there was more emphasis on organizational learning than that of individual staff members; only two participants stated that individual training was a specific aim of the exercise.

Development and assessment of interpersonal skills and cognitive skills were highlighted as clear aims by ten participants, and highlighted as being beneficial by similar numbers.

Individual communications was frequently mentioned, as was establishment of a working relationship with team members and an understanding of the roles of the team: “*That build up of trust is vital when you walk into the room. It’s about understanding how you fit into everybody else’s role and what your responsibilities are*” (Participant M2).

Emergency Department staff felt that other acute medical staff and external organizations caused organizational problems during an incident, and felt that response planning needed to focus more on these groups. “*A lot of the time, our internal staff really know what to do but it’s everybody else descending on the place that creates problems*” (Participant C8).

Development of situational awareness, learning to manage stress and decision-making in times of a major incident was the most commonly-identified cognitive skills. The tabletop environment was thought to be especially useful for this skill development. *“What was realistic about the last tabletop was the uncertainty of not having all the answers yourself and not being able to see the full system. You get the same sort of stresses that happen in a real incident and you have to make the same difficult decisions”* (Participant M4).

Training in clinical aspects was only highlighted by six participants. The lack of clinical input in largely management-based training scenarios attracted negative comments from both clinicians and managers. *“(These exercises) assume that people can perform the clinical roles effectively, without testing it”* (Participant C5) and *“There is an assumption that senior clinicians know what to do in a major incident, but often they don’t...they are often the people who don’t come for training”* (Participant C7).

	Number of participants mentioned
Organizational skills Testing of current plans and modification Familiarization with documentation Identification of training gaps Management of patient flows Communication systems testing	12
Interpersonal skills • Clarification of responsibilities and roles (individual/team) • Communication (individual/team) • Leadership/Command • Developing relationships with others • Multi-team and multi-agency working • Staff and Physical resource management	10
Cognitive skills • Situational awareness • Management of team/department • Decision-making and task prioritization • Risk assessment • Experience of stressful working environment	10
Triaging/Medical management	6

Table 12: Aims of current exercises: what skills do they aim to train and develop?

5.7.3.2 Factors that determine the success of an exercise

Participants generally found it difficult to define what made an exercise successful – i.e., to define clear criteria (Table 13). Emerging themes reflected educational factors, mentioned by eight participants, and environmental/organizational factors, mentioned by five participants.

Three educational measures of success were identified; objective learning measures before the exercise commences, structured analysis and the provision of individual feedback to participants. These were felt to improve the individual learning and benefit from an exercise. *“There was one exercise where we had external observers who gave you feedback afterwards. That was really useful”* (Participant C1).

A third of participants mentioned that the occurrence of a real-life major incident facilitated exercises. *“A major event puts major incident planning at the top of the agenda”* (Participant M5). Exercise topics or scenarios were created based on real-life occurrences. For example, one participant spoke of an exercise where all communications had to be done face to face or by passing notes with runners to simulate the effects of a telephone network failing, as happened in the July 7th bombings in London.

Interestingly, it was easier for the participants to identify the barriers to running a successful exercise. Ten participants felt that there was a real issue getting hospital staff to take part, especially those in senior positions, and that there was not enough emphasis on major incident training and preparation. *“Major incident training is not given high enough priority...higher level people often send deputies to exercises”* (Participant M6). Encouragement of hospital leaders to attend exercises was thought to be important in overcoming this barrier.

There was no specific question in the interviews about the existing EMERGO exercise. However, many participants were aware of it and commented negatively about the lack of

individual feedback and the value for money of exercises like EMERGO *“They seem to have cornered the market for these exercises...I do feel it is just a ‘tick the box’ to say we’ve done it”* (Participant M6). In fact, poor quality, unsystematic feedback was commented upon for all types of exercises. A particular difficulty was feedback to higher level people, both clinicians and management. *“It can be difficult to assess people at the top and get them to admit mistakes”* (Participant C3). There was a consensus that there was no objective method of assessing the quality of response or the learning for organizations or individuals. *“A common practice is to have a debriefing session, writing of a report and appropriately altering major incident plans. However, lot of the time it is down to the individual to take away what they require”* (Participant M5).

An identified training barrier specific to the Emergency Department was the constant rotation through the Department of junior doctors and nurses who had fixed hours of work. *“We have such a rotational group of staff...and they’re very inflexible. I think that is a big hurdle”* (Participant C3).

	Number of participants mentioned
Educational factors Individual feedback Structured analysis Objective learning measures	8
Environmental/Organizational factors A recent major incident Input of a specialist to write the exercise Specialist emergency planners Encouragement of hospital leaders	5
What are the barriers to running a successful exercise? Problem getting staff to take part Time taken to run an exercise Other organizational barriers - Constantly changing staff - Space constraints - Lack of funding/exercises too expensive	10 5 6

Table 13: Factors that determine the success of a tabletop exercise

5.7.3.3 Potential contribution of novel Virtual Worlds technologies

All participants felt that VW technology could contribute positively to major incident training and planning exercises in some form (Table 14). The most positive response was in improving the accessibility and output of training. *“That is a major advantage, the ability to train large numbers of staff”* (Participant C1). Participants felt that the VWs would allow the development of small and large incidents that would be easily accessible and reproducible. An interesting observation was that virtual environments could allow training in environments in which training would not be possible in real life, both within and outside the hospital. It also provides the ability to replicate real-life incidents for training.

Participants identified that capability of recording and replaying exercises (provided by VWs) would allow improved feedback tailored to both individuals and groups. “*The improved debriefing potential is massively valuable*” (Participant M2). This was felt to be advantageous over the current training methodologies. “*Individual participant analysis would add hugely to the learning experience*” (Participant C1).

Eleven participants commented on the benefits of virtual worlds providing a more immersive simulation environment than current tabletop or EMERGO exercises. The same number discussed potential organizational benefits of using VWs. These included an improved understanding of command and control structures, improved knowledge of the multidisciplinary team response and the ability to visualize patients moving through the hospital system in a realistic timeframe. Participants also felt that there would be economic benefits in using VWs, as fewer trainers would be required to facilitate simulations, which could be replicated numerous times.

Half of participants commented on the potential for improved non-technical skills training (e.g., communication, leadership, team coordination), in areas including those mentioned as being deficient in current exercises – particularly communication.

Adding clinical cases to exercises was also thought to be useful “*combining a clinical scenario with a managerial type tabletop scenario would be useful....better engagement, I think you’d have more clinical people willing to join in, rather than being top heavy management*” (Participant M1).

	Number of participants mentioned
Improved visualization/realism compared to tabletop exercises	11
Improved accessibility and output of training Improved feedback Easily reproducible exercises Increased opportunity and Flexibility to train Ability to replicate real life incidents Exercises on both small and large scales	14
Organizational benefits Improved understanding of roles of multidisciplinary team Improved understanding of command and control structure Visualize patient flows through a system Ability to train in real-life replicated environment Reduced cost and number of trainers	11
Improved non-technical skills training (Interpersonal/Cognitive Skills) Leadership Communication Decision-making Coping with distractions Stress management	7
Addition of clinical cases Opportunity to train in clinical skills Link progression of clinical cases to management of incident	8
Potential problems of using Virtual Worlds technology Computer technology or access in NHS is not good enough Older staff may not engage Loss of face to face working	10

Table 14: Potential contributions of Virtual Worlds technology to major incident planning and training exercises

Participants did raise potential problems of using the virtual worlds for simulation and training. In particular, there was widespread concern that the NHS did not have computers of sufficient standard to run the virtual worlds smoothly. There was also concern that older staff and those who were less computer-literate would be reluctant or unable to utilize.

5.7.4 Discussion

This study indicates that current major incident exercises have to fulfil multiple purposes, but are not necessarily designed or equipped to do so. It reinforces the findings of previous studies across the developed world that there is a pressing need to improve major incident response training.^{263,286} There appears to be a discrepancy between the needs of acute healthcare services to prepare for a major incident and the needs of staff to develop their individual skill set. Clearly both these needs must be met to maximize the effectiveness of major incident response. In the light of these findings, it is perhaps unsurprising that our participants found it difficult to clarify the factors that make such exercises successful – those who did, however, discussed individual or team development, rather than the outcome of the exercise in relation to the hospital.

The organizational, interpersonal and cognitive themes identified all reflect the skill set that staff are required to use in the event of a major incident. Communication skills (at the level of the individual, but also at the level of an entire organization) were particularly highlighted – thereby replicating the recommendations of past major incident reports.^{107,287,288} Performance feedback was deemed of paramount importance by our expert participants, and was noted to be a serious limitation of current exercises, at individual, team and organisational levels.

Virtual environments were received positively and were felt to have potential to address some of the shortcomings of current exercises. For example, scenarios that are currently purely management focused could now have an additional clinical focus, by utilizing virtual patients, which have been described and validated previously.²⁸⁹

5.8 Limitations of the interview studies

Whilst these interview studies were carried out in a systematic manner, there are some limitations. Firstly, the sample size was small for both groups, although sufficient by qualitative research criteria as thematic saturation was reached in the interview study. Secondly, the pre-hospital group questioned were from a well-resourced, highly skilled group of ambulance practitioners and it is possible that their responses may not reflect the wider training needs of the pre-hospital care community. However, the themes discussed are generic, reflect previous study and real-life reports and therefore have relevance to pre-hospital responders from different agencies throughout the United Kingdom and potentially Thirdly, the In-Hospital participants were all recruited from within the greater London area, which was for both convenience and to tap into the huge experience that London healthcare providers have in major incident response. Given that guidance for major incident planning and training is national, we believe that these findings do apply to the rest of the UK. Finally, the interviews rely on participants' self-reported views, rather than a more objective analysis using structured observations of exercises in situ. Observational research would certainly complement and validate the findings reported here. Such observations, however, do have their own limitations, such as reliance on the exercises being carried out, which is not a regular occurrence; in addition, observation of an exercise may alter participants' behaviours.

5.9 Conclusions

5.9.1 Current training and preparation modalities

The chapter has demonstrated that current modalities of training, whilst valuable in many respects, are sub-optimal in terms of accessibility, cost and reproducibility, especially for multiagency working and skills assessments. This adds to the evidence from major incident reports both in the UK and internationally which have described the need for improved multidisciplinary training and preparation modalities. Skills assessment and feedback is a key aspect of training which could benefit from recent developments in the domain of non-technical skills training and assessment within the healthcare literature.^{22,57,90,92,290} Training packages that involve simulation and validated performance and skill assessment tools have been developed, validated and evaluated in other healthcare fields – these could inform a similar approach to major incident training.^{41,62,83,87} Key to the success of any future training package would be the incorporation of relevant skills and competencies identified in recent reviews of major incident response.^{263,286,291}

5.9.2 The role of virtual environments

The chapter has also demonstrated that novel virtual environments have potential to act as an adjunct to current training modules, and there was clear enthusiasm for their use in both the user groups and advisory board. With adequate effort to address concerns about engagement of staff and IT facilities, virtual environments appear an exciting prospect for future multidisciplinary major incident training and preparation applications. The feasibility of such modules remains to be established – so as a logical next step, the following chapter

draws on the multi-source evidence described to design a proof-of-concept virtual major incident training environment.

6 DESIGN AND DEVELOPMENT OF VIRTUAL ENVIRONMENTS FOR MAJOR INCIDENT PREPAREDNESS

6.1 Overview

This chapter aims to determine the feasibility of evidence-based design and use of low-cost virtual world environments for preparation and training in multi-agency, multi-site, major incident response, using low-cost virtual environments.

6.2 Introduction

The previous chapter discussed the current status of major incident training and preparation at pre-hospital and within-hospital levels. The systematic approach revealed concerns and deficiencies with current methods, in terms of accessibility, reproducibility, cost and performance assessment. Virtual environments were felt to have potential to act as an adjunct to existing methods.

Prior studies have established the feasibility of utilising virtual environments for healthcare professional education. Dev and colleagues at Stanford University demonstrated the use of the Atmosphere (Adobe, USA) and OLIVE platforms (Forterra Inc, USA); two virtual emergency departments were created and triage, crisis-management and trauma scenarios developed. The studies utilised avatars played by real-life actors and had very limited physiological modelling. Furthermore, there was no validation of the environments and

limited attempts at utilising performance metrics. Neither platform is currently in use for medical training at the time of writing; nevertheless, these studies made an important contribution to the development of virtual environment research.

Conradi and colleagues demonstrated the feasibility of utilising a low-cost, freely accessible virtual world, Second Life (Linden Lab, USA), for medical training.²⁹² Paramedic students were asked to work in small groups to assess and decide on management plans for avatar casualties as part of an innovative problem-based learning course. Interaction with casualties was limited and communication was text-based, which limited the scope of the study, although feedback from participants was generally positive. More recently, Patel and colleagues at Imperial College London have developed operating student inductions, virtual surgical patients and medical device simulators in Second Life.^{102,293,294} These studies demonstrated the capability of voice communications and complex physiological modelling in low cost virtual world and validation of scenarios, together with knowledge and performance assessment of participants.

To date there has been no attempt to create multi-user, accessible, recordable and validated scenarios for multidisciplinary professionals in the field of major incident response. This chapter reports the design, development and evaluation of a novel approach to major incident response planning and training based on virtual environments.

6.3 Methods: Design and development of training scenarios

As discussed in the previous chapter, an evidence-based, user-driven approach was adopted to ensure that the scenarios created would not only be face and content valid, but also relevant to the current training needs of emergency responders in the pre- and within-hospital setting. The design, development and evaluation of the scenarios were carried out in 3 phases:

Phase 1: scenario specification: As described in the previous chapter, an expert advisory group was convened, with the purpose to identify training priorities for which virtual environments could be appropriately utilised. Participants all held prominent local or national roles in the emergency services, emergency or trauma medicine, and in the military within the UK. There was also representation from the security services and organisers of the 2012 London Olympic Games.

Phase 2: scenario design: Three scenarios were created to illustrate the capability of running a continuous, fully reproducible, recordable, multi-agency major incident exercise in real time across multiple sites. Scenarios were created on Second Life and OpenSimulator virtual platforms, utilising externally located modelling software to manage virtual patient physiology where required. Second life was chosen as it was deemed a stable platform, was low cost and had appropriate graphical fidelity; we also had experience of successfully utilising second life for previous projects. OpenSimulator is a non-proprietary virtual environment; it is free to use but requires more technological expertise than Second Life to

develop physical environments. OpenSimulator is also more secure as it can be held on an internal server. All the intellectual property remained with our group.

Phase 3: scenario evaluation with expert users: All three scenarios were tested at Imperial College London using HP Probook 4530s Notebooks containing a dedicated AMD Radeon Graphics Card. Scenarios were observed live by HART, trauma and emergency planning trainers as appropriate, as well as a patient safety and human factors expert (NS). In all three scenarios, participants were sat in isolation, in order that all audio and visual communication took place within the simulated environment. Participants had a short familiarisation session with the software immediately prior to testing; the scenario did not start until participants stated that they were comfortable with the software. After the testing, participants were asked to provide feedback. 5 point Likert scales were used to determine level of agreement with written statements on the participant experience (1=strong disagreement and 5=strong agreement). Participants provided verbal feedback on their experience via a semi-structured interview which asked for their views on the potential of the virtual environment for feedback, debriefing and future scenario development.

6.4 Results

6.4.1 Phase 1: Scenario specification

As described in the previous chapter, the expert advisory group came to a consensus that there was a need to examine the feasibility of virtual worlds in both pre-hospital and within-hospital major incident response, specifically focussing on triage, acute clinical response and acute hospital response. If successful, this would demonstrate proof-of-concept across

bronze and silver response levels. The views of the group were corroborated with the findings of two user-needs analysis studies, existing training syllabuses and published academic and grey literature.²⁹⁵⁻²⁹⁷

6.4.2 Phase 2: Scenario design

The scenarios can be viewed online at www.rockhopper.tv/films/deatil/2nd-life-major-incident-training and www.bbc.co.uk/news/world-radio-and-tv15017142

6.4.2.1 Scenario 1: The pre-hospital response

The pre-hospital response scenario was tested by twelve invited members of the Ambulance Hazardous Area Response Team (HART) recruited from around the UK (H1-12). HART trainers and UK Army medical staff with experience of blast injuries were closely involved in scenario development to ensure face validity of the scene and casualties.

The scenario was created using OpenSimulator and run on a secure server hosted by Imperial College London. A schematic of the scene can be seen in figure 29. The layout was approved by members of the advisory board, UK army medics and HART trainers prior to inception. Skype (www.skype.com) was utilised for all verbal communication, using radio call signs. The scenario incorporated a 3D soundscape with realistic sounds emanating from traffic, equipment and casualties. The casualty noises gradually reduced as they were progressively discovered, treated and moved to the casualty collection point. The scenario begins with the aftermath of a suspected dirty bomb explosion outside a sports stadium. An

emergency cordon has been put in place, and walking wounded casualties have been moved from the scene. Within the cordon, casualties with varying injuries were located around the blast crater and nearby buildings, some of which were unsafe to enter. The HART team leader receives a briefing from the fire incident officer at the scene and is then required to brief his/her team and instruct them on appropriate personal protective equipment (Figure 30). The HART participant assigned to triage worked as a pair with an actor, played by an Imperial College staff member, inside the cordon; the actor was instructed to only respond to instructions from the HART participant. The HART participant inside the cordon was required to identify, triage and treat casualties as appropriate, before moving to a casualty collection point and handing-over the patient (figure 31).

Two versions of the scenario were created, each with different casualty injuries and layouts to enable each HART participant to perform team leader and triage paramedic roles.

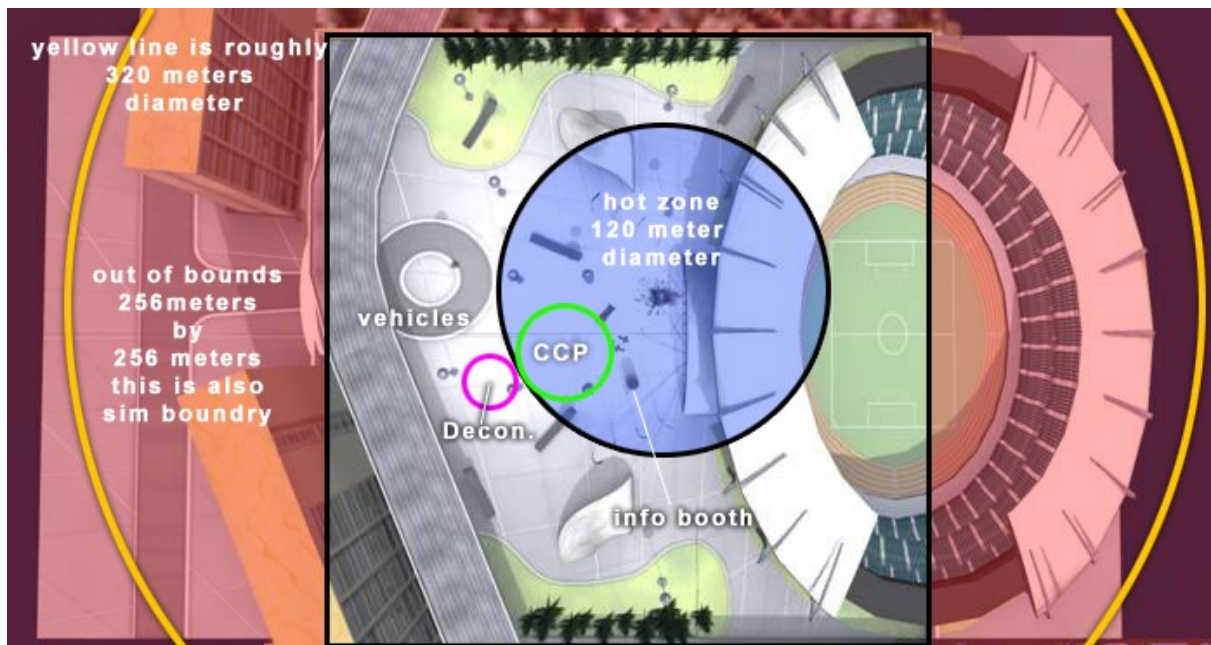


Figure 29: Aerial view of stadium and surrounding area. Blast crater is visible in hot zone.

Decon = Decontamination Area; CCP = Casualty collection point.



Figure 30: Two Ambulance HART practitioners wearing personal protective equipment at the inner cordon with the Fire Incident Officer. The red equipment bag contains medical supplies and equipment; the yellow bag contains oxygen.

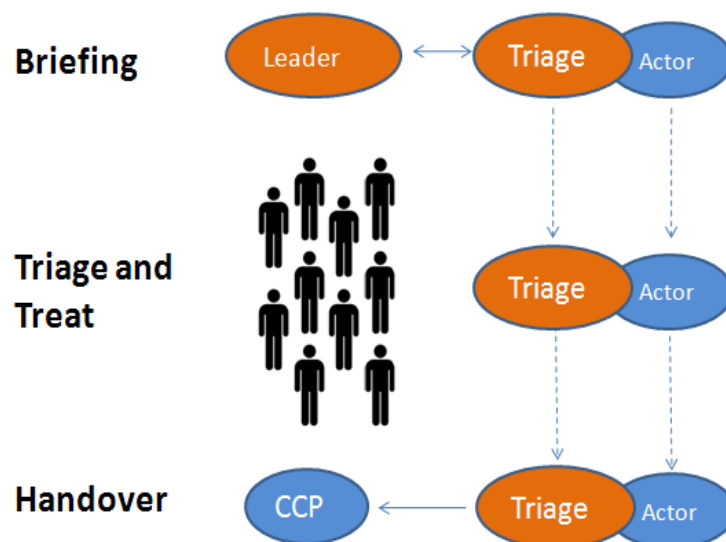


Figure 31: Schema representing the three stages of Scenario 1. The orange roles are played by HART members; the blue by actors from Imperial College London.

During the scenario, HART practitioners were constrained by the same resources available in real-life; the virtual equipment bags contained exactly the same quantity of equipment as standard issue kit, and the team leader had a video view of the scene from the incident truck, as would be the case at a real incident.

Virtual casualties exhibited realistic visual cues as to their injuries and some were able to communicate verbally, depending on their clinical state. A simple point and click interface was developed; this provided textual information when clicking on a patient, and enabled utilisation of equipment located in the oxygen and medical bags (Figure 32). Some casualties were modelled to die if treatment was not given in a timely or appropriate manner. Casualties could be rolled from front-to-back, sat up, or laid flat. The scenario ended when all casualties were moved to the casualty collection point and handed-over to an actor playing the role of a HART team member.



Figure 32: Treating a casualty with an amputated limb next to the crater. Oxygen has been given (white dotted line).

6.4.2.2 Scenario 2: In-hospital trauma

The second stage, a multi-user trauma scenario, takes place in a resuscitation room, which was based on the St Mary's Hospital London Major Trauma Centre. Second Life was chosen for running this scenario; it is a low-cost, easily accessible, stable environment, supporting clear voice interaction.

The scenario required a physiologically responsive virtual patient that could undergo simultaneous investigation and treatment by all members of a trauma team. Existing web-based virtual patient design is limited by decision-tree logic and would not have been fit-for-purpose. This was overcome by development using the Eclipse modelling framework and the Jeewiz code generation facility to build the virtual patient logic as a structured data model.^{298,299} This automated model, previously demonstrated as a single-user proof of concept, controls the patient physiology within the virtual world according to defined criteria. Clinician decisions and preset timed events alter the state of the patient in the virtual world via this model. The framework has been designed in order that clinicians can remodel the patient physiology without requiring computer programming expertise. The physiological parameters were approved after design by a senior emergency department consultant with experience of major trauma, and UK army medics with recent experience of combat trauma injuries in Afghanistan.

The scenario was tested by six current trauma team leaders (T1-6), all of whom held an Advanced Trauma Life Support (ATLS) certification.²⁹⁶ The trauma team comprised of

three ATLS qualified clinicians, playing the roles of anaesthetist, emergency department doctor and surgical senior house officer (figure 16).

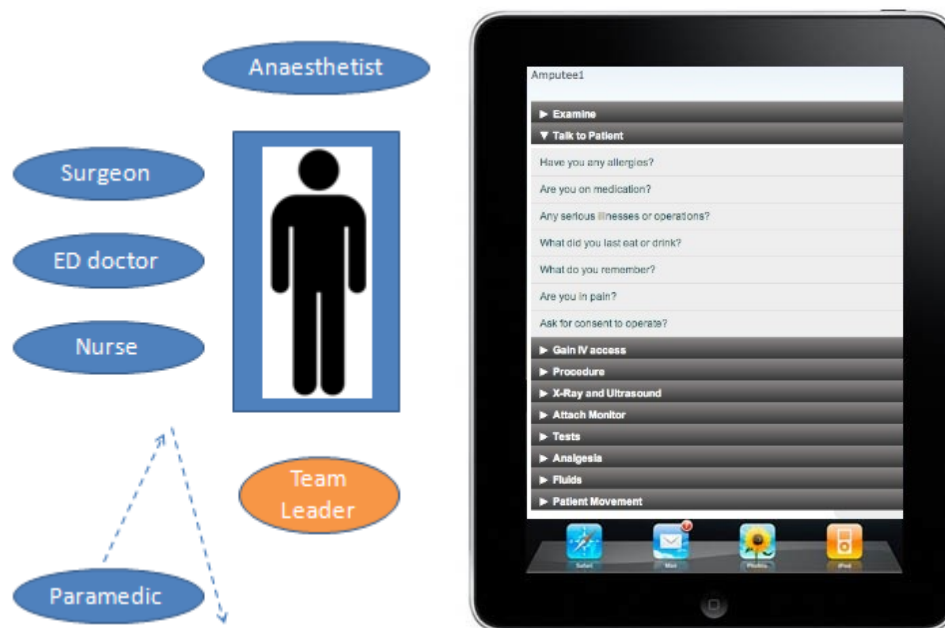


Figure 16: The layout of the trauma scenario. Trauma team members (blue) are played by clinicians from Imperial College. The iPad (Apple, USA) shows the interactive trauma menu, which can be utilised by all team members concurrently.

The virtual trauma patient, a 31 year old male with a blast amputation injury to his left lower leg and occult cervical spine fracture, was developed with expert input from UK military physicians and an ATLS instructor (figure 34). As in a normal trauma moulage scenario, the team leader gives verbal instructions to the trauma team to take a history, examine the patient, order investigations and prioritise management. A web-based menu system, accessible from a computer or tablet device, enables the team to carry out the instructions via their avatar. Questioning of the patient results in text-based answers visible

to all team members. Focused examination (e.g. chest auscultation) reveals a private message to the performing clinician, who then relays this to the team. Any examination or investigation that could be seen by trauma team members in a real-life situation would be visible in the virtual environment (e.g. examination of the amputated limb).

The entire team are able to visualise live physiological changes in the patient in real-time virtual monitors and the respiratory rate can be observed. Observations change in real time due to intervention, such as oxygen therapy or fluid management. Interventions such as central line placement and cervical spine protection are displayed graphically, altering the appearance of the patient (figure 34). Investigation results are displayed virtually using real-life media; radiographs are imported onto display screens and a blood gas analyser displays and prints results.



Figure 34: The trauma team treats a patient; real-time physiological changes are displayed on the monitor.

6.4.2.3 Scenario 3: Silver command

The third scenario focused on the role of the Silver commander/Clinical Major Incident Co-ordinator in the resuscitation room of a trauma centre during a major incident (Figure 35).

Both the advisory board and user-needs analysis identified the need for immersive, real-time, cost-effective method of command and control exercising for tactical (silver) and strategic (gold) emergency response. The aim of the scenario was to establish the feasibility of exercising a combined senior clinical-managerial role in a virtual environment.

The role description was developed using the major incident plan for St Mary's Hospital, London. This plan has been exercised and revised on multiple occasions, notably during the Edgware Road bomb (2005) and Paddington rail crash (1999). The scenario was scripted by an experienced NHS major incident planner (NB), based on recent tabletop exercises and real-life events. The role of the silver commander was combined with that of the clinical major incident co-ordinator (CMIC) for the purposes of this exercise.

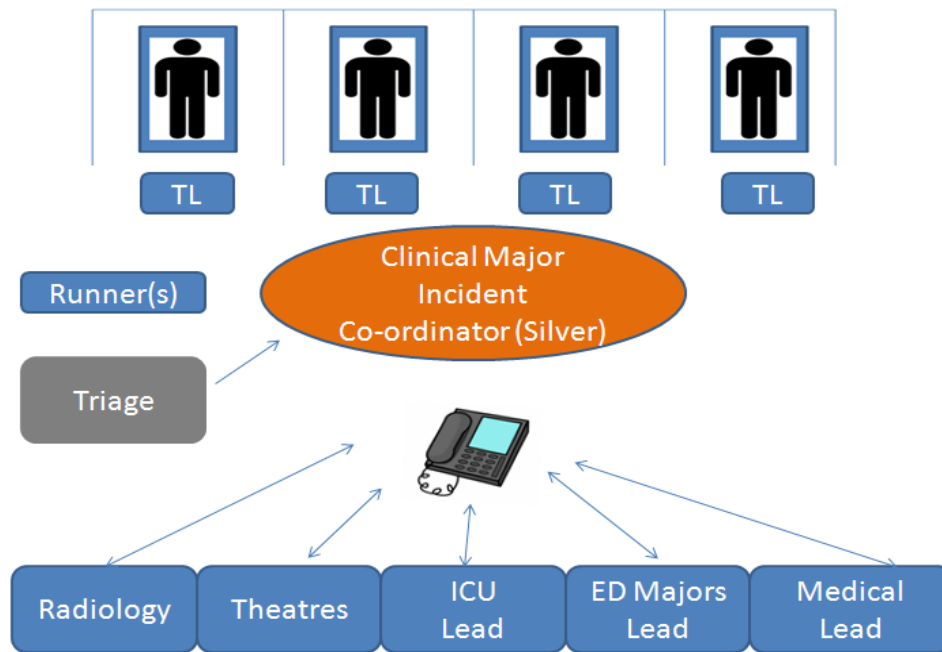


Figure 35: Schema of scenario 3 showing the activities and relationships of the clinical major incident coordinator. Communication was by voice; either avatar to avatar or by virtual telephone.

The scenario is a continuation of the previous themes: a bomb blast outside a sports stadium has resulted in a sudden influx of casualties to a busy Emergency Department. The Silver commander/CMIC must ensure the smooth running of the resuscitation room by liaising with trauma team leaders and specialist colleagues to expedite appropriate investigations and management plans. Roles for radiology, theatre co-ordinator, intensive care, anaesthetics and acute admissions were devised. Communication all took place within Second Life; a telephone was created in-world to communicate with other departments, a virtual runner was available when required, and avatars representing emergency department clinicians were present (figure 36).



Figure 36: The clinical major incident co-ordinator talks to the runner during scenario 3

Five Emergency Medicine Consultants accepted an invitation from the chief investigator to take part (S1-5). Each played the role of a silver commander after being orientated into the virtual environment. The roles of the runners, specialties and trauma team leaders were played by medically-qualified actors where appropriate. The scenario was semi-scripted in order that the system could become stressed at appropriate points. For example, unexpected referrals from triage, non-contactable theatre staff and difficulty with bed availability were some of the stressors in the script. The scenario ends when all stressors have been placed and responded to by the participant.

To facilitate the testing of all three the scenarios a user guide was developed for facilitators, containing technical setup and practical details on how to use the software and avatars. This can be found in Appendix 8.

6.4.3 Phase 3: Scenario Evaluation (Table 8)

In total 23 expert participants were recruited, all of whom took part in a single scenario. All scenarios were completed to the designated end-point. Scenarios took between 18 to 33 minutes to complete.

21 of the 23 participants had little or no experience of playing computer games, but this was not found detrimental to carrying out the virtual exercises. The vast majority of participants felt that the virtual world orientation provided to the scenarios was adequate (87%) and they could use the interface easily during the scenario (91%). Participants “agreed” or “strongly agreed” that the scenarios presented were felt to be realistic both visually (87%) and clinically (96%). Participants felt that the in-hospital scenarios would have benefited from more environmental stressors and distractions; *“In a scenario like this you can’t hear yourself think, there are bleeps and noise...and the department is full of people asking you all sorts of questions constantly (S4).”*

There was a wide-range of responses when asked whether virtual environment actions would mirror those of real-life (mean 3.26, SD 1.01). The participants who perceived their performance to be suboptimal attributed it to using novel technology: *“I’m sure performance would improve the more you get used to the technology...you’d react more like you would in real life (S2).”*

The virtual environment was felt to be a useful method of training by 96% of participants, especially for difficult to access, complex scenarios; *“we just can’t run scenarios like that*

for training...there is huge potential for mutual aid scenarios...we don't get much experience of that and it is difficult to train in" (H8). 11 of 12 HART participants believed that the technology could enable exercising in environments that are inaccessible for exercising in real-life. Participants from the trauma and silver scenarios commented on the utility of the virtual environment to complement existing training methods; *"this could be a great refresher prior to ATLS or working in a trauma unit"* (T1), or potentially replace existing methods; *"this is functionally much better than a tabletop or Emergo exercise...it could replace them"* (S3). The value of exercising in a realistic virtual environment was also noted; *"The (resuscitation) room looks incredibly realistic...it has a definite advantage when exercising in this way"* (T2). Participants reported that non-technical skills (e.g., leadership, communication, etc) could be simulated adequately using this environment (4.39). *"It would be fantastic see yourself performing on a replay – you would learn so much...current feedback from live exercises is pretty poor...Emergo doesn't really give any helpful advice"* (S1).

	Percent (%) “agree/ strongly agree”	Mean (range 1-5)	SD
Orientation			
The virtual world introduction was adequate	87%	4.04	0.824
I was able to navigate easily within virtual worlds	70%	3.74	0.688
I understood how to use the user interface	97%	4.00	0.603
Environment			
The visual portrayal was realistic	87%	3.96	0.638
The scenario was realistic	96%	4.26	0.540
The stressors encountered were realistic	74%	3.82	0.887
I would act the same way in real life	43%	3.26	1.010
Learning and assessment			
The virtual environment is a useful method of training	96%	4.57	0.589
The virtual environment is a useful method of assessment	78%	4.13	0.967
Learning from the simulation will be useful for everyday practice	93%	4.13	0.757
The scenario covered areas of my practice that I do not regularly train in	73%	3.82	1.336
The virtual environment enables training to take place in environments that are difficult/impossible to train in real life (HART only, n=12)	92%	4.5	0.674
Overall			
I enjoyed this simulation	91%	4.30	0.765
I would use a similar simulation again for training	95%	4.48	0.593
I would recommend this simulation to colleagues	95%	4.39	0.583

Table 8: Feedback summary (n=23)

6.5 Discussion

This is the first study to my knowledge to demonstrate the feasibility and acceptability of utilising virtual world environments for multidisciplinary, multiuser, major incident training, both in the pre-hospital and hospital settings. The feedback from this study, although small-scale, indicates that the virtual environment would be likely to improve immersiveness over Emergotrain and some tabletop exercises, placing participants into a realistic and stressful environment which can be based on their local, or novel surroundings. The response from the participants in this study indicates that the environments are appropriate and realistic enough to provide a setting for training, and possibly assessment, of decision-making and team skills in stressful environments, and associated non-technical skills, such as leadership and communication which have been identified as essential response competencies.^{107,240,248}

6.6 Limitations

There are limitations to the findings of this study. Firstly, the sample size was small, although three distinct groups of clinicians took part, all of whom gave feedback consistent with previous reports as to the potential future uses of virtual worlds in healthcare training. Also, the study population was from well-resourced healthcare institutions within the UK, all of whom have access or experience of simulation training. Further work is required to determine the feasibility of utilising virtual environments for training in less-well resourced countries, especially the developing world where other methods of simulation training may be much less accessible. Finally, whilst the face and content validity of the scenarios was established, should they be utilised for assessment purposes in the future, further work

would be required to demonstrate the construct and predictive validity of these scenarios, based on appropriate competencies for major incident response.

The study did not investigate participant behaviour in great detail. Fundamental to achieving a validated tool for training or performance measurement in the future will be the demonstration of correlating behaviour in the virtual world to behaviour in the real-world. Subjective self-assessment is a starting point, but validation of this approach is required. In addition, participants would have to be at ease with the technology and environment before any conclusions could be drawn.

6.7 Conclusion

This study has established the feasibility of developing low-cost, immersive, accessible virtual environments for major incident preparation using a systematic approach. The next stage, described in chapter four, is to establish the potential for performance assessment of both technical and non-technical skills in the virtual major incident environment, which are required for a quality major incident response.

7 SKILLS ASSESSMENT IN VIRTUAL WORLD MAJOR INCIDENT SCENARIOS

7.1 Overview

This chapter sets out to determine the feasibility of technical and non-technical skills assessment within virtual world environments, in the context of a major incident response. Suitable metrics are proposed and then utilised during live assessment of scenarios by experts and self-rating.

7.2 Introduction

A relevant set of standardised competencies has recently been proposed for healthcare personnel involved in managing major incidents, although there is a lack of validated assessment methods.^{242,286} The skills required for effective individual or team response may be very different from those practiced on a day to day basis, and these require frequent upkeep to ensure continued competence.^{300,301} Inadequate skills, competencies and preparation in healthcare personnel within the resource-constrained, time-pressurised, stressful and potentially hazardous environment of a major incident cause deterioration of response, poor decision-making and inadequate performance.^{234,236,302,303} Systematic training and preparation are therefore important to ensure an effective and safe response, at both an individual and organisational level.

It is currently uncertain to what extent current training methods improve major incident response or outcomes.^{300,304} There is little standardisation in the design and assessment of

exercises and a lack of standardised competencies makes formal assessment and feedback difficult.^{242,291,304,305} Lastly, accurate data capture in any exercise is challenging given the often subjective nature of the evaluations, and requirement for on-site expert assessors or later audiovisual recording and playback.²⁶³ There is therefore a need for novel methods of training and skills assessment using validated metrics.

This chapter evaluates the feasibility of technical and non-technical skills assessment within virtual environments, in the context of a major incident response.

7.3 Methods

The virtual scenarios, based around an explosion at a sports stadium, were described in detail in the previous chapter. To recap, the three scenarios were; on-scene pre-hospital response for ambulance staff; a trauma team working in a resuscitation room and finally a command and control scenario for the Emergency Department ‘silver commander’ – which represents a high level leadership role encompassing overall clinical and managerial control of the Emergency Department during a major incident response.

Expert assessors observed the scenarios live on screen and assessed technical and non-technical performance in a dedicated observation room. All participants completed technical and non-technical skills self-assessment forms after the scenarios were completed.

7.3.1 Scenario 1 - Pre-hospital response

Scenario setting:

A blast outside a sports stadium; suspicion of “dirty” element to bomb. Inner cordon established on scenario commencing. Estimates of ten non-mobile casualties at scene, with diverse injury profiles including airway obstruction, crush injuries and amputations. A point and click interface was developed to allow Ambulance HART to interact with both casualties and their equipment.

Actions at scene:

The Ambulance HART team leader receives a written briefing from scene commander. The team leader gives 9-point briefing to team and instructs team into appropriate personal protective equipment. HART triaging team admitted into hot zone by Fire Incident Officer. HART locate, triage and treat casualties according to realistic resource constraints, before handover at the casualty collection point.

Figure 37: an overview of the pre-hospital scenario

The pre-hospital scenario (Figure 37) focused on the Ambulance HART response to a potentially hazardous blast. The technical skills assessment proformas were compiled following discussion with HART trainers (MH, MV and DB) and personal attendance at a live HART exercise at Winterbourne Gunner. Technical skills assessment targeted three phases of the HART response: 9-point briefing, triage and treatment, and casualty handover performance. The standardised 9 point briefing is given prior to entering the inner cordon of an incident, and is taught during the initial HART training; it has been identified as being poorly performed both in practice and in the field. The 9-point briefing scale was extracted from the current HART training syllabus. Triage, treatment and handover performance was assessed using identified competencies based on the HART syllabus and national

ambulance service guidelines.³⁰⁶ Assessments were carried out independently by DC and a HART trainer (MV) following live observation of the scenarios.

Non-technical skills assessments were carried out using a seven-item competency scale based on clearly defined exemplar behaviours, assessed on a Likert-scale from 1 (unsatisfactory) to 4 (excellent). The scale was developed by an organisational psychologist (www.zealsolutions.com) specifically for Ambulance HART for use during individual recruitment. An alternative scale for non-technical skills assessment in paramedics has been proposed by Von Wyl and colleagues.³⁰⁷ However, after discussion with Ambulance HART trainers (MV and MH) and a non-technical skill expert (NT) the seven-item scale was utilised as it was felt to better reflect the unique nature of ambulance HART practice. Furthermore, the language of the likert scale utilised in the Von Wyl study was felt to be ambiguous, perhaps due to translation, and may have affected both self and expert raters' scores.

7.3.2 Scenario 2 – In-hospital trauma team

Scenario setting:

A casualty from a bomb blast is treated by a trauma team in the resuscitation room of a receiving hospital. The physiologically responsive casualty, based on a purpose-built structured data model, can undergo simultaneous investigation and treatment by all trauma team members.

Actions at scene:

The trauma team leader instructs a trauma team to investigate and treat the casualty according to realistic resource constraints, using web-based menus via a split-screen. The trauma team, consisting of an anaesthetist, surgeon and emergency department doctor, are played by medically-qualified actors. Clinical decisions and pre-defined events alter the state of the patient physiology, which is represented by real-time physiology monitoring on-screen.

Figure 38: an overview of the in-hospital trauma scenario

Skills assessment in the trauma scenario focused on clinical (technical) and non-technical skills of the trauma team leader (figure 38). Technical skills were assessed using the principles of Advanced Trauma Life Support (ATLS).²⁷⁸ ATLS is the gold standard, systematic approach to managing acute trauma in the developed world and is being increasingly utilised in the developing world.³⁰⁸ The ATLS instructor manual contains assessment and management forms for each of the scenarios utilised on the ATLS course.³⁰⁹ Participants are assessed against 6-10 critical clinical treatment decisions and a further 6-14 observed manoeuvres or decisions, which are scenario dependent. For this feasibility study, a modified form was created using the principles of the ATLS template and approved as being fit for purpose by two ATLS instructors and Emergency Medicine Consultants (NB and JL). Scenarios were observed and independently/blindly assessed in real time by an ATLS instructor and course director (NB) and ATLS provider (DC).

Non-technical skills were independently/blindly assessed by a human factors expert (NS) and ATLS instructor and course director (NB) using the recently developed Trauma NOTECHS scale (T-NOTECHS).³¹⁰ T-NOTECHS critically assesses five domains; leadership, cooperation and resource management, communication and interaction, assessment and decision making, and situation awareness/coping with stress; 27 illustrative exemplar behaviours related to these domains have been identified by an experienced trauma group.³¹⁰ The scale was initially developed for use in aviation and has reliability and validity in surgical environments.^{89,311}

7.3.3 Scenario 3 – In-hospital silver command/Clinical Major Incident Coordinator

Scenario setting:

The Silver commander/Clinical Major Incident Co-ordinator must manage the after-effects of a bomb-blast resulting in a sudden influx of casualties to a trauma centre. The four-bed resuscitation room is full; the condition of existing casualties deteriorates and new casualties arrive. The scenario encompasses both clinical and managerial responsibilities.

Actions at scene:

The Silver commander must liaise with trauma team leaders in the resuscitation room, specialist services (such as radiology, theatres and intensive care), triage and other areas of the emergency department to ensure smooth running of the major incident. Virtual telephones and runners were developed in Second Life to aid communication.

Figure 39: an overview of the silver command/CMIC scenario

The technical skills assessment document was created using the hospital major incident plan from St Mary's Hospital, London, UK; this has been used in a number of major incidents, notably the Edgware road bomb (of July 7th 2005) and the Paddington Rail crash (1999), and is revised and updated regularly. Key performance metrics were extracted from the role descriptions of the clinical major incident coordinator and silver commander roles in the major incident plan, and merged into a single role description. The role and actions expected were approved independently by an experienced major incident planner and an Emergency Department consultant (JL and NB). Five "critical decisions" were rated as performed (yes/no) and a further 12 performance metrics relating to actions involving

Radiology, Intensive Care, Theatres, the Emergency Department, the Acute Medical Unit and Specialties were assessed on 1-4 Likert scales (1=not performed, 4=satisfactory performance).

Non-technical performance was assessed using the T-NOTECHS scale as described for scenario 2. The NOTECHS scale has not previously been applied to combined clinical/managerial major incidents such as this scenario. The scale was deemed appropriate for use in this context given the applicability of the assessed domains. Both technical and non-technical skills were independently and blindly assessed by an experienced major incident planner (NB), a clinician (DC) and a human factors expert (NS).

A summary of skills assessment across all three scenarios is listed in table 16. All assessment documents are reproduced in full in Appendices 9-11.

7.3.4 Statistical analysis

All analyses were carried out using SPSS version 19.0 (SPSS, Inc, Chicago, IL).

Descriptive statistics were computed using total percentage scores (%) for all measures to allow comparisons between the different assessment metrics. No inferential analyses were carried out on these data due to small sample sizes. Inter-rater reliability between the expert assessors was calculated using intraclass correlation coefficients (ICCs) separately for the technical and non-technical skill scores. ICCs of 0.70 or higher typically indicate acceptable levels of inter-assessor agreement. The relationship between expert assessment and self-assessment of performance by participants was investigated using Spearman's rho between expert raters' and participants' own scores (to test for cross-validation). For all analyses, statistical significance was set at $P < 0.05$ or lower.

Scenario	Technical Skills Assessments		Non-technical Skills Assessments	
	Assessment Tools	Assessment Content	Assessment Tools	Assessment Content
Pre-hospital Ambulance HART	9-point briefing assessment; Competency areas defined by HART training syllabus (yes/no scale)	1. Introduction to the scene 2. General scene description 3. Current situation 4. Aims of operation 5. Execution of tasks 6. Command and control 7. Communications 8. Logistics 9. Timings	A seven-point competency tool, developed by an organisational psychologist for the initial HART recruitment process; assessed on 1-4 Likert scales (1=unsatisfactory, 4=excellent) using clearly defined exemplar behaviours.	1. Team orientation and development 2. Self-discipline and regulation 3. Communication 4. Adaptability 5. Capability 6. Planning orientation 7. Decision making
	Triage, treatment and handover assessment; Competencies defined by HART training syllabus and UK Ambulance Service JRCALC guidelines (yes/no scale) ³⁵	Appropriate triage category, medical interventions - these vary depending on the clinical picture of each patient (e.g. tourniquet, oxygen), appropriate handover of patient including relevant history and interventions		
In-hospital Trauma Resus	Assessment document based on principles of ATLS checklist; competencies relevant to scenario identified by two ATLS trainers (yes/no scale)	Eighteen competencies assessed, including airway management, cervical spine immobilisation, treatment of haemorrhagic shock interpretation of investigations.	T-NOTECHS (The Trauma Non-Technical Skills Scale); performance assessed on likert scale ranging from 1 to 5 using clearly defined exemplar behaviours. ³⁶	1. Leadership 2. Cooperation and resource management 3. Communication and interaction 4. Assessment and decision making 5. Situation awareness/Coping with stress
In-hospital Silver Command	Assessment protocol based on hospital major incident plan; relevant competencies developed by experienced major incident planner	Two sets of performance metrics assessed: 1. Ensuring appropriate care of critically ill patients in resource-constrained environment (yes/no scale) 2. Appropriate interactions with colleagues in specialities within and outside of the emergency department, including Intensive Care, Acute Wards, Radiology and Theatres		

Table 16: Skills assessment across all three scenarios

7.4 Results

7.4.1 Participants' demographics

In total 23 participants completed the three scenarios. 12 ambulance HART practitioners completed the pre-hospital scenario at Imperial College London. They attended in pairs over a 2.5 hour timeframe over a period of two days. The HART practitioners came from six trusts, including East Midlands, East of England, Yorkshire and London Ambulance Service NHS Trusts, and South East Coast and South Western Ambulance NHS Foundation Trusts. Travel costs were reimbursed; no incentive was provided to attend. The trauma team leader scenario was completed by six surgical registrars, all of whom act as trauma team leaders in their current role at Imperial College Healthcare NHS Trust and North West London Hospitals NHS Trust. All were ATLS certified. Lastly, the Silver Commander scenario was completed by five Emergency Department Consultants recruited from Imperial College Healthcare NHS Trust, all of whom could be expected to fulfil the role of silver commander in a major incident (with some having carried out this role in the recent past). All participants completed the technical and non-technical skills self-assessments on paper immediately after the scenarios ended.

7.4.2 Technical and non-technical skills across scenarios

7.4.2.1 Descriptive analyses

Pre-hospital participant performance is shown in Table 17. Self-assessment of technical performance in 9-point briefing and triage and treatment was higher than score of the expert assessors (self-assessments of 68% and 61% vs expert assessments of 63% and 59% respectively). This finding was reversed in the non-technical assessment, where participants

under-scored themselves compared to the expert scores (73% vs 79%). Variability in expert assessments was generally lower in the technical assessments compared to the non-technical ones, whereas participants were more variable in their own self-assessment of their technical skills. In both the Trauma Resus and Silver Command hospital scenarios experts rated non-technical performance higher than the technical performance (Table 18). Finally, as in the pre-hospital scenario, self-assessment of technical skills was overall higher than the self assessment of non-technical skills compared to expert scores.

7.4.2.2 Inter-assessor reliability analyses

Inter-rater reliability analyses are reported in Table 19. There were significant and strong correlations between the expert assessors across both the technical elements of the three scenarios (ICC range 0.73-0.90) and the non-technical elements (ICC range 0.59-0.89). This is a very strong result, as it suggests adequate reliability to carry out skills and performance assessments in virtual environments for such scenarios for five of the six skills categories (those where ICC was higher than 0.70), with the remaining category (non-technical performance of the Silver Commander) approaching this level.

Pre-hospital Ambulance HART (n=12)			
		Expert assessment (median % score, range)	Self assessment (median % score, range)
Technical Skills	9 Point Briefing (tool range: 0-30)	63% (50-80%)	68% (40-83%)
	Triage and Treatment (tool range: 0-51)	59% (52-64%)	61% (51-82%)
Non-Technical Skills	Global score (tool range 7-28)	79% (29-93%)	73% (50-86%)

Table 17: Technical and non-technical assessment scores for Ambulance HART personnel (Pre-hospital scenario) Note: scores converted to percentages (%) and rounded up to the nearest percentage point for ease of comparison.

	Trauma Resus (n=6)		Silver Command (n=5)	
	Expert assessment (median % score, range)	Self Assessment (median % score, range)	Expert assessment (median % score, range)	Self Assessment (median % score, range)
Technical Skills (tool range Trauma Resus 0-18, Silver Command 12-53)	61% (58-64%)	69% (33-94%)	69% (66-79%)	55% (43-70%)
Non-Technical Skills (tool range 5-25)	85% (75-91%)	68% (60-100%)	90% (72-98%)	72% (48-76%)

Table 18: Technical and non-technical assessment scores for the hospital-based scenarios (Trauma Resus and Silver Command scenarios) Note: scores converted to percentages (%) and rounded up to the nearest percentage point for ease of comparison.

7.4.2.3 Relationship between expert and self skill assessments

Correlations between expert and self-assessments are reported in Table 19 (right panel).

Significant and positive correlations were found between expert and self-assessed technical performance for all three scenarios – ranging from 0.52 in the Pre-hospital scenario to 0.84 in Silver command scenario. Although not as high as the expert reliabilities, these correlations suggest that the participants did have some insight into their levels of technical performance. In contrast, there were no significant correlations between expert and self-assessments of non-technical performance in any of the three scenarios. This finding complements the discrepancies obtained in descriptive analyses of expert vs. self scoring.

		Agreement between experts' assessments (inter-rater reliability; ICC)	Agreement between expert & self assessments (cross-validation; Spearman's rho)
Pre-hospital Ambulance HART scenario	Technical Skills	0.90***	0.52*
	Non Technical Skills	0.89**	0.48
In-hospital: Trauma Resus scenario	Technical Skills	0.73***	0.59*
	Non Technical Skills	0.59**	0.40
In-hospital: Silver Command scenario	Technical skills	0.85***	0.84***
	Non-technical skills	0.68***	0.46

Table 19: Reliability in expert scoring (intraclass coefficients) and correlation between expert and self-assessment (Pearson *r* coefficients) across scenarios and skill domains. Note: * $P < 0.05$;

** $P < 0.01$; *** $P < 0.001$

7.5 Discussion

Successful major incident response requires the application of a complex skill set by multi-disciplinary teams working in unpredictable and hazardous environments. Currently available training and preparation modalities are compromised by cost, accessibility and difficulties with data capture to assess and debrief performance.²⁹⁵ This study has demonstrated the feasibility of utilising these immersive, low-cost virtual training environments for skills assessment as an adjunct to existing training and assessment tools in major incident preparation, and has demonstrated advantages over existing live and tabletop preparation modalities. Formal performance metrics (technical and non-technical) were successfully utilised within virtual environments across multiple disciplines, overcoming some of the shortfalls of current methodologies. This was achieved by utilising validated real-world assessment tools for non-technical skills, and the creation of assessment tools for technical skills based on expert-defined, appropriate performance metrics.

7.6 Limitations

The results of this study, whilst promising, must be interpreted with some caution. Firstly, whilst the feasibility of skills assessment has been demonstrated, the construct validity of the scenarios has not been established, so further validation work is necessary using a larger sample size in an appropriately powered study. Predictive validity would be difficult to establish given the random nature of major incident occurrence.²⁶³ Secondly, the scenario assessments were performed using a variety of metrics that had been face and content validated by expert trainers, but not tested elsewhere prior to these scenarios (with the exception of the validated T-NOTECHS). Thirdly, this study was primarily aimed at individual and team assessment, rather than that organisational response. Determining the

organisational preparedness of acute responders is challenging; both questionnaire and observational methods have been developed for this purpose but are not yet validated or in widespread use.^{242,312} Incorporating a full-scale organisational preparedness exercise into a virtual environment (including strategic “gold” command) may enable wider access, improved understanding of incident plans and encourage the further development of appropriate metrics to assess organisational response. Such organisation-level exercises are available and have been used by the military.¹⁰ Further research is required to determine whether similar exercises can be delivered in virtual environments – and indeed whether they can improve organisational response and performance in major incidents. A step towards this would be the development of multiple trauma scenarios that could run synchronously with a silver-command scenario, which would better reflect the reality of major incident response.

7.7 Conclusions

Major incident training and assessment is complex, encompassing multiple competencies and disciplines both inside and outside of the hospital setting. By demonstrating the feasibility of technical and non-technical skills assessment in virtual environments, this study has implications for major incident trainers and planners. Improving the accessibility, immersiveness and feedback potential of major incident exercising is necessary; this study has demonstrated the potential for virtual environments to achieve these goals as an adjunct to existing training and assessment methods.

The next chapter investigates a potential further application of the studies described in chapters 6 and 7 – the feasibility and implications of using virtual environments for live training across the globe.

8 EXPLORING THE USE OF VIRTUAL WORLD ENVIRONMENTS IN GLOBAL HEALTHCARE TRAINING

8.1 Overview

This chapter explores the feasibility and acceptability of utilising virtual environments for real-time trauma training across higher, middle and lower income countries (Canada, South Africa and Malawi), utilising trainers and assessors based in the United Kingdom.

8.2 Introduction

Trauma accounts for 16% of the global disease burden. 5 million people die of traumatic injuries yearly and over 90% of these deaths occur in lower and middle income countries (LMICs).³¹³ More people die of road traffic injuries and falls than HIV, Tuberculosis and Malaria combined; these numbers are projected to rise as motor vehicles become more accessible and treatments improve for other diseases.³¹⁴ Injury also accounts for 11.2% of disability associated life years globally.³¹⁵ Road safety, injury prevention and improved trauma care are key factors in reducing morbidity and mortality.^{316,317}

The Advanced Trauma Life Support (ATLS) course is an established systematic approach to trauma care, accepted as the gold standard for the casualty management across the

globe.³¹⁸ Implementation of ATLS has been associated with improved trauma outcomes in a LMIC, and improved knowledge and skills in high income countries (HICs).^{279,318} The World Health Organisation has established “Guidelines for essential trauma care”, which build on the ATLS approach, and recommend improvements and minimum standards for trauma systems and practice, taking into account the economic and resource constraints of LMICs.³¹⁹ A review and analysis of trauma data by Mock and colleagues estimated that improvements in trauma care in LMICs could reduce fatalities by up to 38%.³¹⁶ Furthermore, in an attempt to reduce the burden of trauma in LMICs, surgeons in Norway and Canada have established formal training partnerships with groups in Botswana and Tanzania respectively.^{320,321} However, deficiencies in knowledge and practice amongst trauma care providers are commonplace, and accessible training provision is limited.^{316,320}

321,322

Virtual environments have not previously been utilised for real-time training or assessment of healthcare professionals between countries. Leong and colleagues ran a surgical conference in Second Life which attracted participants from five different countries, but this was lecture based and did not involve clinical decision making or patient interaction.¹⁰⁵ Heinrichs and colleagues created a trauma scenario which was run on separate occasions in the United States and Sweden, but there was no cross-communication or live-link between the two countries.³²³

Given the challenges of accessibility and cost of healthcare training globally and especially in LMICs, further evaluation of the use of virtual environments is warranted. This was done in the study reported in this chapter.

8.3 Method

8.3.1 The Trauma scenario

The trauma scenario described in chapter 6 was utilised, as was assessment methodology described in chapter 7. Collaborators were emailed the feedback and self-assessment questionnaires in advance and provided printed copies for each participant. Trauma team leaders were recruited as described below. Trauma team members were played by clinically-qualified actors based at Imperial College London. All scenarios were recorded.

8.3.2 Participating countries and institutions

The participating institutions involved in the study are detailed in figures 40 and 41. These countries were chosen to reflect the aim of a widely spread geographical and socioeconomic cohort. The World Bank designates a Lower Income Country as having a Gross National Income per Capita of \$1035 US Dollars (USD) or less; Malawi has a GNIC of \$268 USD and ranks 120 out of 134 countries on the United Nations Inequality Adjusted Human Development Index.^{324,325} South Africa is a Middle Income Country with a GNIC of \$7508 USD. Despite being the 28th largest economy globally, there is profound economic and health inequality within the country.³²⁴ Canada has the eighth highest income per capita globally with a GNIC of \$52219 USD and ranks amongst the highest for quality of life and educational attainment.³²⁴ There are widespread differences in life expectancy, mortality from injury and physicians per head of population, as detailed in figure 40.³²⁶

Clinical collaborators at three institutions were contacted and agreed to take part in the study. Participating institutions were McGill University Health Centre in Montreal, Canada

(collaborators AP and GF); Frere Hospital, Eastern Cape, South Africa (collaborator DF); Beit Cure International Hospital, Blantyre, Malawi (collaborator MP) (figure 41). No collaborator was given any financial incentive to participate. All collaborators were asked to recruit current trauma team leaders to the study; a short information leaflet was provided for this purpose. Local ethical approval was granted for the McGill and Frere arms; Ethical approval was deemed unnecessary by the Beit Cure ethical committee.

The possibility of an Australian centre was considered to further illustrate the capability of the technology to function globally. Two pilot tests were run at the Concord Hospital, Sydney, Australia with current trauma team leaders. Unfortunately due to difficulties coordinating with shift patterns and time zones the study became unfeasible and was not pursued further. The self-assessment data and participant feedback sheets were also not completed so they do not form part of the analysis. However, verbal feedback was received; this is commented on below with other feedback.

	Gross national income per capita (US Dollars)³²⁴	Life expectancy³²⁶	Physicians per 10000 population³²⁶	Age standardised mortality rates due to injury (per 100 population)³²⁶	Health expenditure as percentage of GNI³²⁶
Malawi	268	58	0.2	189	8.4
South Africa	7508	58	7.6	72	8.7
Canada	52219	82	20.7	32	11.4
United Kingdom	39093	80	27.7	25	9.6

Figure 40: Demographic details of the countries in the study



Figure 41: Participating institutions across 3 continents

8.3.3 Technical setup

Pilot runs of the scenarios were carried out to test technical capability. Collaborators were asked to download Second Life and perform a live test to ensure the software worked appropriately. At Frere Hospital, South Africa, the collaborator utilised an HP 530 notebook (2006 model) containing an Intel Core duo 2600 processor, but no dedicated graphics card. Frere Hospital had no available internet access; therefore, a Huawei e367 3G mobile dongle was utilised to enable internet access on the HP notebook. The Beit Cure Hospital, Malawi, had a suitable Ethernet connection to which an HP Pavilion DV6 notebook (2009 model) containing an AMD Athlon II Dual-Core M320 2.10GHz processor with an ATI Radeon 4200 graphics card. In Montreal the collaborator had access to a

computer laboratory at McGill University; an Apple iMac was utilised with a quad-core Intel Xeon processor and dedicated nVidia graphics card (figure 42).



Figure 42: Participants from Montreal (left) and Frere (right)(Photographs reproduced with permission from AP(Montreal) and DF(Frere).

8.4 Results

24 participants were recruited, all were practising clinicians from Surgical or Emergency Medicine backgrounds, and all had responsibility for leading trauma care in their current role. 8 Surgical Residents were recruited from McGill University Health Centre in Montreal, Canada (C) and 11 Medical Officers from Frere Hospital, Eastern Cape, South Africa (SA). The Beit Cure Hospital in Blantyre, Malawi does not receive acute trauma patients and therefore 5 participants were recruited from the neighbouring Queen Elizabeth Central Hospital, which is located 1 kilometre east (M). The Malawian participants consisted of 2 trained doctors and 3 Clinical Officers, all of whom fulfil the same clinical

duties. Clinical Officers, also known as Non-physician clinicians, outnumber doctors in many African countries; they are cheaper and faster to train, and take on many of the clinical duties of formally-trained doctors.³²⁷ Clinical officers are increasingly being utilised for elective and emergency service provision in many LMICs, due to a shortage of doctors, especially in rural and more deprived areas.³²⁸

All scenarios were completed to a suitable end-point, taking between 12 and 25 minutes. Two of the participants, both clinical officers from Malawi, had never used a computer previously. Despite this, they were able to complete the scenario with the aid of a longer introduction and assistance from the collaborator (MP). One scenario in South Africa had to be restarted shortly after commencing due to a temporary failure of the mobile internet network. The South African study was hindered by a slight jerkiness of picture in some of the scenarios, which was dependent on the quality of the mobile internet signal. In Malawi, local internet access failed after the introduction, just prior to commencing a scenario, which was subsequently rescheduled for a different date. Overall, there was little difference in usability or function between computer models, specifications or internet type. All participants completed the feedback and self-assessment forms.



Figure 43: A participant from South Africa reviewing the trauma-series radiographs

8.4.1 Feedback

All 24 participants completed the written feedback sheets following the simulation, summarised in table 20. The vast majority of participants “agreed or strongly agreed” that the introduction was adequate for their needs (96%), but were less confident of their ability to navigate the virtual environment (70%, mean 3.65 SD1.01); *“It was pretty intuitive to use...I am a (computer) gamer though...others may have more of an issue (SA1).”* Some felt that the 10 -15 minutes allowed for familiarising themselves with the interface was inadequate; *“...I needed a more thorough introduction to the programme (M4).”* The majority of participants were convinced by the realism of the virtual environment, both in terms of the clinical scenario (92%) and visual portrayal in the trauma room (96%). Participants commented that the lack of tactile signals was off-putting, and also that this particular trauma environment was *“lacking in the chaos that these events usually are (C2).”* Again, the majority of participants said that stressors and actions mirrored those of real life (83% and 88%). However, participants from the LMICs commented on the realism

of the available resources and high staffing levels of the scenario; *“It is not necessarily representative of real life, especially outside of the major cities (SA3)”* and *“we usually don’t have a trauma team...it is just whoever is around (SA2).”*

Feedback regarding learning and assessment was mixed. 33% felt that the trauma scenario was an area in which they had sufficient training/exposure, although virtual environments could improve immersion *“ATLS feels very static – this is not (C6)”* and *“you can’t create a realistic resus environment on an ATLS course – this is a credible alternative (SA7).”*

Virtual environments were deemed to be a useful method of training (96%), and assessment to a lesser degree (83%). Participants highlighted the potential for future synergy with existing training methods *“it could be best used as a refresher for those who have done ATLS (M1)”* with potential to simulate multiple challenging scenarios *“you could program things to go horribly wrong, which you just can’t do with a mannequin (C2).”* Participants commended that the environment was *“excellent to test decision making (C3)”* and could help *“...with leadership and getting used to managing a trauma team (Aus1),”* which reflects the reasonably high level of positive feedback for the addressing of non-technical skills in this environment (79%).

The potential for debriefing with video recording was highly rated (88%); *“it would be very helpful, especially for trainees (M3)”* and could address current deficiencies in training *“there is very little opportunity for simulated training ...we don’t get enough feedback to learn properly (M4).”*

Overall participants enjoyed the simulation (100%) and recommended it for training (100%); *“this would be a good setting for doctors with trauma experience to teach others across the world with less experience or skill. (SA3)”*

	Percent (%) “agree/ strongly agree”	Mean (range 1-5)	SD
Orientation			
The virtual world introduction was adequate	96%	4.18	0.49
I was able to navigate easily within virtual worlds	70%	3.65	1.07
I understood how to use the user interface	84%	3.95	0.69
Environment			
The visual portrayal was realistic	96%	4.35	0.57
The scenario was realistic	92%	4.34	0.64
The stressors encountered were realistic	83%	4.00	0.98
I would act the same way in real life	88%	4.17	0.64
Learning and assessment			
The virtual environment is a useful method of training	96%	4.56	0.59
The virtual environment is a useful method of assessment	83%	4.08	0.65
Learning from the simulation will be useful for everyday practice	88%	4.29	0.69
The scenario covered areas of my practice that I do not regularly train in	33%	2.92	1.38
The virtual environment can address non-technical/team skills adequately	79%	4.00	0.78
Debriefing			
Post Simulation debriefing is useful	88%	4.13	0.74

Overall			
I enjoyed this simulation	100%	4.50	0.51
I would use a similar simulation again for training	96%	4.42	0.58
I would recommend this simulation to colleagues	100%	4.67	0.48

Table 20: Feedback table for the participants in the global study

8.4.2 Skills Assessment

There was a wide range of participant self-assessed scores for both technical and non-technical skills assessment (17-89% and 44-100% respectively) (table 21). Participants rated their non-technical performance higher than that of their technical performance (78 vs 52%). Expert assessment confirmed this trend, although the technical performance was rated more highly and the non-technical skills less highly (73 vs 64%).

Inter-rater reliability is reported in table 22. As in the previous chapter, there were strong and significant correlations between the expert assessor scores for technical and non-technical elements of the scenario ($P < 0.001$). Again, this suggests that there is adequate reliability to utilise the scenario for both technical and non-technical skills assessment. However, there were no significant correlations between the scores of experts and participants when assessed for cross-validation.

Trauma Resus (n=24)		
	Expert assessment	Self assessment
	(median % score, range)	(median % score, range)
Technical Skills (tool range 0-18)	64% (33-89%)	52% (17-89%)
Non-Technical Skills (tool range 5-25)	73% (36-100%)	78% (44-100%)

Table 21: Technical and non-technical assessment scores for the trauma scenario. Scores converted to percentages (%) and rounded up to the nearest percentage point for ease of comparison.

	Agreement between experts' assessments	Agreement between expert & self assessments
	(inter-rater reliability; ICC)	(cross-validation; Spearman's rho)
Technical Skills	0.70 (P<0.001)	0.08 (P>0.05)
Non-Technical Skills	0.82 (P<0.001)	0.36 (P>0.05)

Table 22: Reliability in expert scoring (intraclass coefficients) and correlation between expert and self-assessment (Spearman's rho coefficients) across scenarios and skill domains.

8.5 Discussion

Improved trauma care is a key component in reducing the global injury burden; a lack of accessible training and preparation modalities are well-defined problems.^{316,329} This study has established the feasibility and acceptability of utilising a novel, immersive, virtual environment for clinical training and assessment across higher, lower and middle income countries. Furthermore, this was achieved using low-cost, widely available computer technology and also having suboptimal internet access in LMICs. Whilst previous reports have demonstrated the educational benefits of internet based learning in LMICs, this study further develops this concept by demonstrating real time, live, recordable simulated scenarios in an immersive clinical environment.^{330,331} Ongoing efforts to improve high speed internet access in the developing world will enhance the potential yet further.³³²

Simulation has significant potential to enhance both the quality of training and patient safety in LMICs.^{32,331} However, cost and accessibility of traditional simulation-based courses, including trauma-related, remains a challenge in LMICs.³²⁹ This study has significant implications for future simulation development; it demonstrates the potential for this, and other, affordable and sustainable internet-based disruptive technologies to radically change and enhance the way in which LMICs train healthcare professionals in immersive, simulated environments, not only in hospital trauma, but in other specialties and in pre-hospital care, as previously demonstrated in HICs at a local level.^{102 333} Previously identified barriers, including a lack of trainers, physical resources and poor accessibility, could be overcome using this technology and may therefore aid expansion of existing training programmes – this is especially applicable to poorly resourced non-physician clinicians, including those who work in rural and deprived areas.^{327,334} Such innovation may

help alleviate ongoing concerns regarding quality of care provided by Clinical Officers globally, if exercises could be validated and approved by national and international training and regulatory bodies.^{328,334,335}

The creation of scenarios based on local resource constraints, tailored with assessments according to the WHO Essential Trauma Care guidelines, may encourage improved clinical standards across regions. Experienced centres in HICs could develop and strengthen partnerships by delivering live training sessions and observe performance in real time, as an adjunct to existing methods, without the costs and difficulties of physically travelling long distances. Feedback could be enhanced by recording and replaying scenarios, and commenting on both technical and non-technical skills performance. Furthermore, the technology could be used for refresher purposes to prevent problematic skill attrition following hands-on training.³³⁶

The health benefits could apply more universally than in just LMICs. Under-resourced and rural areas have significantly worse injury mortality in HICs; accessible healthcare training may impact on this.³³⁷ In addition, virtual environments could provide the flexible meeting platform required for the increasingly recognised paradigm of “reverse innovation” – the learning and application of knowledge and skills from the developing world into the developed world – perhaps in clinical skills or techniques, or at a more systematic level in policy development.³³⁸

8.6 Limitations

This study has a number of limitations that are important to recognise. The study included only two LMIC countries; the positive feedback and adequate internet access may not be representative of attitudes and resources in all LMICs. Whilst the feasibility of the technology has been demonstrated, the educational effectiveness has not, although previous research using virtual environments has demonstrated applicability and effectiveness.¹⁰² Furthermore, lack of previous computer use was a clearly identified barrier, which would have to be overcome in order to encourage utilisation and effectiveness of the technology. Scenarios were all run based on a “gold-standard” HIC resuscitation environment; virtual scenarios utilising local resource constraints, tailored with assessments according to the WHO Essential Trauma Care guidelines, would improve realism and may encourage improved clinical standards across regions.

It is perhaps also important to recognise that participants in this study, especially those who may not have regular access to computing technology, may have given good feedback due to their inexperience and lack of awareness with simulation technology. This should be considered if and when future academic studies and training programmes are developed.

8.7 Conclusion

The feasibility and acceptability of utilising virtual environment simulation technology has been demonstrated. In order for this technology to be developed and implemented, mutual relationships between HICs and LMICs need to be developed and sustained. Future challenges include increasing the number of locally appropriate scenarios and demonstration of educational effectiveness, before integration into local curricula can occur.

The previous four chapters have focused entirely on simulation using virtual environments at a micro- and meso-simulation level (as defined in the introductory chapter one). The second novel approach to simulation to be covered in this thesis is that of behavioural simulation, which is more applicable to meso- and macro-simulations. This is done in the remainder of this thesis – starting with the background to behavioural simulations, which is discussed in the following chapter.

9 GENERAL DISCUSSION

9.1 Overview

There is a growing body of evidence supporting the use of simulation in healthcare. Multiple simulation modalities have been successfully developed and adopted in both clinical and non-clinical practice, with cited benefits in areas as diverse as skills training, patient safety and policy implementation. However, there are areas of clinical and non-clinical practice for which novel simulation modalities may enhance current and future performance. In this thesis, I have investigated the use of two innovative simulation approaches to enhance performance in two very different healthcare problems; major incident training and health policy change.

The first half of the thesis focused on using behavioural simulations in health policy change, with the key aim being to develop behavioural simulations according to best practice and develop suitable analytics for evaluation of both the simulation and participants. In the second half of the thesis I have reviewed the literature on major incident training and defined current practice, establishing expert opinions and then developed and evaluated training exercises in the virtual environment, both in the UK and globally.

In the final chapter of this thesis, I will discuss the main findings, the limitations of this body of work, and the implications for development, in both research and healthcare practice.

9.2 Thesis findings

In chapter one I reviewed the history and uptake of simulation in healthcare, including the uses of simulators and simulations, at both operational and systems levels, and at micro, meso and macro-scales. The chapter concluded with an explanation of the rationale for this thesis; that, areas of clinical practice and policy development in healthcare could benefit from novel methods of simulation, or application of existing simulations to improve practice or outcomes. The thesis then split into two sections. In chapters 2-4 I concentrated on Behavioural Simulations, and chapters 5-8 on Virtual Environments. In Chapter 2 I reviewed the history and development of behavioural simulations in healthcare, and put forward a reproducible methodology for simulation design and evaluation. In Chapter 3, I described the setup and evaluation of a behavioural simulation (The Crucible) aimed at improving the knowledge of health system change and leadership skills in a cohort of clinicians. In chapter 4 I reported on the design, development, setup and evaluation of a simulation (Lateral Play) designed to aid the development of Imperial College Health Partners, a newly-formed Academic Health Sciences Partnership. I then moved from behavioural simulations to explore how contextualised virtual environments simulations could enhance major incident training and preparation, by examining current training, seeking expert opinion and reviewing current literature. Using these findings, in Chapter 6 I demonstrated the feasibility of designing immersive pre-hospital and in-hospital major incident simulations in using low-cost virtual environments. The development and process of evaluating performance of both technical and non-technical skills in the virtual scenarios was described in Chapter 7, using self and expert raters. In Chapter 8, I demonstrated the feasibility of utilising one of the virtual scenarios for healthcare training across the globe, by running virtual, live trauma moulages between the UK and Malawi, South Africa and Canada.

9.3 The aims of the thesis

9.3.1 To review the evidence base for behavioural simulations in healthcare and determine the how future simulations may be structured and assessed for educational value and behaviour change

In Chapter two I reviewed the background and rationale for behavioural simulations, and their development and previous uses in the healthcare sector. Behavioural simulations have been widely used in the UK, Europe and USA over the last four decades. The majority of the publications are in “grey” literature, and neither the design nor analysis has been subjected to rigorous academic review in formal peer-reviewed publications. However, the evidence described consistently describes educational benefits to both individuals and organisations, albeit at a low-evidence level. Furthermore, many of the simulations have been designed and run by respected organisations, including the King’s Fund and the Office for Public Management. I was keen to understand how simulations could be designed and implemented according to best practice. Chapter two describes a six-phase process, based on work by Richard Duke and Jac Geurts, which uses a clear and reproducible methodology that can be generically applied for simulations across the healthcare sector. Finally, the chapter describes how simulations may be evaluated for effectiveness using validated scales where appropriate, utilising participant feedback, knowledge and behaviour change.

9.3.2 To further examine the feasibility and acceptability of utilising behavioural simulations in the healthcare sector

The feasibility of utilising behavioural simulations in the healthcare sector has previously been established by prominent simulations including the Windmill series. The two simulations described in this thesis are the first to be analysed with academic rigour, and, in the case of Lateral Play, have the design and methodology detailed in a systematic way, according to suggested best practice. The Crucible simulation described in chapter three was not designed by our group, although we did have a significant role to play in determining the purpose and target audience of the simulation. The Lateral Play simulation was designed and implemented by our group. In both simulations, the feedback from participants was positive; scores were high on simulation relevance, active involvement and educational benefit. The more senior cohort of participants (Lateral Play) found the simulation less challenging and realistic than their more junior colleagues in the Crucible; however, mean scores were still positive. Furthermore, the aims of the two simulations were different – the Crucible was centred on individual development, whereas Lateral Play was focused on organisational development following a policy change. The lower feedback scores regarding future actions may well reflect this. However, both groups commented in the qualitative feedback sections that the experience of taking part was valuable, enabling them to understand the perspectives of others and improving relationships. In summary, the studies indicate the feasibility and acceptability of utilising behavioural simulations in the healthcare sector, adding to the existing body of evidence described in chapter two. It is important to note that both the simulations described in this thesis, together with the majority of those reviewed in chapter two, were designed and facilitated by groups

containing simulation experts. The feasibility of designing and running future simulations depends on having appropriately trained people to design and facilitate.

9.3.3 To determine whether behavioural simulations can improve knowledge, skills and behaviours in a healthcare context.

Behavioural simulations are complex and costly to design and implement; both simulations described in this thesis required substantial development time, multi-sector input and skilled facilitators. Despite this, there is no published data showing the educational effectiveness of behavioural simulations. In chapters seven and eight I attempted to systematically address this, by evaluating the simulations according to the criteria proposed by Kirkpatrick.¹⁵⁶

The participants in the Crucible simulation were asked to evaluate their knowledge of NHS structure and leadership competencies pre- and post-simulation. In all aspects, the participants rated their performance as being significantly higher post-simulation, leading to the conclusion that the simulation had a positive effect on learning in the few weeks post simulation. No quantitative evaluation of learning took place after the Lateral Play simulation as it was deemed inappropriate for the context.

In both simulations, participants self-assessed their behaviours, albeit with different scales. The behaviour change scales utilised in the crucible also demonstrated a significant pre and post simulation change in perceived capability, and smaller changes in behavioural intentions, attitude and subjective norms. In Lateral Play, Capability was again significantly improved following the simulation, using self-assessment measures.

In summary, the simulations did have a measurable positive effect on learning and behaviours, albeit by self-assessment. The limitations of these studies are discussed in the section 9.4.

9.3.4 To review the current status of major incident preparedness and assess the views of trainers and responders as to how virtual world environments may enhance practice.

In chapter 5 I utilised a tri-modal approach to reviewing the current status of major incident preparation – an expert advisory board was convened, trainers and responders were interviewed and major incident literature was examined. The expert advisory board felt that current training methodologies were largely inadequate and novel approaches were required to improve both technical and non-technical skills, and overall major incident response. However, there was no validated method of training or assessment tool for major incident response upon which to base a new approach. Furthermore, the board felt that virtual environments had sufficient potential as a training platform that the feasibility should be established by developing pre-and in-hospital proof-of-concept scenarios. To further my understanding of the needs of trainers and responders, I conducted semi-structured interview studies with pre-hospital and in-hospital responders.

The pre-hospital user-needs interviews indicated that pre-hospital hazardous environment response requires a specific and complex set of skills in addition to a standard set of clinical competencies. Pre-hospital care providers have to be able to work in a wide variety of typically stressful environments, encountering numerous potential hazards, operating with people and teams that they may not work with on a regular basis. Consensus was evident

within the study on the need for high quality, accessible, ongoing training to ensure that these skills are maintained and further developed, with appropriate feedback and debriefing provided to pre-hospital practitioners. Participants recognized the strengths of existing operational and technical skills training. However, the study did highlight areas of skill development that were required by practitioners on an ongoing basis, many of which were difficult to cover using current training modalities. Skills such as triage, mass casualty response and command and control were identified as being areas in which ongoing training was essential, but challenging to access using traditional training modalities. Physical space and equipment constraints, together with the need to have multiple actors playing casualties (or using low-fidelity mannequins) limits the ability to train on a large scale. Furthermore, the logistical difficulty and costs of regular exercises with other emergency response agencies creates difficulties in command and control training.

The acute-hospital group also highlighted areas of current training provision that were in need of improvement. Primarily the interviews concluded that current hospital major incident exercises have to fulfil multiple purposes, but are not necessarily designed or equipped to do so. There appears to be a discrepancy between the needs of acute healthcare services to prepare for a major incident and the needs of staff to develop their individual skill set. Clearly both these needs must be met to maximize the effectiveness of major incident response. In the light of these findings, it is perhaps unsurprising that our participants found it difficult to clarify the factors that make such exercises successful – those who did, however, discussed individual or team development, rather than the outcome of the exercise in relation to the hospital. The organizational, interpersonal and cognitive themes identified all reflect the skill set that staff are required to use in the event of a major incident. Communication skills (at the level of the individual, but also at the level of an

entire organization) were particularly highlighted – thereby replicating the recommendations of past major incident reports.^{107,287,288} Other similar non-technical skills, including leadership, and effective resource management, were also prominent. Although the majority of these skills are required in day to day practice, especially in a busy acute hospital, they are tested to a greater degree (arguably, to breaking point) at the time of a major incident, when staff are under severe pressure. The potentially extreme pressure and stress triggered by a major incident can be detrimental to healthcare workers' performance, and evidence shows that non-technical skills do suffer in such circumstances.³³⁹ It is therefore important that such skills are trained and assessed appropriately. Feedback in such a training process was deemed of paramount importance by our expert participants. Both individual staff and their organizations require high quality, systematic feedback from the exercises in order to hone skills and procedures and develop those that are lacking. Lack of, or limited, feedback to groups and particularly individuals within the existing training packages and approaches is a severe limitation, which ought to be addressed.

Novel simulation technologies in the form of VWs were generally received very positively by both pre- and acute-hospital responders, and were felt to have potential to address the shortcoming of current training and preparatory modalities. Participants discussed the benefits of virtual exercises to individuals and teams within organizations, and the potential for intra-organizational simulations, for example with pre-hospital responders, other regional and national healthcare providers. Creation of immersive, easily accessible, reproducible and recordable exercises could enable improvements in the availability of realistic simulations for training and the direct feedback that participants require. Such scenarios would allow an organization to view its response to an incident in real-time,

manipulating in virtual space real-life physical space and resource constraints that would be impossible other than by performing a disruptive live exercise.

9.3.5 To examine the feasibility of designing and running a major incident exercise in a virtual environment

Chapter five described the need for major incident exercises that were immersive, accessible and allowed for performance assessment. The next step was to determine whether such exercises could be developed in a virtual environment. Previous studies exploring the use of virtual worlds in related areas have used higher-cost, higher-fidelity environments that I felt would be prohibitively expensive for use on a large-scale.^{323,340} In chapter six, I describe the design and development of three scenarios that establish the feasibility and acceptability of using virtual environments for multidisciplinary, multiuser training in major incident settings. These were the first truly multi-user, multidisciplinary, major incident exercises to be developed and run in virtual environment platforms anywhere in the world. All scenarios were developed in low-cost virtual platforms, and were deemed by participants to be immersive and realistic enough to provide a basis for future exercises, and certainly more immersive and realistic than many current exercise modalities.

The study demonstrated reproducibility of the scenarios, which could be reset and rerun within seconds to maximise the resource availability and cost-effectiveness, enabling participants to perform and gain an understanding of multiple key roles. Furthermore, the ability to record and playback the scenarios from the point of view of each participant

enables accurate and structured debriefing, either by expert trainers or peers, which is difficult to achieve in a large-scale live or tabletop exercise.

Overall, the feasibility of scenario development has been established, but there are caveats. Appropriately skilled programmers and developers are required to create the virtual environments. In addition, the computerised patient physiology model developed for the trauma patient required a huge amount of clinician-programmer collaboration to function accurately. This model is designed to be modifiable by clinicians in future, rather than computer programmers or game developers.

9.3.6 To examine the feasibility of skills assessment in a virtual environment, in the context of a major incident

Chapter 6 described the feasibility of utilising immersive, low-cost virtual training environments for skills assessment as an adjunct to existing training and assessment tools in major incident preparation. Formal performance metrics (technical and non-technical) were successfully utilised within virtual environments across multiple disciplines, overcoming some of the shortfalls of current methodologies. This was achieved by utilising validated real-world assessment tools for non-technical skills, and the creation of assessment tools for technical skills based on expert-defined, appropriate performance metrics. Previous research has demonstrated the feasibility of utilising virtual worlds and gaming platforms for different components of major incident preparation.^{43,104} To the best of our knowledge, this study is the first to attempt to formalise skills assessment in virtual environments.

The feasibility of both technical and non-technical skills assessment was successfully demonstrated across operational and tactical response levels, including both clinical and managerial roles. Formal (i.e. systematic and reliable) individual and team skills assessment is therefore feasible in these virtual training environments. In addition, the tactical response theme of the scenarios (ambulance HART team leader and Silver command roles) enabled elements of real organisational major incident plans to be tested (derived from St Mary's Hospital, London); although not formally assessed here, this could improve individual and team awareness of existing emergency response plans.

9.3.7 To examine the potential for using virtual world simulations across lower, middle and higher income countries for healthcare professional education.

In Chapter 8 I demonstrated the feasibility of utilising virtual environments for live clinical training and assessment between our centre at Imperial College London, and three centres in higher, middle and lower income countries. This was the first study to demonstrate the potential of virtual environments to deliver live clinical training and assessment between countries, including those in the developing world. The feedback from participants in each of these three countries was positive, and demonstrated the acceptability of using such environments together with the wish to develop further studies in the future. Importantly, the scenarios functioned well, even when using suboptimal internet connections, and low-cost computing technology. The study also demonstrated some of the barriers that exist in adoption and diffusion of virtual environment technologies globally; for example, the lack of computer literacy in some parts of the developing world, and the difficulties of coordinating busy clinical schedules across different time zones.

9.4 Limitations

9.4.1 Limitations of the behavioural simulations

In chapter two I discussed a methodology for design and implementation of behavioural simulations. This was followed for the Lateral Play simulation, but may not have been strictly adhered to for the Crucible, as the simulation design and development was outsourced to a consultancy company, Loop 2. However, given the excellent participant feedback and my own personal experience of taking part, I feel that it is highly unlikely that the simulation content or delivery could have been significantly improved, and moreover, given the experience of Loop 2, it is likely that they followed a similar process to that which was recommended.

Chapter two described the potential of behavioural simulations as a predictor of future events which could potentially avoid undesirable unforeseen consequences. Such prediction has been described in previous simulations.³⁰ In neither simulation did I attempt to clarify future system response, instead concentrating on education and behaviour change. The ability to predict future events would be hugely desirable and may be a focus of future research.

Finally, both simulations were stand-alone events, and neither was incorporated into a formal learning programme. In the case of the Crucible in particular, such events may be better run as part of a dedicated medical leadership programme, which could objectively assess the learning and performance of participants over time and against a formal syllabus. Furthermore, participants commented on the lack of formal leadership training in the Crucible simulation, and in the introductory sessions it could, with hindsight, have been advantageous to discuss leadership styles and the effectiveness of different approaches.

Skills assessment

In both simulations, participants were required to self-assess their performance. As discussed in relation to virtual environments, the accuracy of self-assessment is variable. In the context of healthcare leadership and management, self-assessment is commonly practiced; expert assessment is challenging, costly and time consuming.²⁰⁸ Further work is required to validate the self-assessment tools and process, but from a practical viewpoint, it would be challenging and costly to assess participants by any other method, although triangulation of data, encompassing self and observer assessments, together with simulation outcomes, may offer a more accurate approach.²⁰⁸

Ideally similar assessment methodologies would have been utilised between the two simulations to allow for comparisons. However, the two were very different in terms of objectives and setting. The Crucible was an educational event, was attended voluntarily and participants were aware that the certificate of attendance depended on completion of the questionnaires. By contrast, Lateral Play was an event with a specific and more sensitive purpose (i.e. the development of ICHP) for a more specific group of (more senior) participants, who would be required to work together in the coming years. It would not have been appropriate to burden the Lateral Play participants with a long questionnaire. Therefore, a conscious decision was made to cut the questionnaire substantially for the Lateral Play participants, which I hoped would encourage a higher response – it did not! The behavioural aspect of the lateral play questionnaire was tailored differently to that of the Crucible, as I moved from using the principles described by Ajzen to those of Michie et al – The Behaviour Change Wheel (BCW).²¹⁷ The rationale for the change was the greater simplicity of the BCW, which allowed the ICHP objectives to be tailored into each of the three behavioural constructs (Capability, Motivation and Opportunity) that were being

examined as part of behaviour change. At face value the differences are minor, as Capability and Motivation were already factors in the Crucible questions. However, the BCW describes and categorises intervention functions (e.g. incentives, persuasion and training) and policy that could be targeted in future simulations to change behaviour.²¹⁷ The example of leadership training was discussed earlier, and this model could provide a clearer structure for such a targeted intervention.

9.4.2 Limitations of interview studies – virtual environments

There are a number of limitations in the interview studies. Firstly, the combined number of participants was small – 26 in total. Despite this, thematic saturation was reached in both interview studies. In addition, both interview studies sought the views of UK experts, and more specifically, London-based experts in the hospital arm, and highly skilled HART practitioners in the ambulance arm. It is therefore possible that their responses are not representative of the wider pre and in-hospital major incident responders nationally and internationally. However, the thematic findings of the interview studies aligned with those of the focus group and major incident reports from around the globe, thus leading to the conclusion that the findings have relevance throughout the multiple emergency response agencies the United Kingdom and further afield. Ultimately, the aim of the interview studies was to inform the design of the feasibility studies reported in chapter 6 and it was successful in this regard.

The interview studies enabled me to understand the needs of the emergency responders and planners. I was able to attend a live HART training exercise at Winterbourne Gunner, which was an invaluable experience. However, I did not undertake any structured, objective analysis of training exercises, which could have complemented and validated some of the

interview findings. This would have been challenging due to the relative lack of exercises, difficulty gaining access and also the potential for participants to alter their behaviour in the knowledge that observers are present.

9.4.3 Limitations of the virtual environments

Virtual scenarios

Three virtual environment scenarios were developed and implemented, using two different low-cost virtual worlds. Although all three studies were run to completion and feasibility demonstrated, there are limitations to the findings. Firstly, the sample size was small, although three distinct groups of clinicians took part, all of whom gave feedback consistent with previous reports as to the potential future uses of virtual worlds in healthcare training.

In addition, elements of the three described scenarios that had a mean score of less than 4 (i.e. “agree”) on the feedback questionnaire. These require addressing individually.

Participants in the UK and Global studies commented that ease of navigation could be improved. This may reflect a lack of overall computer-literacy in the lower-income countries, or perhaps too short an orientation period. Future studies could address whether navigation improves with further exposure. The UK participants felt that their actions in the virtual environment did not correspond to their real-life actions. Again, this may be related to perceived difficulties in navigation and interaction with the virtual environment, or the unusual context of the exercise, or unrealistic stressors in the environment – which could be too few sensory stressors (e.g. noise, heat, smells) or too many (the possible stress of using new technology and being observed). Further research going beyond the remit of this feasibility study could address virtual performance versus real-life performance, should suitable metrics be developed. Despite the low score, participants were positive about the use of virtual environments for future training and wanted to use them for that purpose.

Skills assessment

The studies in chapters 7 and 8 have demonstrated the feasibility of technical and non-technical skills assessment in virtual environments, albeit in the context of major incidents. However, the construct validity of the scenarios has not been established, so further validation work is necessary using a larger sample size in an appropriately powered study. Predictive validity would be difficult to establish given the random nature of major incident occurrence.²⁶³ However, skill sets related to specific elements of response could be tested, for example performance of on an ATLS course against that in the virtual environment. Secondly, the scenario assessments were performed using a variety of metrics that had been face and content validated by expert trainers, but not tested elsewhere prior to these scenarios (with the exception of the validated T-NOTECHS). Thirdly, the scenarios were primarily aimed at individual and team assessment, rather than organisational response. Determining the organisational preparedness of acute responders is challenging; both questionnaire and observational methods have been developed for this purpose but are not yet validated or in widespread use.^{242,312} Incorporating a full-scale organisational preparedness exercise into a virtual environment (including strategic “gold” command) may enable wider access, improved understanding of incident plans and encourage the further development of appropriate metrics to assess organisational response. Such organisation-level exercises are available and have been used by the military.¹⁰ Further research is required to determine whether similar exercises can be delivered in virtual environments – and indeed whether they can improve organisational response and performance in major incidents. A step towards this would be the development of multiple trauma scenarios that could run synchronously with a silver-command scenario, which would better reflect the reality of major incident response. Finally, although there was good reliability between expert assessors, self-assessment of performance was mixed, which reflects the findings of

previous studies.^{341,342} This may improve with more formal training and awareness of both technical and non-technical skill sets in the future, but should be noted as a limitation of the assessment methodology, should experts not be available.

The limitations of virtual worlds for future research must be considered. Virtual environments are not a substitute for hands-on training; they cannot simulate the physical elements of incident response, nor can they provide training in the dexterity of performing procedures on a patient. However, the response from the participants in this study indicates that the environments are appropriate and realistic enough to provide a setting for training, and possibly assessment, of decision-making and team skills in stressful environments, and associated non-technical skills, such as leadership and communication which have been identified as essential response competencies.^{107,240,248}

Future researchers must also appreciate the challenges of developing and running a virtual environment simulator. Developing virtual scenarios is time consuming and requires multiple skill sets, including clinical and technological. However, the benefits, including reproducibility of scenarios, and the ability to train in circumstances that would not normally be possible, have potential to outweigh the limitations.

9.5 Implications

9.5.1 Implications for Behavioural Simulations

The two behavioural simulations described in this thesis were generally very well received by participants, who perceived their overall capability (and knowledge, in the Crucible) was improved by taking part in the simulations. The outcomes reinforce previous findings that support the use of behavioural simulations in healthcare – in this case in medical leadership, understanding of new structures and organisational development.^{30,142} However, unlike the

major incident simulations described previously, there is little in the way of comparable training with which to compare the simulations. A recent systematic review found that leadership and development initiatives of multiple modalities were well-received by participants, and had varying effects on learning, behaviours and outcome, although none of the studies investigated was a behavioural simulation.²⁰⁸ In addition, the long-term benefit of utilising behavioural simulations for individuals and organisations is yet to be determined. Development of achievable strategies to quantify the learning, behaviour change and impact on organisations is necessary to justify the considerable time and expense in design and development. Whilst this will be challenging – it requires both self and observed feedback over the medium to long term – it could prove to be extremely valuable, as behavioural simulations do fulfil the two most desirable characteristics of educational modalities identified by the next generation of professionals; the simulations are “face to face” and also experiential.³⁴³ In addition, whilst the simulations demonstrated improvements in perceived capability, other constructs demonstrated less or no significant changes pre and post simulation. Whilst this may be due to simulation design or analysis, it may also reflect the wider need to change the mind-set of NHS organisations and leaders to adopt a more inclusive approach to innovation and/or the added value of more junior clinicians in leadership and management roles.^{196,344} Appropriately designed behavioural simulations could facilitate the engagement of junior and senior clinicians, together with management, and may enhance perceived opportunity and motivation amongst staff. To achieve this goal, simulation design could target the “intervention functions” of education, persuasion, incentives, coercion, enablement, training, restrictions and environmental restructuring that were described in the Behaviour Change Wheel; these functions are all thought to contribute positively to the capability, motivation and opportunity of behaviour. Future behavioural simulation research could address the impact of these functions on

individuals and organisations, and help understand in particular how motivation and opportunity could be enhanced to promote positive behaviour change.

Behavioural simulations offer huge potential in experiential learning, enabling clinicians and managers at all levels to gain experience build relationships and test new policy ideas. Such simulations could also provide a safe environment to practice different leadership styles, or for trainers to trial behavioural interventions on different cohorts to try to determine effects on processes or outcome. For example, errors or suboptimal processes could be built in to the simulation to challenge participants to identify areas in which practice could be improved.³⁴⁵ In addition, the application of a clinical and patient safety focus to managerial-focused simulations can enable greater understanding and insight, as demonstrated by a group in New England.³⁴⁶ The simulations also offer a unique opportunity for senior professionals in healthcare and other disciplines to aid the leadership development of participants. For example, the presence of simulation moderators in both Lateral Play and The Crucible enabled participants to learn contextually and experientially from experts to whom they may not otherwise have access. Future simulations could be part of recognised leadership strategies, including coaching and action learning, and may form the start of more formal mentoring relationships.¹⁹⁵

The most tantalising prospect for behavioural simulations is the potential to predict future events and avoid unintended consequences by changing strategy or behavioural response, which could all be played out in a simulation. Previous simulation reports have alluded to this, although neither of the simulations described in this thesis aimed to have predictive power. From my own personal discussions with simulation leaders, (Jac Geurts, Laurie McMahon, Alasdair Liddell and Greg Parston), no simulation sets out to be predictive,

instead having a wholly educational aim, which can be individual or organisational, and can involve policy change or development. However, the outcomes of such simulations, together with the conclusions drawn by observers and participants, can offer insight into future individual and organisational behaviours and their consequences.³⁰ In addition, the behaviours from simulations could be used to inform predictive computer-based models. This approach was utilised in the SeeSaw simulation run by the Kings Fund in 2008, although there is little information in the report as to the benefits or challenges of using this approach.³⁴⁷ Physician behaviours have been used in the United States to inform computer-based models of health policy change, although this was based on responses to previous real-life events and not from a simulation.³⁴⁸ Future research linking the two modalities may offer promise for the future.

9.5.2 Major incident training using virtual worlds

The evidence provided throughout this thesis has shown that major incident training and assessment has clear deficiencies. Virtual environments present one option for improving on current practice. Virtual environments have advantages over current live or tabletop exercises. For example, these scenarios were all recorded in full from scene-generic and participant-specific views, using straightforward and inexpensive computer technology. The difficulties of live assessment in fast-paced, geographically spread, multi-person emergency scenarios have been previously documented.^{349 307,350} Provision of accurate participant feedback has been identified as the most important feature of simulation-based medical education.²³ Review of scenario recordings may enable improved trainer-led assessment and development, by providing evidence-based feedback on actions.³⁵⁰ With suitable training, participants may also be able to self-assess their performance or that of their peers using

video review, which would limit the requirement for expert trainers to be present at each scenario.

The ability to modify and rerun scenarios could provide a mechanism for analysis of skill improvement over time and provide increasingly challenging environments as practitioners gain additional skills which can be contextualised into the major incident setting. Previously run live exercises could be scaled-up to involve multi-disciplinary responders, varying levels of incident command and the media, or tailored to address specific learning requirements. Patient movements, surge capacity, communications and equipment failures could all be simulated. Scenarios can be altered and reproduced numerous times at little extra cost, conferring an economic benefit. Major incident plans and protocols could be tested in such environments, and modifications made to allow for them to be rerun, testing the organisational response, in addition to individual response. Novel approaches, such as guided error training, could be used to improve recognition and correction of individual or organisational errors, and the consequences of suboptimal response.³⁴⁵ In addition, the virtual environment scenarios could be developed to allow training in scenarios that would be impractical to train in real life, for example on major roads, airports and whole-hospitals. Furthermore, such scenarios could be used to prime participants in major incident response, which could enhance their performance and usefulness of future, more expensive, live exercises.

Virtual environments may also be utilised to address the documented shortcomings of current induction programmes for doctors in hospital major incident preparedness, based on previous successful programmes for operating theatre induction.^{102,245,252,253}

Virtual environments allow individuals and teams that are physically distant to exercise together in an immersive environment. Further validation of exercise assessment metrics would enable individuals, teams and organisations to benchmark their performance against, and learn from other peer groups nationally and potentially around the world, by using the virtual environment as a live educational platform.

9.5.3 Innovations in virtual environments

The findings of this research have implications for future research using virtual platforms. Whilst Second Life and OpenSimulator were accessed using relatively generic hardware, improving access and environment quality further on portable hand held devices, such as tablets or even telephones, requires an internet-based environment rather than a downloaded programme. Technology such as the Unity games engine offers potential to deliver this, and is being tested at the present time.^{351,352}

An intriguing possibility is the potential to simulate aspects of major incidents using other simulation methods that influence the virtual environment. For example, using a discrete-event simulator to model patient flows in a virtual major incident may enable the consequences of the clinical and managerial decisions at the time of an incident to be more readily visualised and the impact of alternative decisions to be seen.³⁵³ Another example is the development of a blast-injury simulator, which could improve the realism of the injury burden in different simulated explosion-related environments.³⁵⁴

9.5.4 Further medical training using virtual worlds

The scenarios demonstrated in this study demonstrate the future generic training potential of the virtual platform, especially for resuscitation and other emergency medical settings,

building on the work of our group and others.^{102,333} The multiuser technology pioneered in this work could be applied to decision-making in other areas. For example, the use of actor-based ward round simulations is currently being assessed, but this is expensive and relatively inaccessible, which could be overcome by virtual environments.³⁵⁵ In addition, mannequin-based simulation exercises, such as ATLS, could be linked to virtual scenarios with realistic physiology models, allowing for refresher training or ongoing skills assessment.

9.5.5 Global training implications

The success of the scenarios in chapter 8 has demonstrated the huge potential for distance training using virtual environments. Many of the implications discussed in this chapter are applicable to the global setting. Further work is required to determine optimal structures for design and delivery of such training modules, including improving the computer-literacy of the target population of medical practitioners and development of appropriate, resource-constrained scenarios following a user-needs analysis. A sensible way forward would be to build on existing training collaborations, such as LAST, Urolink and the Centre for Global Surgery.³⁵⁶⁻³⁵⁸

9.6 Summary

This thesis has demonstrated the feasibility for two innovative methods of simulation to enhance the current understanding of healthcare structures and practice in local, national and international settings. Development of these methodologies will be challenging, but with appropriate funding and support could enhance healthcare training and outcomes for future generations.

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Appendix 1 – The Crucible simulation: Participant questionnaires pre and post-simulation

1. The Crucible - Participant questionnaire pre-attendance

- This information is being collected by Imperial College London and NHSL as part of a research project to better understand the development and training needs of future clinical leaders.
- All information will be kept **entirely confidential** and will be anonymised before being entered onto a password-protected database.
- The data will not be accessible to your current or future employers
- NHS London will only have access to the data after it has been anonymised.
- We would like to contact you after the simulation to conduct a short online survey

Name: _____

Current position: _____

Best contact email address: _____

Please rate your understanding of the following:

	Poor				excellent
The regulation of healthcare providers	1	2	3	4	5
The role of patient organisations in the NHS	1	2	3	4	5
How NHS organisations are held accountable for their performance	1	2	3	4	5
The role of the local authority in public healthcare	1	2	3	4	5
The financial climate in the NHS	1	2	3	4	5
The roles and responsibilities of commissioners	1	2	3	4	5
The roles and responsibilities of care providers	1	2	3	4	5

Please rate the following:

1-poor to 7- excellent

I am aware of my strengths and limitations	1	2	3	4	5	6	7
I can obtain, analyse and act on feedback from a variety of sources	1	2	3	4	5	6	7
I acknowledge mistakes and treat them as learning opportunities	1	2	3	4	5	6	7
I act with integrity and behave in an open, honest and ethical manner	1	2	3	4	5	6	7

In the following areas please rate your own ability to:

1-poor to 7-excellent

work in partnership to improve services	1	2	3	4	5	6	7
communicate effectively	1	2	3	4	5	6	7
gain the trust of colleagues and understand their viewpoints	1	2	3	4	5	6	7
manage a conflict of interests and differences of opinion	1	2	3	4	5	6	7
work in a team, acknowledging contributions and compromises	1	2	3	4	5	6	7
actively contribute to plans to achieve service goals	1	2	3	4	5	6	7
appraise service options in terms of benefits and risks	1	2	3	4	5	6	7
take action when resources are not being used effectively	1	2	3	4	5	6	7
support team members and leaders to develop their roles	1	2	3	4	5	6	7
take responsibility for tackling difficult issues	1	2	3	4	5	6	7
balance economic considerations with the need for patient safety	1	2	3	4	5	6	7
assess the risk to patients of service change	1	2	3	4	5	6	7
critically evaluate existing processes and services	1	2	3	4	5	6	7
develop creative solutions to transform services and care	1	2	3	4	5	6	7
motivate and focus a group to accomplish service change	1	2	3	4	5	6	7
understand and interpret relevant legislation and accountability frameworks when considering service transformation	1	2	3	4	5	6	7
produce an evidence-based challenge to systems and processes	1	2	3	4	5	6	7
contribute to organisational decision-making processes	1	2	3	4	5	6	7
evaluate the impact of service decisions and change where necessary	1	2	3	4	5	6	7
negotiate effectively	1	2	3	4	5	6	7

I intend to lead change in the NHS in the immediate or near future								
Highly Unlikely	1	2	3	4	5	6	7	extremely likely
I plan to lead NHS service change in the distant future								
Highly Unlikely	1	2	3	4	5	6	7	extremely likely
I enjoy the challenge of leading service change								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am excited to be a part of reconfiguring London's health service								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I want to learn more about the implementation and effects of the NHS bill								
Highly Unlikely	1	2	3	4	5	6	7	Extremely likely
Being involved in clinical leadership will benefit my career								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My career prospects will be limited if I don't improve my leadership skills								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Understanding the NHS reforms is important for me to deliver high quality care								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am required to understand the system changes to the NHS to practice effectively								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My colleagues will expect me to become involved in leading service reconfiguration								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Most of my colleagues in my organisation are involved in leading service reconfiguration								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Current / future employers will expect clinicians to understand the reconfigured NHS and lead service delivery appropriately								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am confident in my clinical leadership skills								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I possess the knowledge and skills to lead change in my organisation								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My knowledge of NHS reforms empowers me to provide better services for my patients								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Most of my fellow clinicians have the appropriate skills to cope with NHS system change								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
It is possible for me to lead a service change in my organisations								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Junior consultants in the NHS are able to deliver effective service change								

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

My role within the organisation will allow me to lead change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I have support within my organisation to enable me to change practice

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

My organisation will expect me to reorganise services and change patient pathways

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The culture at my organisation encourages innovative clinician-led service change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The barriers that exist in my organisation will prevent me from implementing change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

My current job structure does not allow me to take a leadership role

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Thinking about the challenges you face in clinical leadership and service provision, could you answer the following?

	disagree				agree
I can always manage to solve difficult problems if I try hard enough	1	2	3	4	5
If someone opposes me, I can find the means and ways to get what I want.	1	2	3	4	5
It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4	5
I am confident that I could deal efficiently with unexpected events.	1	2	3	4	5
Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4	5
I can solve most problems if I invest the necessary effort.	1	2	3	4	5
I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4	5
When I am confronted with a problem, I can usually find several solutions.	1	2	3	4	5
If I am in trouble, I can usually think of a solution.	1	2	3	4	5
I can usually handle whatever comes my way.	1	2	3	4	5

On-the-day: Post-event participant feedback document

Please note: this information is being collected by Imperial College London to better understand the development and training needs of future clinical leaders.

All information will be kept entirely confidential and will not be accessible to your current or future employers, including Imperial College NHS Trust.

NHS London will only have access to the data after it has been anonymised.

Name:

Contact email:

Was this your first attendance at a behavioural simulation?

Yes No

	disagree				agree
The course was well organised	1	2	3	4	5
I understood the aims and objectives of the simulation	1	2	3	4	5
I was appropriately challenged by the material	1	2	3	4	5
I found the course content to be realistic	1	2	3	4	5
I found the course content to be relevant	1	2	3	4	5
I was actively involved in the simulation	1	2	3	4	5
I felt engaged by the simulation topic	1	2	3	4	5
I found this method of learning to be useful	1	2	3	4	5
I would like to take part in similar simulation events in future	1	2	3	4	5
I recommend this simulation to colleagues at my professional stage	1	2	3	4	5

What are the benefits of using this type of simulation?

Could the learning that you gained have been delivered more effectively, or by a different method?

If you hadn't attended today's event, how else would you have learned about the issues covered?

About the simulation today....

	disagree				agree
The presence of field coaches enhanced the simulation learning	1	2	3	4	5
The simulation has increased my awareness of issues facing the NHS	1	2	3	4	5
The simulation will help me address important issues facing the NHS	1	2	3	4	5
The simulation has made me more aware of my current/future roles and responsibilities	1	2	3	4	5
I have a better understanding of the structure and organisation of the health system following the simulation	1	2	3	4	5
Learning from the simulation will help me deliver better long term care to my patients	1	2	3	4	5

Following the simulation, please rate your understanding of the following:

	Poor				excellent
The regulation of healthcare providers	1	2	3	4	5
The role of patient organisations in the NHS	1	2	3	4	5
How NHS organisations are held accountable for their performance	1	2	3	4	5
The role of the local authority in public healthcare	1	2	3	4	5
The financial climate in the NHS	1	2	3	4	5
The roles and responsibilities of commissioners	1	2	3	4	5
The roles and responsibilities of care providers	1	2	3	4	5

The Crucible Post-event participant feedback document (at 2-4 weeks)

Please note: this information is being collected by Imperial College London to better understand the development and training needs of future clinical leaders.

All information will be kept entirely confidential and will not be accessible to your current or future employers, including Imperial College NHS Trust.

NHS London will only have access to the data after it has been anonymised.

Name: _____

Please rate the following:

1-poor to 7- excellent

I am aware of my strengths and limitations	1	2	3	4	5	6	7
I can obtain, analyse and act on feedback from a variety of sources	1	2	3	4	5	6	7
I acknowledge mistakes and treat them as learning opportunities	1	2	3	4	5	6	7
I act with integrity and behave in an open, honest and ethical manner	1	2	3	4	5	6	7

In the following areas please rate your own ability to:

1-poor to 7-excellent

work in partnership to improve services	1	2	3	4	5	6	7
communicate effectively	1	2	3	4	5	6	7
gain the trust of colleagues and understand their viewpoints	1	2	3	4	5	6	7
manage a conflict of interests and differences of opinion	1	2	3	4	5	6	7
work in a team, acknowledging contributions and compromises	1	2	3	4	5	6	7
actively contribute to plans to achieve service goals	1	2	3	4	5	6	7
appraise service options in terms of benefits and risks	1	2	3	4	5	6	7
take action when resources are not being used effectively	1	2	3	4	5	6	7
support team members and leaders to develop their roles	1	2	3	4	5	6	7
take responsibility for tackling difficult issues	1	2	3	4	5	6	7
balance economic considerations with the need for patient safety	1	2	3	4	5	6	7
assess the risk to patients of service change	1	2	3	4	5	6	7
critically evaluate existing processes and services	1	2	3	4	5	6	7
develop creative solutions to transform services and care	1	2	3	4	5	6	7
motivate and focus a group to accomplish service change	1	2	3	4	5	6	7
understand and interpret relevant legislation and accountability frameworks when considering service transformation	1	2	3	4	5	6	7
produce an evidence-based challenge to systems and processes	1	2	3	4	5	6	7
contribute to organisational decision-making processes	1	2	3	4	5	6	7
evaluate the impact of service decisions and change where necessary	1	2	3	4	5	6	7
negotiate effectively	1	2	3	4	5	6	7

Has today made you more aware of your developmental and leadership needs? If so, how?

I intend to lead change in the NHS in the immediate or near future								
Highly Unlikely	1	2	3	4	5	6	7	extremely likely
I plan to lead NHS service change in the distant future								
Highly Unlikely	1	2	3	4	5	6	7	extremely likely
I enjoy the challenge of leading service change								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am excited to be a part of reconfiguring London's health service								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I want to learn more about the implementation and effects of the NHS bill								
Highly Unlikely	1	2	3	4	5	6	7	Extremely likely
Being involved in clinical leadership will benefit my career								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My career prospects will be limited if I don't improve my leadership skills								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Understanding the NHS reforms is important for me to deliver high quality care								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am required to understand the system changes to the NHS to practice effectively								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My colleagues will expect me to become involved in leading service reconfiguration								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Most of my colleagues in my organisation are involved in leading service reconfiguration								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Current / future employers will expect clinicians to understand the reconfigured NHS and lead service delivery appropriately								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I am confident in my clinical leadership skills								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
I possess the knowledge and skills to lead change in my organisation								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My knowledge of NHS reforms empowers me to provide better services for my patients								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Most of my fellow clinicians have the appropriate skills to cope with NHS system change								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
It is possible for me to lead a service change in my organisations								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
Junior consultants in the NHS are able to deliver effective service change								
Strongly disagree	1	2	3	4	5	6	7	Strongly agree
My role within the organisation will allow me to lead change								

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I have support within my organisation to enable me to change practice

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

My organisation will expect me to reorganise services and change patient pathways

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The culture at my organisation encourages innovative clinician-led service change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The barriers that exist in my organisation will prevent me from implementing change

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

My current job structure does not allow me to take a leadership role

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Thinking about the challenges you face in clinical leadership and service provision, could you answer the following?

	disagree				agree
I can always manage to solve difficult problems if I try hard enough	1	2	3	4	5
If someone opposes me, I can find the means and ways to get what I want.	1	2	3	4	5
It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4	5
I am confident that I could deal efficiently with unexpected events.	1	2	3	4	5
Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4	5
I can solve most problems if I invest the necessary effort.	1	2	3	4	5
I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4	5
When I am confronted with a problem, I can usually find several solutions.	1	2	3	4	5
If I am in trouble, I can usually think of a solution.	1	2	3	4	5
I can usually handle whatever comes my way.	1	2	3	4	5

Briefly, what do you feels are the benefits of using this type of simulation for education?

Could another method have been more effective in conveying the knowledge, skills and behaviours?

Did attending the simulation event you more aware of your developmental and leadership needs? If so, how?

It is early on, but have you taken any learning from the simulation into your practice so far?

The end, thanks for completing

Appendix 2 – The Lateral Play simulation: Organisation datasets

Greendale Partnership

-LATERAL PLAY-

Appleton

Appleton is the largest Trust in the partnership and is linked to the medical school, it is working towards being an FT and is an AHSC. Appleton is within the North Greendale CCG area, it employs almost 5,000 staff and has over 400,000 patient episodes p.a. The buildings and facilities at Appleton are relatively new.

Trust Name	Appleton
Total activity (p.a)	402,082
o/p activity p.a.	314,277
day case activity p.a.	20,605
total i/p activity p.a. (incl. d/c)	87,805
Bed capacity	750
Bed occupancy %	84%
Staff	4,729
Spend (million p.a.)	£328
Financial Position	- £ 5.4 m
financial comment	
Spend / activity	814.6
Activity / staff	85.0
i/p : o/p activity	30%
i/p activity / beds	117.1
day case : total i/p	23%
Specialist services	Emergency department
	Regional Trauma Centre
	Orthopaedics
	Maternity Services
	+++ large range of specialist services
% share of under grads	40%
No. of post grads	400
Research	Approx. £ 100 million p.a. funding - NIHR BRC funding & MRC base

Orthopaedics :

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	95%
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	17.7
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	20.6
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	1.91%
	Patient experience	Dr Foster % of patients who would recommend to a friend	76%
Travel	Access by public transport	?	Excellent
	Access by blue light (8 mins.)	?	90%
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£12.1 million
	Total o/p (2012-13)	HES	314,277
	T&O o/p (2012-13)	HES	20,390
	Total i/p (2012-2013)	HES	87,805
	T&O i/p (2012-13)	HES	3,374
	Mean Length of Stay (LOS)	HES	4.3
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	12
		Quality of training index	
Research		% 4 * (RAE)	20
Transition			

Area	Appleton
Quality	Clinical - recovery ++
	Clinical – PROMS +
	Clinical MRSA rates --
	Patient experience +
Travel	Access to public transport ++
	Avg. response time for blue light ++
Finance	Est. T&O income £12m
	Net surplus / (deficit) within T&O --
Training	T&O trainee numbers ++
Research	Value of research activity ++
	Rating of academic research ++
Transition	To be confirmed ...

Maternity

Area		
births p.a		3,304
births - hospital led		1,118
births - midwife led		1,585
births - other / unknown led		600
births - cons ward		1,652
births - GP ward		-
births - cons / midwife / GP ward		-
births - other		1,651

Quality data

Area		Appleton
Quality	Patient survey – care received during labour	8.4
	Maternity complaints / 10,000 episodes	46.3
	Cleanliness (very clean – no. of ratings received)	21
	Dignity & respect (all of the time – no. of ratings received)	24
Travel	Ease of access	++
Finance	Est. maternity income	£11.5 m
	Net surplus / (deficit) within Maternity	(£0.4 m)
Training	O&G trainee numbers	++
Research	Value of research activity	++
	Rating of academic research	++
Transition		
For info		
..		

Pls note scale : ++ very good, + good, - limited, -- very limited / poor

Blackstone

Blackstone is an FT, it is a large DGH and is a busy, modern Acute Trust working with both CCGs. Blackstone has almost 4,000 staff and 550 beds.

Trust Name	Blackstone
Total activity (p.a)	421,649
o/p activity p.a.	332,199
day case activity p.a.	27,953
total i/p activity p.a. (incl. d/c)	89,451
Bed capacity	550
Bed occupancy %	88%
Staff	3,848
Spend (million p.a.)	£241
Financial Position	£ 3.9 m
financial comment	
Spend / activity	508.4
Activity / staff	109.9
i/p : o/p activity	30%
i/p activity / beds	149.1
day case : total i/p	31%
Specialist services	Emergency department
	Orthopaedics
	Maternity Services
% share of under grads	10%
No. of post grads	50
Research	Small pockets of research at Dept. level – approx.. £15 mill p.a.

Orthopaedics

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	85%
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	14.3
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	21.4
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	1.15%
	Patient experience	Dr Foster % of patients who would recommend to a friend	73%
Travel	Access by public transport		Excellent
	Access by blue light (8 mins)		85%
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£25.4 million
	Total o/p (2012-13)	HES	332,199
	T&O o/p (2012-13)	HES	43,721
	Total i/p (2012-2013)	HES	89,451
	T&O i/p (2012-13)	HES	6,995
	Mean Length of Stay (LOS)	HES	4.0
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	2
		Quality of training index	
Research		% 4 * (RAE)	10
Transition			

Area	Blackstone
Quality	Clinical - recovery -
	Clinical – PROMS -
	Clinical MRSA rates --
	Patient experience -
Travel	Access to public transport ++
	Avg. response time for blue light +
Finance	Est. T&O income £25m
	Net surplus / (deficit) within T&O +
Training	T&O trainee numbers +
Research	Value of research activity -
	Rating of academic research -
Transition	To be confirmed ...

Maternity

Area		
births p.a		4,074
births - hospital led		1,560
births - midwife led		2,510
births - other / unknown led		5
births - cons ward		0
births - GP ward		0
births - cons / midwife / GP ward		4,071
births - other		1

Quality data :

Area		Blackstone
Quality	Patient survey – care received during labour	8.7
	Maternity complaints / 10,000 episodes	58.1
	Cleanliness (very clean – no. of ratings received)	13
	Dignity & respect (all of the time – no. of ratings received)	29
Travel	Ease of access	++
Finance	Est. maternity income	£14.22 m
	Net surplus / (deficit) within Maternity	(£0.1 m)
Training	O&G trainee numbers	+
Research	Value of research activity	-
	Rating of academic research	-
Transition		
For info ..		

Pls note scale : ++ very good, + good, - limited, -- very limited / poor

Chrysalis

Chrysalis is an Acute Trust with some community based pathways – it is working towards being an FT – it has recently invested in new facilities and buildings and is sited close to a new business district within the area. Chrysalis employs just over 2,000 staff and handles over 250,000 patients episodes p.a.

Trust Name	Chrysalis
Summary	
Total activity (p.a)	251,897
o/p activity p.a.	190,553
day case activity p.a.	20,598
total i/p activity p.a. (incl. d/c)	61,344
Bed capacity	300
Bed occupancy %	92%
Staff	2,011
Spend (million p.a.)	£123
Financial Position	- £ 5.3 m
financial comment	Small PFI commitment - £5.8 million in new facilities. Discussing merger with another trust outside the region
Spend / activity	488
Activity / staff	125.3
i/p : o/p activity	30%
i/p activity / beds	204.5
day case : total i/p	34%
Specialist services	Emergency department
	Orthopaedics
	Maternity Services
% share of under grads	10%
No. of post grads	50
Research	Community service based research with private sector – linked to large patient roll of approx. 250,000.

Orthopaedics :

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	75%
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	16.2
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	20.0
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	0
	Patient experience	Dr Foster % of patients who would recommend to a friend	74%
Travel	Access by public transport		frequent
	Access by blue light (8 mins.)		75%
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£13.8 million
	Total o/p (2012-13)	HES	190,553
	T&O o/p (2012-13)	HES	21,660
	Total i/p (2012-2013)	HES	61,344
	T&O i/p (2012-13)	HES	3,890
	Mean Length of Stay (LOS)	HES	3.2
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	3
		Quality of training index	
Research		% 4 * (RAE)	5
Transition			

Area	Chrysalis
Quality	Clinical - recovery --
	Clinical – PROMS +
	Clinical MRSA rates ++
	Patient experience -
Travel	Access to public transport +
	Avg. response time for blue light -
Finance	Est. T&O income £14m
	Net surplus / (deficit) within T&O --
Training	T&O trainee numbers +
Research	Value of research activity +
	Rating of academic research --
Transition	To be confirmed ...

Maternity

HES information	
births p.a	3,416
births - hospital led	1,057
births - midwife led	2,061
births - other / unknown led	298
births - cons ward	395
births - GP ward	0
births - cons / midwife / GP ward	2,129
births - other	604

Quality data

Area		Chrysalis
Quality	Patient survey – care received during labour	8.7
	Maternity complaints / 10,000 episodes	28.9
	Cleanliness (very clean – no. of ratings received)	8.9
	Dignity & respect (all of the time – no. of ratings received)	8.89
Travel	Ease of access	+
Finance	Est. maternity income	£11.92 m
	Net surplus / (deficit) within Maternity	£0.1 m
Training	O&G trainee numbers	+
Research	Value of research activity	-
	Rating of academic research	-
Transition		
For info ..		

Pls note scale : ++ very good, + good, - limited, -- very limited / poor

Davenport

Davenport is an Acute Trust and is working towards being an FT. It is a similar size of hospital to Chrysalis and Essen. Davenport is sited in the middle of the North Greendale CCG area – but outside of the main urban centre. Davenport has almost 300,000 patient episodes p.a., has 400 patient beds and just over 2,200 staff.

Maternity services within Davenport are highly recommended by patients and there is spare capacity within their department. The lead Maternity consultant has been asked by the CCG to advise on options for the redesign of Maternity services including the option for midwife led birthing centres (maternity hotel).

Trust Name	Davenport
Total activity (p.a)	299,185
o/p activity p.a.	236,291
day case activity p.a.	25,923
total i/p activity p.a. (incl. d/c)	62,893
Bed capacity	400
Bed occupancy %	78%
Staff	2,249
Spend (million p.a.)	£132
Financial Position	- £ 5.8 m
financial comment	
Spend / activity	442.6
Activity / staff	133.0
i/p : o/p activity	30%
i/p activity / beds	157.2
day case : total i/p	41%
Specialist services	Emergency department
	Orthopaedics
	Maternity Services
% share of under grads	15%
No. of post grads	100
Research	Approx. £35 million p.a. - host organisation for NIHR & HIEC

Orthopaedics :

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	95%
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	15.1
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	18.7
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	0.38%
	Patient experience	Dr Foster % of patients who would recommend to a friend	51%
Travel	Access by public transport		Fair
	Access by blue light (8 mins)		65%
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£12.5 million
	Total o/p (2012-13)	HES	236,291
	T&O o/p (2012-13)	HES	17,521
	Total i/p (2012-2013)	HES	62,893
	T&O i/p (2012-13)	HES	3,651
	Mean Length of Stay (LOS)	HES	4.5
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	4
		Quality of training index	
Research		% 4 * (RAE)	10
Transition			

Area		Davenport
Quality	Clinical - recovery	++
	Clinical – PROMS	-
	Clinical MRSA rates	-
	Patient experience	--
Travel	Access to public transport	+
	Avg. response time for blue light	-
Finance	Est. T&O income	£12m
	Net surplus / (deficit) within T&O	-
Training	T&O trainee numbers	+
Research	Value of research activity	-
	Rating of academic research	-
Transition	To be confirmed ...	

Maternity

HES information	
births p.a	3,084
births - hospital led	130
births - midwife led	2,604
births - other / unknown led	349
births - cons ward	0
births - GP ward	0
births - cons / midwife / GP ward	2,982
births - other	101

Quality data :

Area		Davenport
Quality	Patient survey – care received during labour	8.5
	Maternity complaints / 10,000 episodes	70.8
	Cleanliness (very clean – no. of ratings received)	8.85
	Dignity & respect (all of the time – no. of ratings received)	9.19
Travel	Ease of access	+
Finance	Est. maternity income	£10.76 m
	Net surplus / (deficit) within Maternity	£0.5 m
Training	O&G trainee numbers	+
Research	Value of research activity	-
	Rating of academic research	-
Transition		
For info ..		

Pls note scale : ++ very good, + good, - limited, -- very limited / poor

Essen

Essen is an Acute FT – it is a busy, high performing Trust and works closely with other organisations outside the partnership given its location on the southern boundary of the area. Essen has annual activity levels of approx.. 250,000 patient episodes, employs almost 4,000 staff and has 400 patient beds.

Trust Name	Essen
Summary	
Specialist services	Emergency department
Total activity (p.a)	258,896
o/p activity p.a.	193,374
day case activity p.a.	18,090
total i/p activity p.a. (incl. d/c)	65,523
Bed capacity	400
Bed occupancy %	93%
Staff	3,709
Spend (million p.a.)	£243
Financial Position	£ 8.3 m
financial comment	
Spend / activity	939.9
Activity / staff	69.8
i/p : o/p activity	30%
i/p activity / beds	163.8
day case : total i/p	28%
	Orthopaedics
	Maternity Services
	incl. high value specialties
% share of under grads	25%
No. of post grads	20
Research	£20million NIHR funding p.a.

Orthopaedics :

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	90%
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	12.6
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	20.5
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	0
	Patient experience	Dr Foster % of patients who would recommend to a friend	65%
Travel	Access by public transport		Local
	Access by blue light (8 mins.)		50%
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£13.8 million
	Total o/p (2012-13)	HES	193,374
	T&O o/p (2012-13)	HES	23,309
	Total i/p (2012-2013)	HES	65,523
	T&O i/p (2012-13)	HES	3,809
	Mean Length of Stay (LOS)	HES	4.3
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	4
		Quality of training index	
Research		% 4 * (RAE)	10
Transition			

Area	Essen
Quality	Clinical - recovery +
	Clinical – PROMS --
	Clinical MRSA rates ++
	Patient experience -
Travel	Access to public transport -
	Avg. response time for blue light --
Finance	Est. T&O income £13m
	Net surplus / (deficit) within T&O ++
Training	T&O trainee numbers +
Research	Value of research activity -
	Rating of academic research -
Transition	To be confirmed ...

Maternity

HES information	
births p.a	2,150
births - hospital led	689
births - midwife led	1,368
births - other / unknown led	93
births - cons ward	1,635
births - GP ward	415
births - cons / midwife / GP ward	0
births - other	88

Quality data :

Area		Essen
Quality	Patient survey – care received during labour	9.0
	Maternity complaints / 10,000 episodes	46.3
	Cleanliness (very clean – no. of ratings received)	49
	Dignity & respect (all of the time – no. of ratings received)	48
Travel	Ease of access	-
Finance	Est. maternity income	£7.5 m
	Net surplus / (deficit) within Maternity	(£0.75 m)
Training	O&G trainee numbers	+
Research	Value of research activity	-
	Rating of academic research	-
Transition		
For info		
..		

Pls note scale : ++ very good, + good, - limited, -- very limited / poor

Frontier

Frontier is a large Community Trust covering the South Greendale area. It is not an FT and discussions on an applicable FT pathway have been constrained by a deficit budget and limited evidence of growth.

As a Community Trust, Frontier does not offer mental health services, but has a focus on low risk day case activity and outpatients, with inpatient episodes accounting for only 10% of activity.

Trust Name	Frontier
Summary	
Total activity (p.a)	39,366
o/p activity p.a.	35,019
day case activity p.a.	243
i/p activity p.a.	4,347
Bed capacity	94
Bed occupancy %	82%
Staff	2,576
Spend (million p.a.)	£104
net surplus / (deficit)	(£3.1 m)
financial comment	
Spend / activity	2641.9
Activity / staff	15.3
i/p : o/p activity	10%
i/p activity / beds	46.2
day case : total i/p	6%
Specialist services	Nil
% share of under grads	
No. of post grads	
Research	Community based research linked to Diabetes with private sector – approx.. £10 million p.a.

Orthopaedics :

Criteria	Orthopaedics data	Ref. source	Value
Quality	TKR / THR recovery within 24 hrs.	Dr Foster – est. % of patients walking within 24 hrs of surgery	
	PROMS – knee – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	
	PROMS – hip – to Mar ‘12	HES – Oxford score – casemix adjusted – avg health gain	
	MRSA rates (18 th April 2012)	HPA – provider tables – ref 1a	
	Patient experience	Dr Foster % of patients who would recommend to a friend	100%
Travel	Access by public transport		Limited
	Access by blue light		n/a
Finance	Est. T&O income	HES x PbR HRG HA, B&C	£400k
	Total o/p (2012-13)	HES	35,019
	T&O o/p (2012-13)	HES	2,452
	Total i/p (2012-2013)	HES	4,347
	T&O i/p (2012-13)	HES	0
	Mean Length of Stay (LOS)	HES	5.4
	Net surplus / deficit (T&O)		
Training	T&O trainee numbers	Deanery	0
		Quality of training index	
Research			21.2
Transition			

Gateway

Gateway is the only Mental Health Trust in the partnership – it has yet to reach FT status. Gateway has over 600 patient beds and almost 3,000 staff. It is a national pioneer in online CBT.

Gateway has a large offering of community services for mental health patients, but doesn't at present, offer community based services outside the mental health pathways.

The CCGs across the Partnership have agreed to adopt new integrated tariff arrangements covering Community and Mental Health services. This will have an impact on Gateway finances and may threaten the current FT pathway.

Trust Name	Gateway
Summary	.
Total activity (p.a)	418,645
o/p activity p.a.	415,700
i/p activity p.a.	2,945
Bed capacity	601
Bed occupancy %	91%
Staff	3,153
Spend (million p.a.)	£154
net surplus / (deficit)	£8.4 m
financial comment	
Spend / activity	367.9
Activity / staff	132.8
i/p activity / beds	4.9
Specialist services	Mental Health
% share of under grads	
No. of post grads	
Research	£ 30 million p.a. - specialist mental health research interests

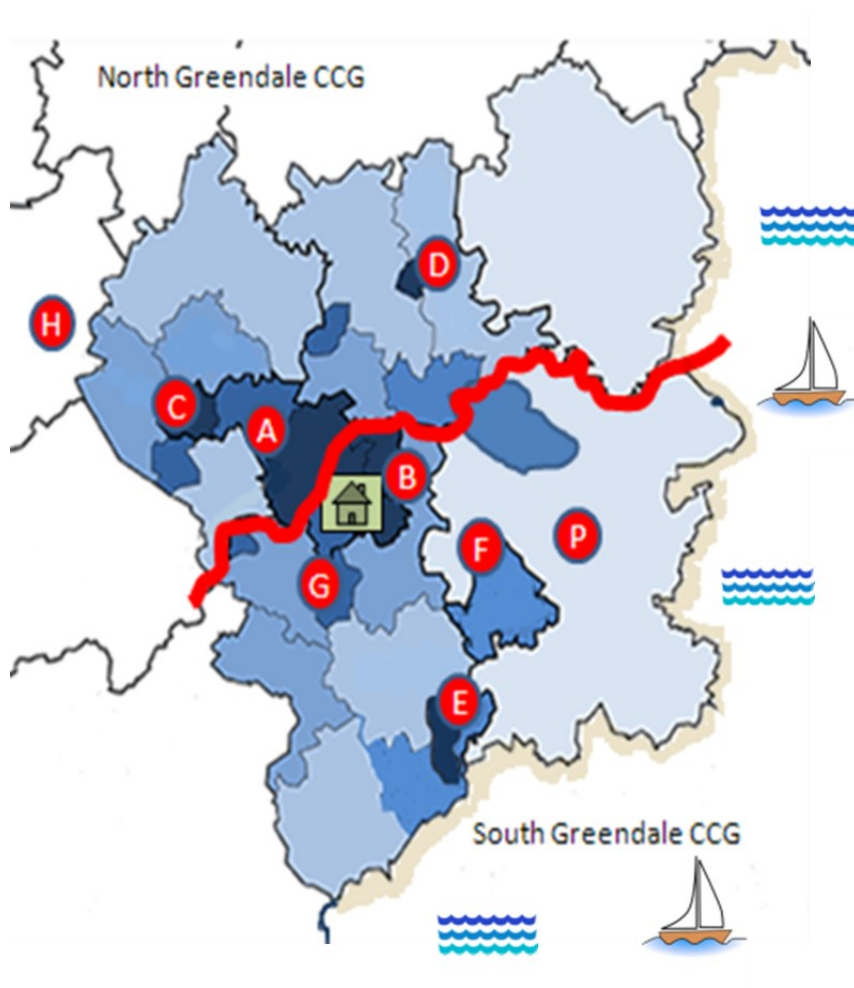
Orthopaedics :

Orthopaedics data	
HES Total o/p (2012-13)	415,700
HES T&O o/p (2012-13)	0
HES Total i/p (2012-2013)	2,945
HES T&O i/p (2012-13)	0

C.O.R.E. Clinical & Organisational Research and Education

The C.O.R.E. group comprises the Medical School, the LETB and the CLAHRC within the Greendale area. The members of the group will be responsible for ensuring that due consideration is given to the research and education agenda during all discussions. The aim of the group should be to enhance the opportunities for education and research in each of the working group proposals.

The group should also ensure that developments and changes align with their (CORE) needs and expectations. The working groups will need CORE "sign off" for any proposed changes.



North Greendale CCG

North Greendale CCG covers a population of approx. 800,000 population and there are 3 Trusts Appleton, Chrysalis and Davenport within the area.

North Greendale CCG has been involved in discussions around the reconfiguration of Orthopaedic services and the redesign of Maternity services and is very supportive. The CCG has made a commitment to commission in line with the working group outcomes.

North Greendale CCG commissions community services from Howston – an FT outside the Partnership - the contract is coming up for re-tender. Howston has recently approached North Greendale CCG with an offer which in line with the new tariff arrangements, combines community and mental health provision.

The CCG should also ensure that developments and changes align with their commissioning needs and expectations. The working groups will need CCG "sign off" for any proposed changes.

Note : The integrated tariff to be adopted by the CCGs covers community and mental health pathways – the provider will agree a treatment pathway applicable to patient needs but will receive a single 'standard' payment (similar to the new maternity pathway payment) instead of individual 'fee-for-service' payments. In areas where a high number of patients have complex needs – this could have considerable impact on provider finances.

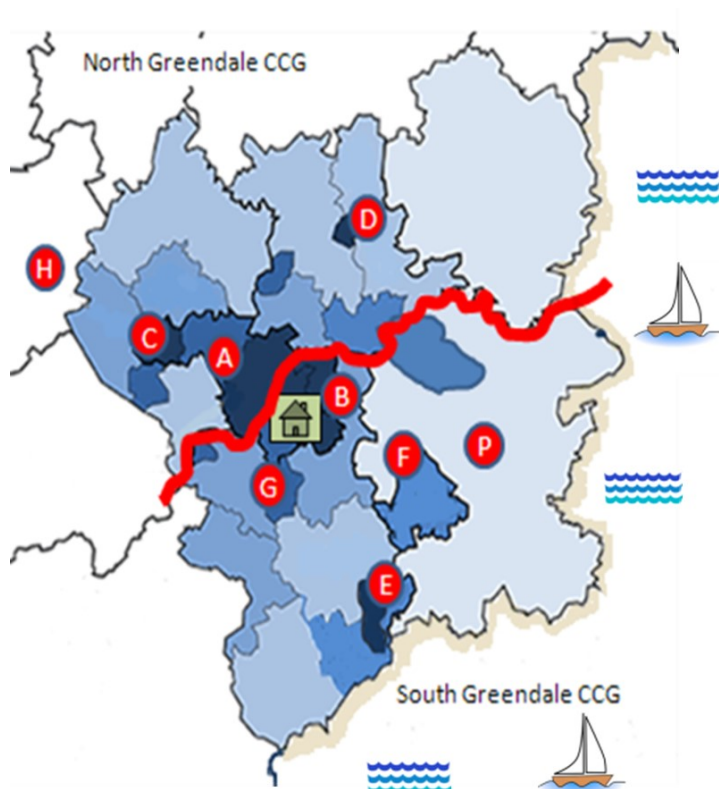
Organisation	North Greendale CCG	Appleton	Chrysalis	Davenport
Total activity (p.a)	953,163	402,082	251,897	299,185
o/p activity p.a.	741,121	314,277	190,553	236,291
day case activity p.a.	67,125	20,605	20,598	25,923
i/p activity p.a.	212,042	87,805	61,344	62,893
Bed capacity	1,450	750	300	400
Bed occupancy %	85%	84%	92%	78%
Staff	8,989	4,729	2,011	2,249
Spend (million p.a.)	583	£328	£123	£132
net surplus / (deficit)	-	(£ 5.4 m)	(£ 5.3 m)	(£5.8 m)

South Greendale CCG

South Greendale CCG covers a population of approx. 1.2 million and there are 4 Trusts Blackstone, Essen, Frontier and Gateway within the area. The University / Medical is also centred within the South Greendale area.

South Greendale CCG has been involved in discussions around the reconfiguration of Orthopaedic services and the redesign of Maternity services and is very supportive. The CCG has made a commitment to commission in line with the working group outcomes.

The CCG should also ensure that developments and changes align with their commissioning needs and expectations. The working groups will need CCG "sign off" for any proposed changes.



Organisation	South Greendale CCG	Blackstone	Essen	Frontier	Gateway
Total activity (p.a)	1,138,557	421,649	258,896	39,366	418,645
o/p activity p.a.	976,291	332,199	193,374	35,019	415,700
day case activity p.a.	46,287	27,953	18,090	243	-
i/p activity p.a.	162,265	89,451	65,523	4,347	2,945
Bed capacity	1,645	550	400	94	601
Bed occupancy %	88%	88%	93%	82%	91%
Staff	13,276	3,838	3,709	2,576	3,153
Spend (million p.a.)	716	£214	£243	£104	£154
net surplus / (deficit)	-	£ 3.9 m	£8.3 m	£1.5 m	£8.4 m

Appendix 3 – Lateral Play participants: real-life and simulation roles (anonymised)

Simulation role	Real-life role in NW London NHS
Appleton CEO	CEO (Chief Executive Officer)
Appleton DoS	DoS (Director of Strategy)
Appleton Med Dir	MD (Medical Director)
Blackstone CEO	CEO
Blackstone Chair	Chairman
Blackstone Med Lead (Mat)	Acute medical director
Chrysalis CEO	CEO
Chrysalis CFO	CFO (Chief Financial Officer)
Chrysalis Med Dir	MD
Davenport CEO	CEO
Davenport Clinical lead	Clinical Director
Davenport Med Dir	MD
Essen CEO	CEO
Essen Med (T&O)	Lead T&O
Essen Service director	Service Director
Frontier CEO	CEO
Frontier Med Dir	MD
Frontier Nursing Lead	Nursing Lead
Gateway CEO	CEO
Gateway Dir Strategy	DoS
Gateway Med Dir	MD
North CCG - Chair	CCG Chair
North CCG - GP	GP
South CCG - Chair	CCG Chair
South CCG - GP	GP
CORE - Clinical & Org Research & Ed.	CLAHRC
CLAHRC	CLAHRC
Dean Med School	Dean of Medical School
Chair of Partnership	Ara Darzi
MD of Partnership	Adrian Bull

Appendix 4 – The Lateral Play simulation: *-LATERAL PLAY-*

Participant questionnaires pre and post-simulation

Survey 1 - Imperial College Health Partners (ICHP)

- Please note: this information is being collected by Imperial College London, on behalf of ICHP to better understand the development needs of ICHP.
- All information will be treated confidentially
- ICHP will only have access to the data after it has been anonymised.

Imperial College Health Partners (ICHP) is a newly formed organisation spanning the healthcare interests of providers and commissioners in the area of North West London. The aim of the partnership is to bring about real, practical improvements to the quality of healthcare delivery and the research agenda across the whole population. The vision is for ICHP to act as the driving force for collaborative working across North West London to deliver improvements in patient care and population health, generate value for the taxpayer, support and develop staff and create wealth for the economy. Long-term relationships need to be built to ensure trust and understanding and to create space for innovative working and creative thinking. ICHP will be a source for knowledge capital, consisting of human capital (new knowledge, skills ideas and practices), social capital (new relationships, reputation and trust), and structural capital (new organising structures, routines, documents and tools).

The aim of this survey is to measure your perception of the development of ICHP and also asks you to consider your role within this Partnership. Please be open and honest in your views – the survey will be repeated in six month's time and results will be compared. ICHP will be able to focus development plans based on the results from each survey and the progression over the six month period.

Thank you for your time in completing this survey!

Name: _____

Section 1

These questions test your perception of the Partnership based on its ability to meet stated objectives around research, adoption of innovation and wealth creation.

Please rate ICHP's performance in the following areas:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improving research participation	1	2	3	4	5	6	7
translating research into practice	1	2	3	4	5	6	7
achieving service improvement	1	2	3	4	5	6	7
collaborating on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
fostering wealth creation	1	2	3	4	5	6	7
achieving population wide health benefit	1	2	3	4	5	6	7

Section 2

According to recent theoretical frameworks in social sciences, human behaviour is influenced by a interaction of Capability, Opportunity, and Motivation. This framework will help understand some of the drivers and barriers to achieving the key objectives of ICHP

- Capability is defined as the individual's psychological and physical capacity to engage in the activity concerned.
- Opportunity is defined as all the factors, social and physical, which are outside the individual and make the behaviour possible or prompt it.
- Motivation is defined as the psychological processes that energize and direct behaviour, which include beliefs, attitudes, emotions and habits.

The survey looks at your assessment of your own capability, motivation and opportunity to help contribute to the development of the Partnership in achieving its objectives.

Section 3

Capability is what people are able to do and to be. This includes the extent to which you are able to adapt to change, generate new knowledge, and improve your performance. Important aspects of capability in the context of the ICHP are assumed to be collaboration and leadership skills.

Please rate your personal CAPABILITY to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improving research participation	1	2	3	4	5	6	7
translating research into practice	1	2	3	4	5	6	7
achieving service improvement	1	2	3	4	5	6	7
collaborating on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
fostering wealth creation	1	2	3	4	5	6	7
achieving population wide health benefit	1	2	3	4	5	6	7

Section 4

Opportunity refers to conditions (physical and social) that are external to the individual. Physical opportunity is afforded by the environment, such as organizational structures and resources. Social opportunity refers to the milieu that dictates the way that we think about things, the words and concepts we use and the predominant discourse, such as the organizational culture.

Please rate the extent to which you personally have OPPORTUNITY afforded to you in your role to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improve research participation	1	2	3	4	5	6	7
translate research into practice	1	2	3	4	5	6	7
achieve service improvement	1	2	3	4	5	6	7
collaborate on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
foster wealth creation	1	2	3	4	5	6	7
achieve population wide health benefit	1	2	3	4	5	6	7

Section 5

Motivation can be divided into reflective and automatic processes. Reflective motivation involves more conscious decision making in which a choice or intention is present based on beliefs and attitudes about the consequences. Automatic motivation is based on emotions and impulses that arise from associative learning or innate dispositions. Resistance to change or work engagement are examples of automatic motivation.

Please rate your personal MOTIVATION to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

improve research participation	1	2	3	4	5	6	7
translate research into practice	1	2	3	4	5	6	7
achieve service improvement	1	2	3	4	5	6	7
collaborate on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
foster wealth creation	1	2	3	4	5	6	7
achieve population wide health benefit	1	2	3	4	5	6	7

Survey 2

- Please note: this information is being collected by Imperial College London, on behalf of ICHP to better understand the development needs of ICHP.
- All information will be treated confidentially
- ICHP will only have access to the data after it has been anonymised.

The aim throughout the simulation is to foster and encourage active contribution to the wider partnership at all times, the participants will be briefed on the need to focus on innovation adoption, collaboration and governance.

The aim of this survey is to measure the impact of the simulation of the development of ICHP and each individual's understanding of their role within the partnership. Please be open with your answers. There are no right / wrong answers.

Thank you for your time in completing this survey!

Name: _____

Section 1 :

Was this your first attendance at a behavioural simulation? **Yes No**

	disagree				agree
The simulation was well organised	1	2	3	4	5
I understood the aims and objectives of the simulation	1	2	3	4	5
I was appropriately challenged by the material	1	2	3	4	5
I found the simulation content to be realistic	1	2	3	4	5
I found the simulation content to be relevant	1	2	3	4	5
I was actively involved in the simulation	1	2	3	4	5
I found this method of learning to be useful	1	2	3	4	5
I would like to take part in similar simulation events in future	1	2	3	4	5

Section 2 :

What do you think are the benefits of using this type of simulation?

e.g. team working, safe environment, multi-stage event, reflection etc

—
If you hadn't attended the simulation, how else would you have learned about the issues covered?

Section 3 :This section looks at the impact of the simulation on the partnership

I understand the objectives of the ICHP

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I am aware of my current/future roles and responsibilities within the ICHP

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I am aware of the issues facing the ICHP

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

I am able to address important issues facing the ICHP

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

This section looks at your perception of the needs of the partnership

How important are the needs of the partnership in your work?

Not important at all 1 2 3 4 5 6 7 very important

How important are the needs of your trust/organisation in comparison to the needs of the partnership?"

Not important at all 1 2 3 4 5 6 7 very important

Section 4

Has the Lateral Play simulation made you more aware of your collaboration and cooperation needs within ICHP? If so, how?

Survey 3

This information is being collected by Imperial College London, on behalf of Imperial College Health Partners (ICHP). All information will be treated confidentially. ICHP will only have access to the data after it has been anonymised.

The vision of the Partnership is to act as the driving force for collaborative working across North West London to deliver improvements in patient care and population health, generate value for the taxpayer, support and develop staff and create wealth for the economy. Long-term relationships need to be built to ensure trust and understanding and to create space for innovative working and creative thinking.

The aim of this survey is to measure your perception of the development of ICHP since the Lateral Play simulation and also asks you to consider your role within the Partnership. Please be open and honest in your views. ICHP will be able to focus development plans based on the results from the survey.

Thank you for your time in completing this survey

Section 1

After the Lateral Play simulation in 2013, a partnership development plan was created and adopted by the ICHP board. With commitment to this development plan in mind, we would like you to respond to the following questions related to your perception of the partnership going forward.

A summary of the plan is below - the survey begins on the next page:

ICHP strategic objectives	Projects	Project Objectives
Enable the discovery of best practice	Alignment and dissemination of research	• Identification of new knowledge from research for implementation. • Improved patient access to research with a single repository of all patients consented to participate in research. • Reinvigorate Primary Care research & education network • Single point of entry to reduce lead time with greater standardisation of research management and governance protocols within the NWL sector
	Intelligent use of data	• Collaborative use of informatics data with NWL Commissioning Support Unit • Creation of linked data across health and possibly social care • Potential for NWL to be national demonstrator site • Develop a suite of applications for linked data informed by NHS and industry need • Identification of an appropriate robust data warehouse as a tool to measure ICHP Projects
	Mental Health	• Strategic scoping of current position of mental health and mental healthcare services in NWL • Agree set of priorities with Mental Health Programme Board for ICHP Clinical Advisory Group programme of work • Develop and host seminar for leading academics and clinicians in mental health in NWL.
Adopt best practice systematically	Patient Safety	• Research to establish cross-system clinicians perspective on key patient safety factors across NWL in primary care, mental health and cancer • Promote a culture of continual learning for leaders across the sector on placing the quality of patient care, especially patient safety, above all other aims for investment, inquiry, improvement, regular reporting, encouragement and support • Align the induction and mandatory training for junior doctors moving across organisations within the system by introducing core and common approach across all organisations (Collaboration with LETB). • Identify the current variation in approach across NWL to patient safety Board reporting and establish a performance measurement process to monitor success of project and associated work streams.
	Evaluation of Whole Systems Integration (WSI)	• Lead the development and execution of the WSI evaluation to ensure the investment provides value for money and leads to measurable outcomes. • Provide information on best practice from around the world by bringing together thought leaders to enable partners to co-design the model effectively.
	Chronic Obstructive Pulmonary Disease (COPD)	• Strategic review of current level of diffusion and to secondary care bundle implementation and engage with CLAHRC to develop a Primary Care bundle • Identify best practice for COPD and collaborate with appropriate stakeholders to diffuse across the sector to achieve best practice outcome.
	Cardiovascular rehabilitation	• Establish best practice for cardiovascular rehabilitation and the management of patients at high risk of cardiovascular disease.
	Cancer	• Specific objectives to be developed and agreed on early diagnosis and intervention, compliance with best practice pathways, monitoring of outcome measures (in association with LCA and Cancer Registry) • Promote Cancer SBRI amongst stakeholders
	Neurorehabilitation	• Conduct a network-wide service review including detailed clinically-informed capacity and demand analysis across all providers and levels of care up to Level 1 specialist rehabilitation. • Development of a web-based interactive system that would act as a common waiting list for patients. This will allow active case management and efficient matching of need to provision as well as improved surveillance of blockages and inefficiencies in the system. • Design and pilot an innovative cross-organisational model of integrated rehabilitation.
Support wealth creation in the sector and beyond	Overseas development	• Develop a sector offer to assist international development • Develop operating model with partners • Introduce formal philanthropic offer to partners alongside commercial outfit
	Collaboration with industry	• Develop a "matchmaker" infrastructure for its partners to systematically articulate need among partner organisations and enable industry to respond to this need in a standardised and transparent form • Develop a proactive engagement with industry

New Screen

With the implementation of the ICHP development plan in mind, encompassing the strategic and project objectives, how would you assess current performance of ICHP in comparison to what the group said a year ago?

NOTE: The most commonly given response given prior to the Lateral Play simulation is in brackets next to each question

improve research participation (3)	1	2	3	4	5	6	7
translate research into practice (3)	1	2	3	4	5	6	7
achieve service improvement (3)	1	2	3	4	5	6	7
collaborate on education and training (4)	1	2	3	4	5	6	7
better use of information (4)	1	2	3	4	5	6	7
foster wealth creation (3)	1	2	3	4	5	6	7
achieve population wide health benefit (4)	1	2	3	4	5	6	7

Do you have any comments on the above?-

Section 2

Human behaviour is influenced by a interaction of Capability, Opportunity, and Motivation. This framework will help understand some of the drivers and barriers to achieving the key objectives of ICHP

- Capability is defined as the individual's psychological and physical capacity to engage in the activity concerned.
- Opportunity is defined as all the factors, social and physical, which are outside the individual and make the behaviour possible or prompt it.
- Motivation is defined as the psychological processes that energize and direct behaviour, which include beliefs, attitudes, emotions and habits.

The survey looks at your assessment of your own capability, motivation and opportunity to help contribute to the development of the Partnership in achieving its objectives.

Capability is what people are able to do and to be. This includes the extent to which you are able to adapt to change, generate new knowledge, and improve your performance. Important aspects of capability in the context of the ICHP are assumed to be collaboration and leadership skills.

Please rate your personal CAPABILITY to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improving research participation	1	2	3	4	5	6	7
translating research into practice	1	2	3	4	5	6	7
achieving service improvement	1	2	3	4	5	6	7
collaborating on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
fostering wealth creation	1	2	3	4	5	6	7
achieving population wide health benefit	1	2	3	4	5	6	7

Opportunity refers to conditions (physical and social) that are external to the individual. Physical opportunity is afforded by the environment, such as organizational structures and resources. Social opportunity refers to the milieu that dictates the way that we think about things, the words and concepts we use and the predominant discourse, such as the organizational culture.

Please rate the extent to which you personally have OPPORTUNITY afforded to you in your role to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improve research participation	1	2	3	4	5	6	7
translate research into practice	1	2	3	4	5	6	7
achieve service improvement	1	2	3	4	5	6	7
collaborate on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
foster wealth creation	1	2	3	4	5	6	7
achieve population wide health benefit	1	2	3	4	5	6	7

Motivation can be divided into reflective and automatic processes. Reflective motivation involves more conscious decision making in which a choice or intention is present based on beliefs and attitudes about the consequences. Automatic motivation is based on emotions and impulses that arise from associative learning or innate dispositions. Resistance to change or work engagement are examples of automatic motivation.

Please rate your personal MOTIVATION to contribute to the following objectives of the ICHP:

1-poor to 7-excellent

	1	2	3	4	5	6	7
improve research participation	1	2	3	4	5	6	7
translate research into practice	1	2	3	4	5	6	7
achieve service improvement	1	2	3	4	5	6	7
collaborate on education and training	1	2	3	4	5	6	7
better use of information	1	2	3	4	5	6	7
foster wealth creation	1	2	3	4	5	6	7
achieve population wide health benefit	1	2	3	4	5	6	7

Finally, thinking back to the Lateral Play simulation, do you think that the simulation had a positive, negative or a neutral impact on the development and progression of the partnership? Are you able to give examples?

Thank you for taking the time to complete this questionnaire

Appendix 5 – The Lateral Play simulation: Greendale news reports and press releases developed during the simulation

Issue 1 March 2013

GREENDALE COURIER

US Health Giant “seeks to profit from Greendale patients”.

By our Sickie Correspondent.

A giant US health company is planning to make big profits by closing wards in Greendale’s local hospitals and forcing frail elderly patients to be treated in their own homes instead.

Mountain Health, one of America’s biggest private health plans wants to launch a joint venture with the newly formed Greendale Partnership – the grouping of all the hospitals and health providers in the borough – to treat patients in a “virtual” ward rather than a real one.

If the programme works, Mountain Health and Greendale plan “a roll out of the programme into other countries on the continent” according to a paper put to the board of the Greendale Partnership. The “commercial benefits could be significant for the Greendale Partnership”, the paper says.

Tom ‘I know where the votes lie’ Parsons, Labour’s health spokesman on Greendale Brough Council said “this is yet another example of this government’s drive to privatise the NHS come hell or high water.

This time is not just a US health company but our own local hospitals who are putting profits before patients.”

A spokesman for Greendale North said no decision had yet been made on Mountain Health’s proposal but “we know that given a choice patients would much rather be cared for in their own homes than in a hospital. This approach of a ‘virtual’ ward has already been tried in other parts of England and patients like it. It means fewer hospital admissions, less risk to patients from going into hospital, and better treatment at home.” The spokesman conceded that fewer admissions might lead to fewer beds and wards being needed in hospital.

Mountain Health said it used the programme – which can involve using new technology to monitor patients with complex medical and social needs remotely - very successfully in the United States. “But we need proof of concept in Europe.

The spokesman denied the US health care giant was planning to “experiment” on Greendale’s patients. “We just need to

demonstrate that what works in the US works as well here in a very different context.”

Mountain Health is a “not for profit” in the US terms. But last year it reported \$900m dollars of profit from its insurance and health care provision business. It was also fined \$300m by the US authorities for false claims under the United States Medicaid programme – the US system that helps pay for care for the poorest.

A health department spokesman said any decision on whether Greendale should team up with Mount Health “is a matter for the local health economy.”

A spokesman for Greendale North CCG said if the deal went ahead, and if it was then

exported to Europe any profits would go back into the NHS locally. “This can be good for patients locally and good for the finances of the local health economy as well as in the long run.”

However, Tom Parsons, a lecturer in health at Greendale University as well as a local councillor, said a study by the Nuffield Trust of an experiment in virtual wards in Croydon, South London, showed “it was not very successful. It didn’t really stop patients coming into hospital. So these people are setting out to make money out something that doesn’t work anyway.”

A spokesman for the Nuffield Trust said its study did show that overall patients did feel they got better care from the virtual ward, but there was little evidence that it reduced demands on the hospital or saved money.”

Top NHS boss worried about local NHS

John Lennin, chief executive of the NHS National Commissioning Board, said he is worried about the finances of Greendale’s local NHS.

“They are not really dealing with the money,” he told the Greendale Courier in an exclusive interview.

They are doing lots of interesting things with their plans for virtual wards and reshaping services, but I am very concerned that they may not have a proper financial grip.

“I am going round the country talking to CCG chiefs and I will certainly be talking to those in Greendale and expressing my concerns. I am not convinced that all these ideas will prove value for money.

GREENDALE COURIER

Mother dies as maternity unit is “full to overflowing”

By our Sickie Correspondent

A mother has died and her baby is in intensive care after being turned away from the maternity unit at Chrysalsis Hospital.

May Streeter, 39 of Harrington Street, Greendale, was taken by ambulance to Chrysalsis hospital bleeding profusely after she went into sudden labour at home but once she got there at 2 in the morning she was told the unit was full to overflowing, Dan, 41 her grieving husband said.

“We were held outside for what seemed like forever, Mr Streeter said, before being told that the unit was overflowing and we had to go Appleton. May was in agony, and there was blood everywhere and she went unconscious before we got there.

“She was rushed into Appleton but I was told two hours later that she had died. The baby survived but she’s in intensive care and I just don’t know what I am going to do.”

The Care Quality Commission – in the NHS inspectorate – has been called in to investigate the case as a spokesman for Chrysalsis said it wished to apologise profusely to the family. “The unit was under unprecedented pressure,” a spokesman said “and a clinical judgement was made that it would be far safer to transfer Mrs Streeter to Appleton. Clearly that was a misjudgement and we are investigating precisely what happened. Until that investigation is complete we cannot comment further.”

The shocking death follows a critical report on Greendale’s maternity services from the CQC last year and comes amid rumours that the Greendale Partnership is proposing closure of

at least one and possibly two of the local maternity units, with two of the other three being downgraded to units staffed by midwives only with no on-the-spot cover from doctors.

Board papers shows that the Greendale Partnership has agreed in principle to a “reconfiguration” of the five maternity units across the borough.

June Tree, shop steward for the Royal College of Nursing, said “we still don’t have all the details. But the rumour is that two of the five units could be closed and two of the others will lose their consultant cover.

“That will mean more travelling time for mums-to-be which is very worrying in the light of this dreadful case. We are also very worried about what it could mean more generally for the hospitals whose maternity units are downgraded. This can be the thin end of the wedge. Once acute maternity goes, other services can follow.

GREENDALE COURIER

Wholesale hospital changes and closures being planned by secretive NHS body

Local MP demands “who is in charge round here?”

Plans to close two maternity units, downgrade two more, and shut hospital orthopaedics departments in favour of a trauma centre and a new hips and knees factory are being drawn up by Greendale Partnership, the somewhat secretive body that represents all of the local NHS interests in Greendale.

The changes are likely to see Chrysalis hospital lose both its maternity unit and orthopaedics department. A top consultant at the hospital warned that was “a big play towards the hospital’s closure.” He told the Courier unattributably that the “consultant body is very unhappy” about the plans adding that “I am sure the non-medical staff and the patients will be too.”

At the same time, as the Courier has already reported, a US health giant is planning to work with some of the local hospitals to run “virtual” rather than real wards, while the borough’s community and mental health services are considering merger.

Tom Parsons, a local Labour councillor and health lecturer at Greendale University, said: “This new secretive partnership, which doesn’t meet in public and which has no democratic legitimacy, appears hell bent on turning the whole of our local health system upside down. We don’t want to see profits put before patients and patients do not want to lose their local maternity and orthopaedic services”.

As the proposals become clearer, however, there appear to be real tensions between the proposals being drawn up by the partnership and the local clinical commissioning groups, the new GP –led bodies who are now responsible for “buying” care for local patients.

Asked if she believed mums-to-be want to have to travel further to deliver their babies, Dr Ruth O’Hare, chair of Greendale North CCG, said: “No, of course they don’t. But we have to consider safety and other issues, and we will look at this and make a decision after talking to our members GPs, other clinicians and our patient representatives.”

Dr O’Hare said the proposal to shut maternity units and downgrade others had been drawn by the hospitals which had put the idea to the partnership. When the Courier pointed out that the CCG is itself part of the partnership that is making all these radical proposals, Dr O’Hare said the ideas came from the hospitals, but it was the CCGs, as the purchasers of care, who would finally decide.

Harry Burnstone, the local Labour MP, said: “There seem to be massive changes being proposed for our local health service, but I can’t find anyone who is actually in charge of making them, and that fills me with alarm.

“I will be writing to the health secretary demanding to know who is charge of decision making around here.”

Cindy Walker, chair of the Greendale Save Our NHS Campaign, said: “There seems to be a wholesale agenda to privatise and dismantle our local health service by this government and by the local health service itself.

“We are launching a petition against all these hospital closures and are planning a march for next month.” Asked who the march would be on, she said, “we are not sure yet. But if it is our local GPs who are going to be making these decisions on the clinical commissioning group then I guess we will be marching on them while making our views crystal clear to the health secretary.”

PRESS RELEASE FROM HARRY BURNSTONE MP

April 1 2013

Health ministers are worried about Greendale NHS's plans to team up with a US health giant to treat patients in non-existent "virtual wards", according to Harry Burnstone, Greendale's Labour MP.

"I have written to the health minister and raised this is an adjournment debate," Mr Burnstone said, in a press release. "He told me afterwards that he too was very worried about the idea of a US health company which has been fined for cheating on the US health system getting involved in the NHS.

"He gave me a personal assurance that this would not go ahead without safeguards."

Mr Burnstone said he had been "highly alarmed" by the Greendale Courier's revelation of the potential US tie-up. Mr Burnstone said he would also be raising with Professor Ara Darzi, the chair of the recently formed Greendale Partnership concerns expressed by John Lenin, the NHS chief executive, about the state of the local NHS finances.

The Partnership, a new grouping of all local NHS interests, had some interesting ideas for changing services, Mr Lenin had told the Greendale Courier, but he was worried there was "a lack of grip" on the finances.

HEALTH SERVICE JOURNAL

April 12 2013

NHS set to miss savings target

John Lenin, the chief executive of the NHS Commissioning Board, has announced further pressure on hospitals to meet the ‘Lenin productivity challenge’ under which the NHS has to save £20bn over the next few years.

Publishing this year’s “tariff” – the price hospitals are paid for treatments – Mr Lenin announced a 5 per cent real terms across the board cut. In cash terms, that means hospitals will be paid 8 per cent less per procedure.

“We simply are not yet making enough progress in driving efficiency in the NHS,” Mr Lenin said, “so there is a clear need to act to ensure that the service makes the savings needed.”

Appendix 6 – The Lateral Play simulation: ICHP Programmes developed following the simulation

ICHHP strategic objectives	Projects	Project Objectives
Enable the discovery of best practice	Alignment and dissemination of research	• Identification of new knowledge from research for implementation. • Improved patient access to research with a single repository of all patients consented to participate in research. • Reinvigorate Primary Care research & education network • Single point of entry to reduce lead time with greater standardisation of research management and governance protocols within the NWL sector
	Intelligent use of data	• Collaborative use of informatics data with NWL Commissioning Support Unit • Creation of linked data across health and possibly social care • Potential for NWL to be national demonstrator site • Develop a suite of applications for linked data informed by NHS and industry need • Identification of an appropriate robust data warehouse as a tool to measure ICHHP Projects
	Mental Health	• Strategic scoping of current position of mental health and mental healthcare services in NWL • Agree set of priorities with Mental Health Programme Board for ICHHP Clinical Advisory Group programme of work • Develop and host seminar for leading academics and clinicians in mental health in NWL.
Adopt best practice systematically	Patient Safety	• Research to establish cross-system clinicians perspective on key patient safety factors across NWL in primary care, mental health and cancer • Promote a culture of continual learning for leaders across the sector on placing the quality of patient care, especially patient safety, above all other aims for investment, inquiry, improvement, regular reporting, encouragement and support • Align the induction and mandatory training for junior doctors moving across organisations within the system by introducing core and common approach across all organisations (Collaboration with LETB). • Identify the current variation in approach across NWL to patient safety Board reporting and establish a performance measurement process to monitor success of project and associated work streams.
	Evaluation of Whole Systems Integration (WSI)	• Lead the development and execution of the WSI evaluation to ensure the investment provides value for money and leads to measurable outcomes. • Provide information on best practice from around the world by bringing together thought leaders to enable partners to co-design the model effectively.

ICHP strategic objectives	Projects	Project Objectives
	Chronic Obstructive Pulmonary Disease (COPD)	• Strategic review of current level of diffusion and to secondary care bundle implementation and engage with CLAHRC to develop a Primary Care bundle • Identify best practice for COPD and collaborate with appropriate stakeholders to diffuse across the sector to achieve best practice outcome.
	Cardiovascular rehabilitation	• Establish best practice for cardiovascular rehabilitation and the management of patients at high risk of cardiovascular disease.
	Cancer	• Specific objectives to be developed and agreed on early diagnosis and intervention, compliance with best practice pathways, monitoring of outcome measures (in association with LCA and Cancer Registry) • Promote Cancer SBRI amongst stakeholders
	Neurorehabilitation	• Conduct a network-wide service review including detailed clinically-informed capacity and demand analysis across all providers and levels of care up to Level 1 specialist rehabilitation. • Development of a web-based interactive system that would act as a common waiting list for patients. This will allow active case management and efficient matching of need to provision as well as improved surveillance of blockages and inefficiencies in the system. • Design and pilot an innovative cross-organisational model of integrated rehabilitation.
Support wealth creation in the sector and beyond	Overseas development	• Develop a sector offer to assist international development • Develop operating model with partners • Introduce formal philanthropic offer to partners alongside commercial outfit
	Collaboration with industry	• Develop a "matchmaker" infrastructure for its partners to systematically articulate need among partner organisations and enable industry to respond to this need in a standardised and transparent form • Develop a proactive engagement with industry

Appendix 7 – The major incident scenario simulations in virtual environments (MISSIVE) Advisory board meeting minutes

MISSIVE Advisory Board Meeting 28th April 2010

Major Incident Scenario Simulation in Virtual Environments
Division of Surgery Imperial College London

Advisory Board

Prof Lord Ara Darzi	(Chair)
Dr Nicola Batrick	(Consultant in Emergency Medicine, Imperial College)
Dr John Simpson	(Health Protection Agency)
Mr John Ibbotson	(Health Protection Agency)
Mr Dave Bull	(Training Lead, Hazardous Area Response Team)
Mr Andy Cobb	(Counter Terrorism and Critical National Infrastructure Lead, DoH)
Col. Tim Hodgetts	(Defence Professor of Emergency Medicine)
Ch Insp Colin Tansley	(National CBRN Centre, Home Office)
Mr Jason Killens	(Deputy Director of Operations, London Ambulance Service)
Prof Keith Willett	(National Clinical Director for Trauma Care)
Dr Fionna Moore	(Medical Director, London Ambulance Service)
Mr Paul Friday	(Olympic Security Directorate)

Imperial College

Dr Karen Kerr	(Research Manager)
Mr Daniel Cohen	(Research Fellow)
Mr Dave Taylor	(Virtual World Lead)
Dr Nick Sevdalis	(Senior Lecturer in Psychology)
Ms Kate Miles	(Project Co-ordinator)

Apologies

Ch Supt Andy Sigsworth	(National CBRN Centre, Home Office)
Dr Peter Bradley	(Chief Executive, London Ambulance Service)
Russ Mansford	(HART lead)
Mr Gary Dobson	(Director of Operational Policy and Training, London Fire Brigade)

Objectives of Meeting

- Introduction of team and board members
- Understanding of confidential nature of study
- Study overview

Summary of discussion:

1. Professor Darzi introduced the background and rationale for MISSIVE. He explained the role of the advisory board and led the round table introductions.

2. Daniel Cohen presented a detailed overview of the project and informed the advisory board of current project status.
3. Dave Taylor presented a summary and examples of the Division of Surgery's work in Virtual Worlds, Opensim and Second Life and illustrated the potential of these low cost disruptive technologies for simulated exercises.
4. Nick Sevdalis gave an overview of the proposed skills assessment approach and tools.
5. Discussion focused on the points below:
 - Exact details of scenario needed to be worked up further, eg. Whether CBRN/Hazmat suits are appropriate in the scenarios to be developed and used within this project.
 - It was suggested there should be focus on a conventional incident in this Proof of Concept study – Dave Bull and Jason Killens agreed to provide input and SOPs on the scenario as it would develop, providing expertise of both HART and non-HART paramedics. This is to ensure scenario clinical fidelity and representativeness.
 - Dave Bull also agreed to provide an educationalist from his team to help on a weekly basis.
 - It was noted that investigation of interpersonal and cognitive skills to train current and future leaders was needed, particularly in relation to clinical decision making and this project was an excellent base to address this.
 - It was agreed that the Olympics was a suitable theme and could be utilised by the Olympics Security Directorate, as simulation had been considered and this appeared cost-effective.
 - Colonel Tim Hodgetts queried the nature of the trauma injuries and offered the use of his database, which has data from 2003 on registered injuries and outcomes. It was agreed this would be used alongside Dr Batrick's expertise and those of the military registrars working on the project.
 - It was agreed that the project aims needed to be clearly defined and could not be overly ambitious as it is only funded for 12 months.
 - The agreed priorities are to simulate triage, clinical response, clinical decision making and management at the acute trust i.e. at both the incident site and in A&E.
 - The ability to re-run scenarios with changes i.e. segmentation of scenarios, was noted as a huge advantage to current simulation and training tools.
 - It was noted that the technology would supplement current systems, and fit in well between live and table-top exercises.
 - Ultimately, the aim of the project is to improve patient safety.
 - Dave Taylor explained the advantage of MISSIVE as an open-ended team-based tool as opposed to single-person and other game-based packages.
 - It was queried whether there would be a facility for individual Trusts to apply their own level of resources to the scenarios – John Simpson explained that this was outside the remit of this proof of concept study but could be considered in the future.

A summary of the MISSIVE project is detailed below:

MISSIVE is a 12-month “proof of concept” project, which aims to develop major incident scenarios simulations using Virtual Worlds technology. We hypothesise that these 3D social virtual environments will provide a unique and useful adjunct to current simulation methodologies.

There will be two areas where the incident takes place, as follows:

The first will involve the HART (Hazardous Area Response Team) paramedics responding to the incident. The clinical focus of this exercise will be triage and initial treatment of the casualties, whilst behavioural and cognitive components (e.g. leadership, communication) will also be assessed.

The second scenario will focus on the Emergency department in a hospital following a major incident. Multi-user trauma cases will be developed to enable a trauma team to simulate patient management. This will enable assessment of behaviours such as team-working, leadership and communication within a trauma team, as well as clinical management of the patient. Multiple cases will be developed, with the possibility of linking the clinical pathway of the cases to resource constraints and timelines as appropriate to the hospital major incident plan.

Appendix 8– The major incident scenario simulations in virtual environments user guide

MISSIVE

Major Incident Scenario Simulation In Virtual Environments

Missive - User Guide for Research Team

Dave Taylor

Version 1.5 5 April 2011

Chapter 1: The Resus Patient

Set-up

You will require an account on our menu system in the name of your avatar. Please contact Dave Taylor if your avatar has not participated before so that I can set you up with an account and give you a set of clothing (scrubs and lead apron) to wear.

The following avatars/roles are pre-defined:

Avatar	Password	Menu Password	Role	
Wizard1 Merlin	Automatic	welcome	Anaesthetist	
Wizard2 Merlin	Automatic	welcome	Surgeon	
Wizard3 Merlin	Automatic	welcome	Observer	
Wizard4 Merlin	Clockwork	welcome	A&E Doctor	
Wizard5 Merlin	Clockwork	welcome	Trauma Team Leader	

Both male and female versions of these avatars are available. If you wish to change sex or are not dressed appropriately (scrubs and lead apron) then please ask for assistance.

Please use Second Life Viewer 2. If you are not using one of the pre-assigned avatars then we suggest you set your user name to your real name (yes, you can do that now). Open your profile and click on the spanner/screwdriver icon at top left. We suggest a format such as "Dave Taylor - Anaesthetist". Use the role that has been assigned to you so that everyone in Resus can recognise who is who. This display name can be changed at any time, so if you are at a meeting in SL you may wish to change it to the following form: "Dave Taylor at Imperial College".

Teleport to this location:

<http://maps.secondlife.com/secondlife/Second%20Health%20Training/18/140/28>

Preference Settings

You will need to set your preferences for Voice in the **Sound & Media tab** and you should be familiar with how to operate voice and toggle it on and off inworld.

Name tags should be On or 'Show briefly' and you should enable View Display Names (in General tab). Logs (all 3 checkmarks) should be enabled in the **Privacy tab**. Note where the logs are saved.

There are crosses marked on the ground around your patient. The Team Leader should Click on the one at the foot of bed. The other crosses are just to give a sense of position. Do not click on them - just take up a position by the one relevant to the role you are assigned: eg. Anaesthetist at head of bed.

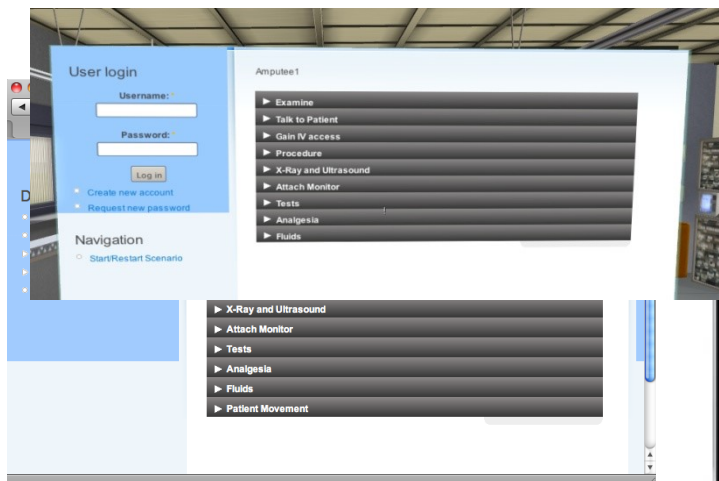
Observers should stand outside of the room and move their camera so as to view inside the room. The avatars will not then distract the team.

Everyone except the Team Leader/Experimental Subject will need an actions menu. The Anaesthetist will have a special additional researcher's menu with other actions that the team leader may require (such as log roll or phoning the theatre). Its probably best if the researcher takes on the role of Anaesthetist.

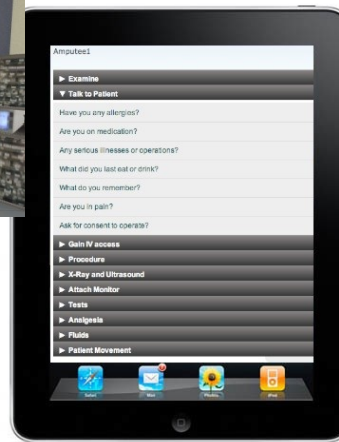
You may use any of the following methods:

1. External browser, on another screen
2. External browser, on another computer or on an iPhone, Android phone, iPad, Samsung Galaxy or any other smartphone that permits web browsing
3. The menu board that can be found outside the room on the roof

In cases 1 or 2 you need to open the browser using the following link: <http://173.203.210.137/>



In case 3 simply click 'logout' on the menu screen unless you are already logged in.



Enter your username

and password:

The username is the same as your avatar name (including the initial capitals if you used them in SL)
eg: Davee Commerce

The password is 'welcome' unless you have changed it.

Note: It may seem odd at first, but any number of users can login to the same inworld menu screen. You will each be able to operate it as if it is your own browser, and only you will receive the private responses detailed below.

Starting the Scenario



Locate the big red (now transparent) button on the floor next to the desk near the entrance to resus (by the way, the blood gas analysis machine is sitting on this desk).

1. NOTE: Before you begin first click the big red button once to reset the virtual patient inworld.

2. THEN: If not already logged in Login to the menu screen, and click "Start/Restart Scenario"

3. Select the (only) case "Accident and Emergency Cases" and press "Submit".

Either: The nurse will appear with a speech bubble and green introductory text should appear on the left side of your screen. Speech bubbles only include the first part of the text spoken. To see the full text click the speech bubble before it disappears.

Or: You will hear a recorded message with the paramedic's handover. The patient asks for help in a speech bubble.

You are now ready to begin examining & treating your patient.

NB. Please bear in mind that you must complete the scenario within 3 hours or it will automatically end, and you will need to start over by resetting both inworld & menu.



Menus

► Examine
► Talk to Patient
► Gain IV access
► Procedure
► X-Ray and Ultrasound
► Attach Monitor
► Tests
► Medications
► Fluids
► Researcher Options

▼ Medications
1g Paracetamol oral
1g Paracetamol iv
Morphine 1-3mg im
Morphine 1-3mg iv
Morphine 1-3mg io
Morphine 4-7mg im
Morphine 4-7mg iv
Morphine 4-7mg io
Morphine 8-10mg im
Morphine 8-10mg iv
Morphine 8-10mg io
Ketamine 20mg, iv
Ketamine 20mg, io
Diclofenac 50mg, oral
Diclofenac 50mg, rectal
Tramadol 100 mg im
Cefuroxime 1.5g & Metronidazole 500mg iv
Cefuroxime 1.5g & Metronidazole 500mg io
Augmentin 1.2g iv
Clindamycin 600mg iv
Tetanus toxoid im
Cyclizine 50mg im
Cyclizine 50mg iv
Cyclizine 50mg oral
Naloxone 1mg iv
Antibiotics/Tetanus booster
Ondansetron 4mg iv

FLUIDS

- ☐ Rate - 4hrs
☐ Rate - 2 hrs
☐ Rate - 1 hour
☐ Rate - 30 mins
☐ Rate - stat
☐ Colloid 0.5L
☐ 5% Dextrose 1L
☐ Saline 1L
☐ Hartmanns 1L
☐ FFP - 6 units
☐ FFP - 5 units
☐ FFP - 4 units
☐ FFP - 3 units
☐ FFP - 2 units
☐ FFP - 1 unit
☐ O neg Blood - 6 units
☐ O neg Blood - 5 units
☐ O neg Blood - 4 units
☐ O neg Blood - 3 units
☐ O neg Blood - 2 units
☐ O neg Blood - 1 unit
☐ Crossmatched Blood - 6 units
☐ Crossmatched Blood - 5 units
☐ Crossmatched Blood - 4 units
☐ Crossmatched Blood - 3 units
☐ Crossmatched Blood - 2 units
☐ Crossmatched Blood - 1 unit
-

▼ Examine
Airway
Chest
Heart sounds
Capillary refill
Pulses
GCS
Back
Right Leg
Left Leg
Right Arm
Left Arm
Head
Eyes
Ears
Abdomen
Bowel
Musculoskeletal
Pelvis
Palpate Neck

▼ Researcher Options
Start log roll
End log roll
Call trauma and orthopaedics
Call vascular
Call plastics
Call CT scanner
Move to CT

BLOOD TESTS

- ☐ Crossmatch 1 Unit
☐ FBC
☐ Crossmatch 2 Units
☐ Crossmatch 3 Units
☐ Crossmatch 4 Units
☐ Crossmatch 5 Units
☐ Crossmatch 6 Units
☐ Group and Save only
☐ O neg blood urgent
☐ U+E
☐ LFT| Bone profile & Amylase
☐ INR
☐ APTT
☐ PT
-

X-RAYS

- ☐ Abdominal
☐ Lumbar Spine
☐ Thoracic spine
☐ Amputated Leg
☐ Pelvis
☐ Chest
☐ C-Spine
-

▼ Procedure
Expose (cut clothes)
Remove tourniquet
Loosen tourniquet
Replace/Tighten tourniquet
Dress wound
Remove dressing
Immobilise C-Spine
Remove C-Spine
Apply pelvic binder
Remove pelvic binder
Urinary catheter
Give Oxygen
Remove Oxygen
Intubate
Deploy bair hugger
Remove bair hugger

▼ Talk to Patient
Have you any allergies?
Are you on medication?
Any serious illnesses or operations?
What did you last eat or drink?
What do you remember?
How is the pain?
Ask for consent to operate?

▼ Gain IV access
Peripheral L
Peripheral R
Femoral line
Jugular Line
Subclavian
Intraosseous (R Leg)
Intraosseous (L Leg)
Intraosseous (R Humerus)
Intraosseous (L Humerus)
Arterial line, right radial
Arterial line, left radial

▼ X-Ray and Ultrasound
Xrays
Remove Xray machine
FAST Scan
Release FAST scanner

▼ Tests
Blood tests
Blood gases
Blood glucose fingerprick
Activate blood gas machine

Notes for Testers and for Demonstration Purposes

If you do not wish to wait for blood results (which take 30 minutes) or other items that are delivered on timers, you can cause all timers to instantly trigger by going outside the resus room and clicking the purple hemispherical object. Any timers will immediately expire.

Experimental Setup

There are a few options that will have been configured by MMDL before use of the system.

Timers indicate that someone is busy: Visible timers will be labeled with either the name of the avatar that initiated the action or the role they are playing (ie. to show that they are busy and cannot be asked to do something else at the same time).

Text messages: Other variables that can be readily configured by the system administrator include specific content of all text messages. Changes in model logic will require more time and testing and should not therefore be considered lightly.

Avatars and Roles

The following avatars have been prepared for this simulator, and have the roles and display names listed below.

Wizard1 Merlin Anaesthetist

Wizard2 Merlin Surgeon

Wizard3 Merlin Clinical MI Coordinator

Wizard4 Merlin A&E Doctor

Wizard5 Merlin Trauma Team Leader

Both male and female versions of these avatars are available. If you wish to change sex or are not dressed appropriately (scrubs and lead apron) then please ask for assistance.

Team Leader views

The team leader can conveniently look around the room and switch between 2 camera views of the patient and monitor (respectively) as follows. This is the simplest way for the team leader to see what is going on.



Click on the 'X' on the ground at the foot of the patient's bed.

This will put the 'Mouselook' mode. You viewpoint and can look mouse.



avatar's camera into see the view from the avatar's around the room using the



Click 'M' on your keyboard. This zooms the camera in to view the monitor screen.

Click 'M' again. This puts you back in Mouselook mode. You can toggle back and forth by clicking M repeatedly. Alternatively the mouse scroll wheel (if you have one) will toggle between the two views.

To regain control of your camera you should toggle into the mode where you are looking at the monitor, then click the monitor. If you wish to re-enter mouselook mode, click on the 'X' on the floor again and hit 'M'.

Chapter 2 - The Silver Scenario

Set-up

You will require an account on our menu system in the name of your avatar. Please contact Dave Taylor if your avatar has not participated before so that I can set you up with an account and give you a suitable set of clothing (scrubs and lead apron) to wear.

The following avatars/roles are pre-defined:

Avatar	Password	Role		
Wizard1 Merlin	Automatic	Observer		
Wizard3 Merlin	Automatic	MI Coordinator - Silver		
Wizard4 Merlin	Clockwork	INVISIBLE AVATAR (voice of team leaders)		
Acting Bing	aut0mat1c	Telephone (voice of theatre, plastics etc)		
Acting Hax	aut0mat1c	Runner		
Wizard2 Merlin	Automatic	ED Majors		

Both male and female versions of these avatars are available. If you wish to change sex or are not dressed appropriately (scrubs and lead apron) then please ask for assistance.

Please use Second Life Viewer 2. If you are not using one of the pre-assigned avatars then we suggest you set your user name to your real name (yes, you can do that now). Open your profile and click on the spanner/screwdriver icon at top left. We suggest a format such as "Dave Taylor - Anaesthetist". Use the role that has been assigned to you so that everyone in Resus can recognise who is who. This display name can be changed at any time, so if you are at a meeting in SL you may wish to change it to the following form: "Dave Taylor at Imperial College".

Teleport to this location:

<http://maps.secondlife.com/secondlife/Second%20Health%20Training/18/140/28>

Preference Settings

You will need to set your preferences for Voice in the **Sound & Media tab** and you should be familiar with how to operate voice and toggle it on and off inworld.

Name tags should be On or 'Show briefly' and you should enable View Display Names (in General tab). Logs (all 3 checkmarks) should be enabled in the **Privacy tab**. Note where the logs are saved.

Starting the Scenario



Since one of the virtual patients is also used for another scenario they may have been left in a distracting state. If that is the case you can reset them as follows:

Locate the big red (now transparent) button on the floor next to the desk near the entrance to resus (by the way, the blood gas analysis machine is sitting on this desk).

RESEARCH Scripts

In this scenario much of the content will be spoken communication. Each Team Leader, the runner and the phone voices has a script.

The runner comes in and out through the ward doors as required. The phone voice avatar should position themselves outside the room by the phone on the wall.

To keep the research team and computers used to a minimum we have a specially configured invisible avatar that can worn by Wizard4. The person operating this avatar will play the role of all 4 Team Leaders. When the Silver MI Coordinator goes up to speak to any one of the Team Leader dummies the invisible avatar will move to that position and speak for them.

If Wizard4 is not invisible when you login please ask for help.

Alternative assignment when more computers and avatar operators are available:

Here is an alternative assignment of avatars if you intend to use live users for Team Leaders, and dispense with the invisible avatar.

Avatar	Password	Role	Name	Attending
Wizard 1 Merlin	automatic	TL 3	Dr Ross	Head Injury
Wizard 2 Merlin	automatic	TL 4	Dr Benton	Female Patient
Wizard 4 Merlin	clockwork	TL 1	Dr Carter	Maxillofacial
Wizard 5 Merlin	clockwork	TL 2	Dr Weaver	Arnie
Acting Bing	aut0mat1c	Telephone (voice of theatre, plastics etc)		
Acting Hax	aut0mat1c	Runner		
Wizard3 Merlin	Automatic	MI Coordinator - Silver		
Own avatar		Observer		

Chapter 3: HART Scenario

Set-up

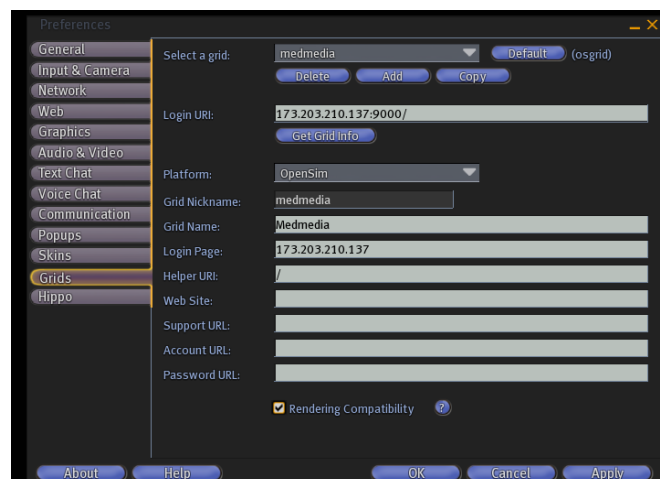
You will require **HIPPO Viewer**. Download it from this address:
<http://forge.opensimulator.org/gf/project/opensim-viewer/frs/>

You will also require **SKYPE** for voice.

Hippo Viewer must be configured to operate with the Medical Media (Medmedia) Grid. When properly configured you can select the Medmedia grid in the grid menu, and confirm that it is correct when you see the display on the left.



If there is no grid called Medmedia then click the Grids button to set it up as shown in the display on the right.



Other Preference Settings

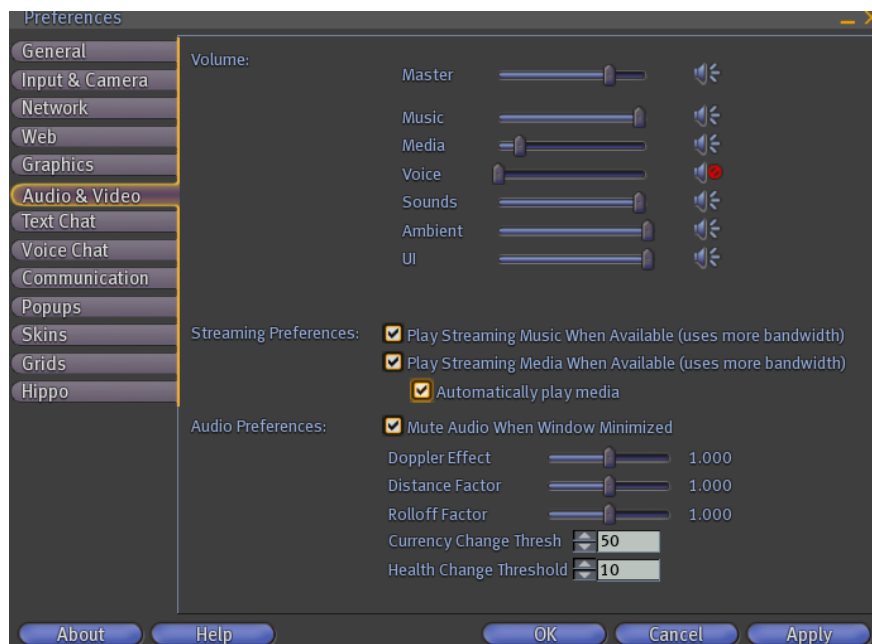
Show Names in the **General tab** should be set to 'Never' or 'Show Temporarily'.

Away timeout should be set to the maximum (600 seconds)

Note where the logs are saved.

In the **Graphics tab**, **Quality and Performance** should be set to Ultra or High.

Adjust settings in the **Audio and Video tab** as shown below and **uncheck "Enable voice chat"** in the **Voice Chat tab**.



The following avatars/roles are pre-defined:

Avatar	Role	Operated by	Comment	
User1 Feedingedge	Team Leader	HART 1	Subject 1	
User2 Feedingedge	Paramedic 1	HART 2	Subject 2	
User3 Feedingedge	Paramedic 2	Research Assistant	Accompanies HART 2	
Dan Feedingedge	Paramedic 3	Dan	Logs in after FIO and CCP har	
Dan Feedingedge	Observer	Dan	View on big screen/record	
Dan Feedingedge	Fire Incident Officer	Dan	Briefs at start then logs out	
All 3 roles on Dan's PC using speakerphone attached to voice recorder.				

Avatar	Role	Skype		
User1 Feedingedge	Team Leader	opensim.one		
User2 Feedingedge	Paramedic 1	opensim.two		
User3 Feedingedge	Paramedic 2	opensim.three		
Dan Feedingedge	Paramedic 3	dan.feedingedge		
Dan Feedingedge	Observer			
Dan Feedingedge	Fire Incident Officer			

The Avatar password in all cases is 'welcome', and the Skype password in all cases is "missive2011"

The default avatars are male, but a female version can be made available if required. If you wish to change sex please ask for assistance (see images of avatars at the end of the document).

Preparation

Before subjects arrive, User1 and User2 should be logged in and relocated to ORIENTATION using the supplied landmark.

At this point mute sound in Hippo so that there is no danger of them over-hearing the scenario sounds. Do this by opening **Preferences>Audio and Video tab** and click on the master volume symbol.

Before logging in to hippo, all should connect to a skype conference call and check sound levels.

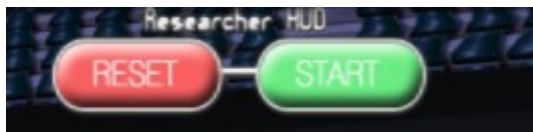
Observers

Observers should stand outside of the inner cordon at all times. However you can move your camera to any position so it is possible to view the action close up without entering the scene.

Orientation

The orientation area contains a practice casualty, and recce and oxygen bags.

The Researcher should RESET and START the scenario before orientation begins.



Subjects can practice the following:

- Starting Skype conference for voice
- Walking
- Putting on hazmat suit
- Picking up and carrying recce bag and oxygen bag
- Putting bag down and revealing their content
- Electing to treat patient
- Selecting items from Recce bag: triage slapper, blast bandage, pain killer, etc [NOTE: tourniquet will not work on this patient as there is no bleeding]
- Laying casualty down and sitting them up again
- Applying oxygen
- Moving casualty to CCP

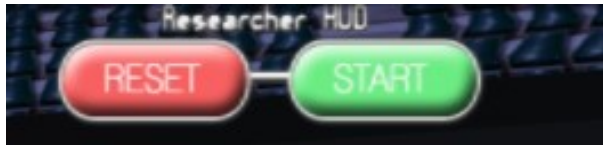
Once confident, teleport to the 'Scenario 1' landmark.

You will be located outside of the inner cordon, next to the command vehicle.

At this point unmute the master volume by clicking on the loudspeaker symbol in the **Preferences>Audio and Video tab** and click ok.



The Researcher should RESET and START each scenario as described below.



After Scenario 1 has been completed, use the landmark for Scenario 2 to get ready for the next briefing

Team Leader Camera

After the briefing the Team Leader should stay by the command vehicle and click on the monitor screen. This will give you a view of the scene inside the inner cordon from the camera mounted on top of the vehicle. If you want to revert to controlling your avatar, click the button marked 'stand' which can be found towards the bottom of the screen.

HART Paramedics Recce and Oxygen bags

After the briefing proceed behind the command vehicle (the driver's side) to find the Recce and Oxygen bags. Move near the bag you wish to pick up and click on it. These bags are self replenishing so should you need a further bag during the exercise you can simply return here and pick another one up.

Once you have a bag you can carry it to any part of the scene and place it on the ground, whereupon it will open and display its contents.

You will need to place the Recce bag near to a casualty to treat them. You elect to treat a casualty by clicking on them. A description of the casualty will then appear in your HUD (see below). Once elected in this way you can apply any of the contents of the Recce bag by simply clicking on them. They will be applied directly to your casualty. If you move away from the elected casualty or elect to treat another (by clicking on them) you will automatically be de-elected from the original casualty. So if you need to carry on treat them simply click on them once more.

To move the Recce bag to another casualty simply click the bag to close it, then click again to pick it up. Walk to the casualty you want to treat and click the bag again to put it down and open it up again.

The oxygen bag works in a similar way, but its contents (2 oxygen cylinders) can be separately picked up and carried wherever they are needed. Click to pick one up, carry it to where you wish to place it then click again to put it down.

Each oxygen cylinder has 4 valves and may therefore be used to treat up to 4 casualties. To apply an oxygen mask simply walk over to the casualty, click to elect to treat them and then click on the oxygen cylinder or a valve whereupon it will attach to the elected casualty.

Head-Up Display (HUD)

The HUD appears at the top of your screen and enables you to:

Don a helmet

Wear the Hazmat suit (note: this immobilises your avatar for 1 minute to simulate the time taken to put one on in practice)

Read a description of the currently elected casualty

Sit the elected casualty up (if they are lying down)

Lie them down (if they are sitting)

Move the casualty to the CCP or Decon area

Researcher HUD

In addition the researcher has two additional buttons and can RESET and START the scenario. This should only be done at the start of the exercise, by first clicking RESET, wait 1 minute then click START. These buttons will reposition the casualties inside the inner cordon and resets their conditions.

Casualties' behaviour

When you approach a casualty you should be able to tell that they are alive and breathing. If they are not breathing then they are likely to be dead. Casualties that are sitting up may not show obvious breathing movements but are nevertheless alive (they are managing to sit up).

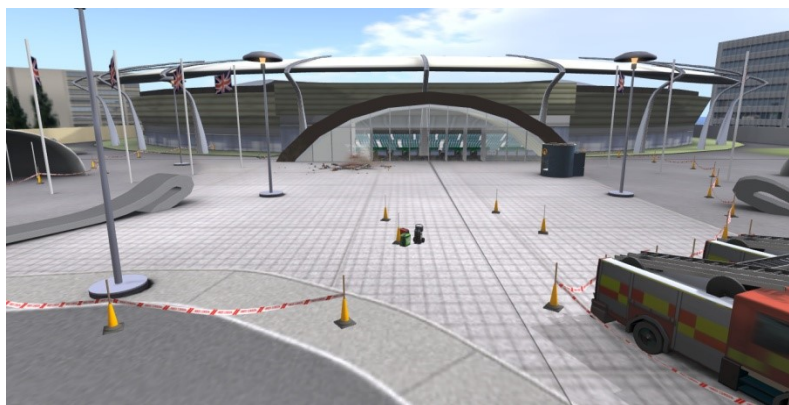
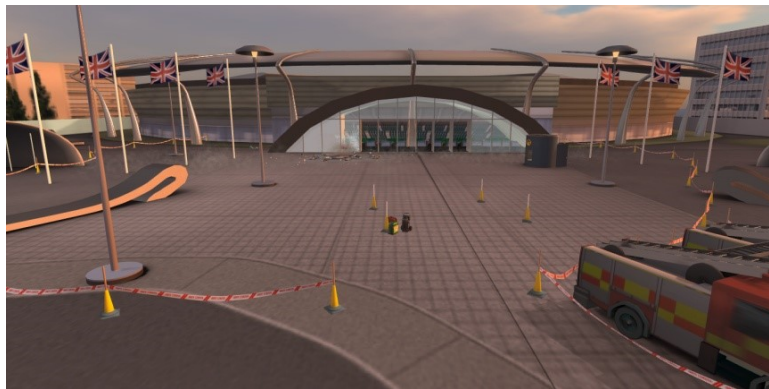
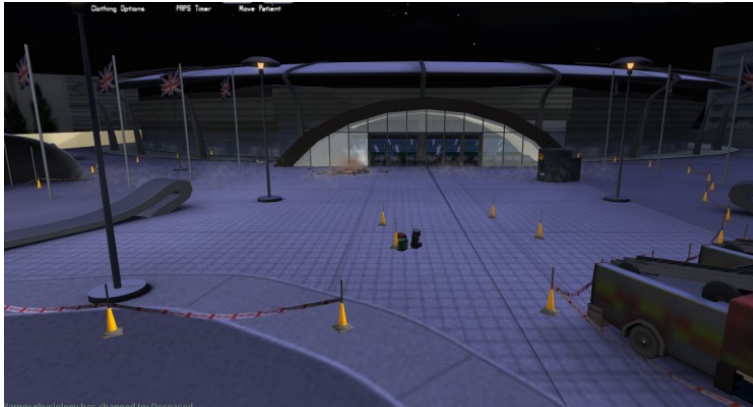
Once you elect to treat a casualty, however, they will appear to have stopped breathing. This does not indicate that they have died - it is simply an artifact of the method we are using to portray them. If, despite your best efforts to treat them, they nevertheless die, you will receive a message to that effect in your HUD. Moving a casualty to CCP or Decon does not involve the usual stretcher or fire officers to assist - the casualty will simply disappear from the incident scene and re-appear at the designated position.

Skype accounts and voice controls

The Opensim regions used in this exercise do support voice, but the quality of Skype is usually higher. We therefore require Skype to run in the background and for all participants to be connected to the same conference call. This simulates a single radio channel, so that every participant can clearly hear each of the others as if they were on a single channel and regardless of the soundscape that surrounds them.

Environment Control

You can change the time of day for each scenario using the environment controls. Select World>Environment Settings. The region default is actually sunset.



NOTE TO TECHNICAL SETUP PERSON

It would be wise to disable building on the region defaults prior to testing. But remember to re-enable at end of testing session.

MEDIA STREAM

Please check that the media stream is actually playing in order to hear the additional street sounds. ie. click this play button



Need to adjust volumes approximately as shown here



Avatars

User 1 - Team Leader (use 'add to outfit' to change from male to female and vice versa)



User 2 - HART Paramedic (use 'add to outfit' to change from male to female and vice versa)



User 3 - Paramedic helper



Nanodave and Dan/Fireman



Appendix 9

Pre-hospital scenario expert and self-assessment documents



Ambulance HART scenario

HART team leader assessment form: 9 point briefing

Name/Confidential Identifier:

Date of test:

Present position:

Assessors

1. _____

2. _____

Mark as appropriate whether the following are described during the 9 point brief:

Action Checklist		Yes	No
Introduction	Introduces self and other key attendees	☐	☐
General	Description of area in general and particular terms	☐	☐
Situation	What	☐	☐
	How	☐	☐
	What has been done about it	☐	☐
	Casualties	☐	☐
	Hazards	☐	☐
	Dynamic Risk Assessment	☐	☐
	Hazard Detection Identification Monitoring (HDIM)	☐	☐
	Emergency Services on scene	☐	☐
Aim	States the aim of the team at the incident	☐	☐
	Aim is repeated/group repeats it back	☐	☐
Execution	PPE levels	☐	☐
	Individual tasks	☐	☐
	Access and egress	☐	☐
	Equipment required	☐	☐
	Actions on – unexpected events during incident	☐	☐
Command and Control	Key Roles described	☐	☐
	Chain of command at incident	☐	☐
Communications	Call signs	☐	☐
	Radio channels and radio checks	☐	☐
	Other methods of communication	☐	☐
	Decision logging	☐	☐
Logistics and Support	Decontamination Unit availability	☐	☐
	Rescue team	☐	☐
	Equipment on scene	☐	☐
	Re-supply arrangements	☐	☐
	Other agencies/resources required	☐	☐
Timings	Staff relief times	☐	☐
	Time and place of next meeting	☐	☐

Ambulance HART scenario

Participant/Expert Copy

Triage and treatment form

Confidential Identifier: H_____

Date:

Casualty name: Max Maxillofacial Injury (“alive, alert, severe facial and jaw injuries”)

Resp rate 25 breaths per minute:



Appropriate triage category (P2)	Yes	No
Appropriate medical treatment		
Oxygen	Yes	No
Sitting patient up	Yes	No
Analgesia	Yes	No
Appropriate patient interaction (voice)	Yes	No
Appropriate information given at handover		
Description of injuries	Yes	No
Triage Category	Yes	No
Sitting patient up	Yes	No
- Analgesia	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name or description Ed: Eviscerated abdominal organs

“Unresponsive to voice or commands, making spontaneous groaning noises”

Resp rate 20 breaths per minute



Appropriate triage category (P1) Yes No

Appropriate medical treatment

- Oxygen	Yes	No
- Airway adjunct	Yes	No
- Dressing	Yes	No
- Analgesia	Yes	No

Appropriate patient interaction Yes No

Appropriate information given at handover

- Description of Injuries	Yes	No
- Mention of neurological state	Yes	No
- Airway adjunct	Yes	No
- Analgesia	Yes	No
- Triage category	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name Fred; Facial injuries, Blinded

“Hello, somebody help me, I can’t see anything, what’s going on”

15 breaths per minute



Appropriate triage category (P2) Yes No

Appropriate medical treatment

- Oxygen	Yes	No
- Analgesia	Yes	No

Appropriate patient communication Yes No

Appropriate information given at handover

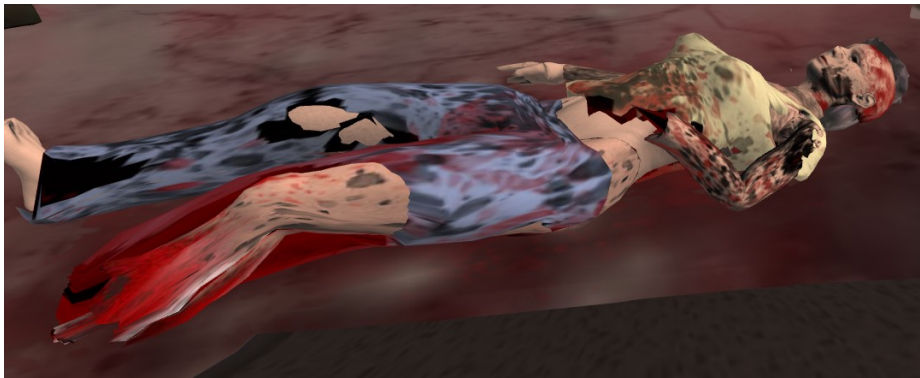
- Analgesia	Yes	No
- Description of injuries	Yes	No
- Triage category	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name or description Trixie; multiple traumatic amputations

“Active bleeding from missing limbs. Patient is groaning, making incoherent sounds. Unresponsive to direct vocal commands”

30 breaths per minute



Appropriate triage category	(P1)	Yes	No
-----------------------------	------	-----	----

Appropriate medical treatment

- Tourniquets	Yes	No
- Analgesia	Yes	No
- Oxygen	Yes	No
- Dressings	Yes	No
- Airway adjunct	Yes	No

Appropriate patient communication	Yes	No
-----------------------------------	-----	----

Appropriate information given at handover

- Tourniquets	Yes	No
- Analgesia	Yes	No
- Airway adjunct	Yes	No
- Triage category	Yes	No
- Description of injuries	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name Arnie: lower limb amputee

Screaming, complaining of pain, responding to voice commands

20 breaths per minute



Appropriate triage category	(P2)	Yes	No
-----------------------------	------	-----	----

Appropriate medical treatment

- Tourniquets	Yes	No
- Analgesia	Yes	No
- Oxygen	Yes	No
- Dressings	Yes	No

Appropriate patient communication	Yes	No
-----------------------------------	-----	----

Appropriate information given at handover

- Tourniquets	Yes	No
- Analgesia	Yes	No
- Triage category	Yes	No
- Description of injuries	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name - Bert: complaining of feeling very short of breath, says there was a big bang and can't remember what happened next

30 breaths per minute



Appropriate triage category (P1) Yes No

Appropriate medical treatment

- Oxygen	Yes	No
- Analgesia	Yes	No
- Sitting patient up	Yes	No

Appropriate patient communication Yes No

Appropriate information given at handover Yes No

- Sitting patient up	Yes	No
- Triage category	Yes	No
- Description of injuries	Yes	No
- Other _____	Yes	No

Comments on case management

Casualty name: Barney; trapped under rubble. Unresponsive to voice (note: patient will die regardless of treatment after three minutes of scenario, thus avoiding need for extraction in scenario)

Initially 30 breaths per minute then dies



Appropriate triage category (P1/Dead) Yes No

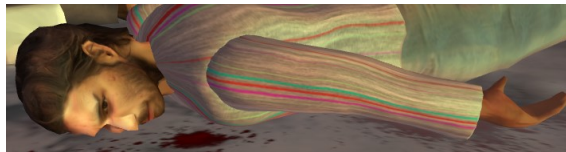
Appropriate medical treatment Yes No

Appropriate information given at handover

Other _____ Yes No

Comments on case management

Casualties 1-3 (Dead)



Appropriate manoeuvres made Yes No

Appropriate triage category Yes No

Casualty left at scene (not to CCP) Yes No

Ambulance HART scenario: Non-technical skills (Assessor/Expert)

Appendix 10 – Trauma scenario skills assessment forms

Identifier:

Performance scale

Date:

Assessor:

Competency	Description/Definition	Unsatisfactory; major improvements required	Competent performance, but improvements required	Good performance, only minimal improvements recommended	Excellent performance
Team orientation and development	Ability to work as part of a team and being supportive of others	1	2	3	4
Self discipline and regulation	Being self-disciplined and conscientious	1	2	3	4
Communication	Ability to communicate with people at all levels	1	2	3	4
Planning orientation	Ability to establish efficiently an appropriate course of action for others/self	1	2	3	4
Adaptability	Open to change, flexible and adaptable	1	2	3	4
Decision Making	Ability to make effective judgements and decisions	1	2	3	4
Capability (confidence)	Being self-confident and ability to develop self, motivate others and instil capability	1	2	3	4

Resus Scenario: Team Leader Technical skills assessment

Name/Confidential Identifier:

Date of test:

Present position:

Assessors 1. _____ 2. _____

Critical decisions: the student must do:

Y N

- | | | |
|--------------------------|--------------------------|--|
| ☐ | ☐ | Assessment and management phases performed properly and in correct sequence |
| ☐ | ☐ | Recognise potential for catastrophic haemorrhage from amputation site;
Tourniquet and wound managed appropriately |
| ☐ | ☐ | appropriately treat haemorrhagic shock |
| ☐ | ☐ | Request appropriate assistance from surgical teams |
| ☐ | ☐ | Sufficient Pain relief given |
| ☐ | ☐ | Moves to central venous access/IO access without delay |

Potential for adverse outcome: if the examiner deems the student's performance to be borderline and the student fails to perform one or more of the items below, the student fails the assessment.

Observed list of manoeuvres

Y N

- | | | |
|--------------------------|--------------------------|--|
| ☐ | ☐ | Obtains AMPLE History |
| ☐ | ☐ | High flow Oxygen |
| ☐ | ☐ | monitoring devices attached including urinary catheter |
| ☐ | ☐ | Chest and Pelvic radiographs ordered and interpreted correctly |
| ☐ | ☐ | Logroll performed |
| ☐ | ☐ | C-spine immobilised throughout |
| ☐ | ☐ | Blood products requested |
| ☐ | ☐ | ABG/VBG ordered and interpreted correctly |
| ☐ | ☐ | Secondary survey carried out appropriately |
| ☐ | ☐ | manages risk of hypothermia |
| ☐ | ☐ | considered need for tetanus prophylaxis |
| ☐ | ☐ | FAST scan performed |

Comments _____

Outcome: Successful ☐ Unsuccessful, requires further training ☐

Resus scenario: Team Leader Non-Technical skills assessment

Name/Confidential Identifier:

Date of test:

Present position:

Assessors

1. _____

2. _____

Leadership

5	4	3	2	1
Clearly defined team leader. Good time management, all tasks completed, non-hierarchical		Individual defined, but some tasks not completed.		Identity of team leader not clear

Cooperation and Resource Management

5	4	3	2	1
All team members clearly fill a role and perform all designated tasks		Identity of all members not clear, some do not perform assigned tasks		Unable to discern role identity of team members

Communication and Interaction

5	4	3	2	1
Clear communication with Team Leader as a hub, relayed to scribe		Communication not always through Team Leader, or not relayed rapidly to scribe		Unorganized or incoherent communication on many different levels

Assessment and Decision Making

5	4	3	2	1
Orderly and complete 1° (ABCDE) and 2° surveys. Plan communicated to team.		Assessment somewhat out of order, all major tasks complete		1° and 2° surveys disorderly and/or incomplete. Plan not clear.

Situation Awareness / Coping with Stress

5	4	3	2	1
Untoward findings and distractions did not upset systematic and orderly flow. Team is calm and plans ahead.		Untoward findings caused disruption but did not preclude task completion.		Untoward findings or interruptions completely upset orderly assessment and task completion Not anticipatory.

Scale below reproduced with permission from Elsevier from:

Steinemann S, Berg B, DiTullio A, et al. Assessing teamwork in the trauma bay: introduction of a modified "NOTECHS" scale for trauma. Am J Surg. Jan 2012;203(1):69-75.

TRAUMA TEAMWORK – EXAMPLES

In general, a “5” indicates flawless teamwork (e.g. could be used for a training video of “what do to”). A “1” indicates the team did not demonstrate this teamwork behavior.

LEADERSHIP

- 5 - Team Leader is clearly recognizable at all times, transition between leaders is clear
Briefs the team prior to patient arrival
Debriefs the team (provides feedback) after resuscitation if time permits
Accepts input from all team members and facilitates team problem solving
Keeps a “birds-eye” view and delegates tasks
Clarifies team member roles and calls for additional assistance or dismisses team members when necessary
Excellent time management – efficient but does not permit corner cutting by self or team (adheres to best practice)
- 3 - Team Leader defined, but does not fulfill all designated functions
Team Leader does procedures that can and should be done by other members
Transition between Leaders not clear
- 1 - Identity of Team Leader not clear

COOPERATION AND RESOURCE MANAGEMENT

- 5 - All team members clearly identified and perform all designated tasks
Members speak up / ask for help if they cannot complete a task or order
Shifting of work responsibilities to underutilized team members- no team members are idle
- 3 - Role identity of all members not clear, or they do not fulfill all of the responsibilities associated with that role
Some team members are idle some of the time
- 1 - Role identity of most of the members is unclear
Some team members are idle or overworked most of the time

COMMUNICATION AND INTERACTION

- 5 - Team Leader is the “hub”: all information and questions directed to the team leader, all orders come from the team leader
EMS report is audible to everyone, all critical information is elicited
Rapid communication of information to the trauma scribe (crisis nurse)
Communication is clear and audible to all members of the team
Information is shared: All key findings are verbalized
All orders given directly to someone, not into thin air
“Closed Loop” Communication – acknowledging that a message was received; clarifying with the sender that the message received is the same as the intended message sent
- 3 - Communication not always through Team Leader, or not relayed rapidly to Scribe
Orders not always acknowledged (not “read back”)
- 1 - Communication frequently inaudible or incoherent
Communication on many different levels and often simultaneous

ASSESSMENT AND DECISION MAKING

- 5 - Primary and secondary surveys done in order and without omissions
Findings (injuries and physiology) summarized
Team input solicited for complex problems or deviation from expected course
Goals and plan communicated to the team – everyone knows the “next step”
- 3 - Assessment somewhat out of order
Primary survey complete, some elements of secondary survey incomplete
- 1 - Elements of the primary survey or important elements of the secondary survey incomplete (e.g. required prompting from the Trauma Scribe)
Multiple team members are not certain about the overall plan or “next step”

SITUATION AWARENESS / COPING WITH STRESS

- 5 - Untoward findings, distractions or deteriorating patient condition did not disrupt systematic and orderly evaluation and treatment
Team is calm
Team plans ahead (e.g. calls CT)
Awareness of system problems which may impact patient care (e.g. only O.R. team is scrubbed on another case, or multiple trauma patients expected)
Awareness of team members’ condition (anxiety, fatigue)
Steps taken to minimize impact of resource and personnel deficits
- 3 - Untoward findings caused minor delay but did not preclude task completion
- 1 - Unforeseen events disrupt patient assessment and treatment
Team members appear stressed or panicky
Not anticipatory – not informed about situations outside the resuscitation room which may impact care. No contingency plan

Appendix 11 – Silver scenario skills assessment forms



Silver Scenario: Technical skills assessment

Please read the following table and assess

participant performance during the scenario:

Action Checklist		Did not perform	Performed Major faults	Performed Minor Faults	Performed performance	Satisfactory
Radiology	Determine availability of CT scanner					
	Prioritise patients appropriately					
ICU	Determine number of available beds					
	Determined timescale of availability					
	Formulated patient priority list for ICU					
Theatres	Appropriately utilised runner through written message					
	Formulated patient order for theatres					
	Determined theatre status					
ED Majors	Determined bed state in majors					
	Appropriately utilised space in majors when required by liaising with Majors consultant					
AMU	Determined bed state in AMU					
Specialty input	Specialties contacted appropriately					

Critical Decision Checklist	Yes	No
Chest pain patient moved to resus		
Chose appropriate patient + destination when freeing bed in resus (chest pain)		
Makes appropriate decision made to move P2 blast lung patient to Resus		
Chose appropriate patient + destination when freeing bed in resus (blast lung)		
Recognised need to change theatre priority when DU patient deteriorates OR expedites theatre if already first on list.		

Silver Scenario: Non-Technical skills assessment

Please read the following table and assess participant performance during the scenario:

Leadership

5	4	3	2	1
Clearly defined team leader. Good time management, all tasks completed, non-hierarchical		Individual defined, but some tasks not completed.		Identity of team leader not clear

Cooperation and Resource Management

5	4	3	2	1
All team members clearly fill a role and perform all designated tasks		Identity of all members not clear, some do not perform assigned tasks		Unable to discern role identity of team members

Communication and Interaction

5	4	3	2	1
Clear communication with Team Leader as a hub, relayed to scribe		Communication not always through Team Leader, or not relayed rapidly to scribe		Unorganized or incoherent communication on many different levels

Assessment and Decision Making

5	4	3	2	1
Orderly and complete 1° (ABCDE) and 2° surveys. Plan communicated to team.		Assessment somewhat out of order, all major tasks complete		1° and 2° surveys disorderly and/or incomplete. Plan not clear.

Situation Awareness / Coping with Stress

5	4	3	2	1
Untoward findings and distractions did not upset systematic and orderly flow. Team is calm and plans ahead.		Untoward findings caused disruption but did not preclude task completion.		Untoward findings or interruptions completely upset orderly assessment and task completion Not anticipatory.

(Acknowledgement as per appendix 10)