Using a high fidelity simulation programme to increase the self assessed competence and confidence of physiotherapists when treating critically ill patients – A preliminary investigation

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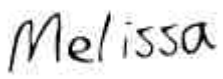
ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.



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ABSTRACT

High Fidelity Simulation (HFS) has been increasingly incorporated into health care education as this form of education has been shown to develop both the non technical and technical skills of healthcare professionals, which potentially results in increases in the standards of patient care. To date, there have been no studies to demonstrate this effect in the field of cardiorespiratory physiotherapy. Similarly, there has been scant literature to guide the design and development of a physiotherapy HFS programme in a hospital setting.

This study, conducted in a tertiary hospital in Singapore, involved the design and implementation of an evidence based physiotherapy HFS programme, which incorporated the physiotherapy assessment and treatment of critically ill patients. The changes in self assessed competence and confidence levels of the ten physiotherapists who participated in the HFS programme were measured pre and post intervention. The results of this study indicated that a one hour physiotherapy HFS programme significantly increased the participants' self assessed competence when treating critically ill patients in HFS case scenarios.

It is suggested that further large or multi-institutional studies using externally validated measuring instruments are needed to provide more evidence that the participation in a HFS programme can significantly increase physiotherapist's self assessed competence and confidence levels when treating a critically ill patient.

1. INTRODUCTION

High Fidelity Simulation (HFS) is a highly realistic way of recreating actual clinical situations to develop the competencies of health professionals (Maran & Glavin, 2003). This is achieved by combining the use of computer controlled manikins together with time pressured scenarios to re-enact patient treatment circumstances. High Fidelity Simulation has several advantages over the traditional methods of teaching as it allows for repeated training in realistic high stress environments and bridges the practice-theory gap. Consequently, this form of education may better develop or accelerate the achievement of competencies and confidence when treating actual patients, which in turn may translate to better standards of patient care.

High Fidelity Simulation has only been recently introduced into cardiorespiratory physiotherapy education and, therefore, there is little evidence to support the processes involved in designing a physiotherapy HFS programme. Similarly, whilst studies have investigated the use of HFS in other healthcare professional groups, there has been no literature to indicate that participation in a HFS programme increases physiotherapists' self assessed confidence and competence when treating critically ill patients. By investigating the effectiveness of HFS programmes in increasing the participants' self assessed confidence and competence levels (which may translate to an increase in the quality of patient care), it will allow educational and healthcare institutions to ascertain the benefit that physiotherapists can gain from such programmes.

This study will introduce HFS and the use of HFS in physiotherapy education. Following this, studies which have investigated the effect of HFS programmes in increasing healthcare professionals' self assessed confidence and competence will be reviewed. Current literature will be evaluated so as to guide the design of the physiotherapy HFS programme for this study. A description of the study methods and processes will be outlined and the study results will then be presented. This study's limitations will be discussed before the report concludes with reflections by the researcher (MK).

2. LITERATURE REVIEW

This chapter introduces HFS and describes how HFS may be incorporated into physiotherapy education. Studies which investigate the effectiveness of HFS in increasing clinicians' self assessed competency and confidence will also be reviewed. A computerised literature search was conducted using the databases of AMED Allied and Complementary Medicine, CINAHL via ESBCOhost, Cochrane Library via OVID, PEDro via Wiley and Web of Science, limiting the search to articles and reviews in education and healthcare disciplines, published up till May 2010 in English.

The search was conducted with the keywords "physiotherapy" or "physiotherapy education" and "simulation". The titles and abstracts of studies were then screened with full text articles that described the use of HFS in physiotherapy education or had evaluated the effect of HFS on the study participants' self assessed competence and/or confidence levels were included in the literature review. Where necessary, the reference list was used to identify other papers that could contribute to the literature review.

2.1 HIGH FIDELITY SIMULATION

Simulation recreates real life situations under test conditions (Aggarwal, Undre, Moorthy, Vincent, & Darzi, 2004). In particular, HFS combines the use of manikins together with time pressured scenarios to replicate realistic and dynamic clinical situations, where physiological parameters like vital signs and physical examination features can be manipulated using computers (Batchelder, et al., 2009; Blackstock & Jull, 2007; Calaman, McGregor, & Spector, 2010; Stringer, Bajenov, & Yentis, 2002; Tsai, Harasym, Nijssen-Jordan, Jennett, & Powell, 2003). High Fidelity Simulation differs from low and medium fidelities of simulation due to the level of technology involved and the way this technology has been utilised to develop the healthcare professional's skills. High Fidelity Simulation has been increasingly incorporated into undergraduate and postgraduate allied healthcare education such as in the paramedical and nursing fields (Watterson, Flanagan, Donovan, & Robinson, 2000). This form of education has only been recently introduced into physiotherapy (Blackstock & Jull, 2007; A. Jones & Sheppard, 2008). This is likely

because physiotherapy educators have just begun to recognise the benefits of using HFS over traditional teaching methods when developing the competencies of healthcare professionals.

High Fidelity Simulation might be a better learning medium than traditional teaching methods as it closely follows the principles of adult learning theories like experiential learning and being relevancy orientated. In contrast to real life clinical situations, HFS provides a standardised environment where the participant's performances can be objectively measured before being reflected upon. The HFS environment allows the instructors to specifically teach the participants where and how errors were made and then repeatedly reproduces the same high stress situations so that participants can learn to avoid their mistakes, gain clinical confidence and achieve minimum levels of competencies without harming a real patient. As such, HFS has been proposed to be a crucial tool in ensuring the delivery of quality patient care and ensuring patient safety (Satava, 2001; Ziv, Small, & Wolpe, 2000).

It has been shown that both the transition from student to practising clinician and/or the encountering of demanding or challenging clinical situations can be stressful (Kim, et al., 2006). A study by Laack et al. (2010) suggests that the stress, which arises from lack of confidence or experience, can have negative repercussions on patient care and safety. As HFS programmes have been shown to reduce the participant's level of anxiety when performing procedures in the clinical situation, it is likely that HFS programmes would be a suitable adjunct to help participants gain more confidence and feel more competent in delivering quality patient care (Aucar, Groch, Troxel, & Eubanks, 2005; Bradley, 2006; Cheng, Duff, Grant, Kissoon, & Grant, 2007; Rothgeb, 2008).

2.2 USE OF HIGH FIDELITY SIMULATION IN PHYSIOTHERAPY EDUCATION

As HFS has only been recently introduced into physiotherapy, there is scant evaluative literature available regarding the use of HFS in physiotherapy education (Blackstock & Jull, 2007). High Fidelity Simulation can be used as a form of formative or summative assessment to identify a healthcare professional's strengths or weaknesses during clinical scenarios. High Fidelity Simulation can also be used

as a training platform where technical or procedural skills such as airway suctioning can be taught or other skills like teamwork, behaviours and communication can be developed. As such, HFS programmes might increase the healthcare professional's competence levels. Recent studies have reported that HFS can also be utilised as an orientation tool to help graduating students or new medical specialists gain confidence, and thus reduce the pressures of working in a new and more challenging environment (Laack, Newman, Goyal, & Torsher, 2010; Nishisaki, et al., 2009). These increases in competence and confidence levels when treating patients may lead to better standards of patient care.

A literature review by Jones and Sheppard (2007) suggested that physiotherapy HFS programmes might facilitate physiotherapy psychomotor skill acquisition, whilst a case report by Kabanza and colleagues (2006) and a small qualitative study by Lasater (2007) proposed that HFS can assist in the development of a participant's clinical reasoning skills. Although the value of HFS in developing clinical reasoning and psychomotor skills is still not known, it is possible that HFS may offer a suitable and invaluable adjunct during the teaching of cardiorespiratory physiotherapy. High Fidelity Simulation might be a superior platform as compared to the real patient environment to assess and then develop clinical reasoning skills as it allows for objective and reliable assessment of clinical reasoning skills (Barach, Ziv, Bloch, & Maze, 2000; Tsai, et al., 2003; Adler, et al., 2007; Black, Nestel, Kneebone, & Wolfe, 2010).

Clinical reasoning is a highly complex internal process which is contextually dependent and influenced by multiple human and environmental variables (Higgs & Edwards, 1999; M. Jones, Jensen, & Edwards, 1999; Newbie, Norman, & Vleuten, 1999) and as such, the interactions between these factors make it difficult to accurately assess clinical reasoning during actual patient encounters. As HFS eliminates the human and environmental variables through the use of a manikin and often an accompanying fixed script, it allows the educator to concentrate on assessing the participant's clinical reasoning skills. High Fidelity Simulation programmes may, therefore, provide a more favourable environment to accurately evaluate and then teach clinical reasoning skills.

2.3 HIGH FIDELITY SIMULATION AND SELF ASSESSED COMPETENCE IN HEALTH CARE PROFESSIONALS

The literature search identified two studies which evaluated the effect of HFS programmes on participants' self assessed competence levels. In studies by Pliego et al. (2008) and Robertson et al. (2009), the authors concluded that HFS programmes significantly increased the participant's self assessed competence in both technical and non technical skills. Table 1 on page 17 provides a summary of the methodology of these studies and their results.

Pliego et al. (2008) designed a HFS programme to develop the leadership management skills of 23 medical residents who provided obstetrics and gynaecology patient care. Based on the questionnaire administered at the end of the HFS programme, the majority of participants reported a significant increase in self rated technical competency scores for all simulation case studies.

Robertson et al. (2009) designed a multi-disciplinary HFS programme that incorporated four short simulated obstetric emergency scenarios that focussed on multidisciplinary teamwork and team organisation. Their HFS programme was different to that by Pliego et al. (2009) as the authors incorporated the use of additional educational methods, such as providing online course materials and delivering lectures before the participants began the simulation case studies. Additionally, the HFS programme utilised a different style of delivering the programme by using short duration case scenarios with long video based debrief that were only conducted after all four scenarios had been completed. Based on a pre and post questionnaire, participants reported a significant increase in self assessed competence in the management of obstetric emergencies.

Although these studies provide some evidence that HFS programmes can increase a participant's self assessed competency levels, they contain certain limitations. Firstly, the two studies were small, non randomised and unblinded trials that were implemented in single institutions. Additionally, based on the study information provided by Robertson et al. (2009), it seems that the HFS programme contributed to only half of the training hours provided to the participants. Therefore, it is unclear whether the HFS programme was the primary contributor to the increase in the

participant's self assessed competency levels or whether the other educational methods like the online course materials or lectures had been the main contributors.

Neither study measured the validity of the tools used to measure the changes in the participant's self assessed competency levels and only the study by Robertson et al. (2009) measured and reported the reliability of the self assessed competency measurement tool. Additionally, Pliego et al. (2008) only measured the participants' competence levels after the completion of their HFS programme; which could introduce recall bias and result in inaccurate study conclusions.

Pliego et al. (2008) also reported that 39% of their participants showed no increase in self assessed competency levels after the HFS programme. This could be due to two factors: a ceiling effect (this group of participants had already reported high levels of self rated competence at the commencement of the study) or the lack of sensitivity of the (five point) Likert scale used to detect the changes in self assessed competency.

In conclusion, although there have been studies to indicate that HFS programmes can increase self assessed competence levels, more evidence is required to demonstrate this effect.

Table 1: Summary of studies which investigate the effectiveness of HFS programmes in increasing participant self assessed competence

Author(s)/ Year	Study sample size and participant demographics	HFS programme details	Measurement tools	Results
Pliego et al. (2008)	23 residents from O & G and family medicine	Single programme (total duration of programme unknown) 4 common team based obstetrics emergencies Simulation components: 1) Pre scenario briefing 2) Scenario 3) Post scenario immediate group debrief	Web based survey using 5 point Likert scale administered post HFS programme Validity and reliability of measurement tool unknown	1) Significant increase in self assessed technical skills scores for all 4 scenarios for O & G residents only ($p<0.05$) 2) No significant improvement in confidence post intervention
Robertson et al. (2009)	22 health care professionals (attending physicians, nurses, resident, and nurse midwives)	Single 4-hour training session 4 standardised team obstetric crisis scenarios Simulation components: 1) Review of online course material 2) Slide presentation 3) Orientation to simulation suite 4) 4 Obstetric crisis scenarios 5) Individualised 30-minute video-based structured debriefing based on team	Pre and post course survey of perceived confidence and competence using a 5 point Likert scale. Pre and post test Cronbach's alpha demonstrated good internal consistency	1) No significant difference in pre and post course confidence in management of obstetric emergencies 2) Significant difference in pre and post course self assessed competence in the management of obstetric emergencies ($p<0.004$)

Abbreviations: O & G – Obstetrics and Gynaecology, HFS – High Fidelity Simulation

2.4 HIGH FIDELITY SIMULATION AND SELF ASSESSED CONFIDENCE IN HEALTHCARE PROFESSIONALS

The literature review identified seven studies which investigated the effect of HFS programmes on the self assessed confidence levels of health professionals who had participated in HFS programmes. A summary of all the studies with methodological details and results is presented in Table 2. Two of the seven studies (Batchelder et al., 2009; Birch et al., 2007) did not provide raw data or statistical analyses to support their conclusions while other studies (Burlacu & Chin, 2008; Owen, Mugford, Follows, & Plummer, 2006; Wenk, et al., 2009) did not provide adequate study information to allow for comparison. Only two studies with sufficient details have been reviewed in detail for the purposes of this study.

Nguyen et al. (2009) demonstrated that a five hour HFS programme successfully increased medical students' self rated confidence levels when treating critically ill patients. Their programme included other educational interventions such as lectures but only incorporated a single 20 minute group based HFS scenario; therefore, it is possible that the other educational interventions were the primary factors that influenced the changes in confidence levels. Paige et al. (2009) reported that a three hour HFS programme increased participants' self assessed confidence levels although their data demonstrated that there were significant changes in only four of 15 self confidence items measured. Given this, it would appear difficult to conclude that the HFS programme made a clinically significant difference to participants' self assessed confidence. Both the studies by Nguyen et al. (2008) and Paige et al. (2009) had small sample sizes and were non-randomised.

In conclusion, given the small number of studies conducted to date, it is unclear whether participation in a HFS programme can increase participant's self assessed confidence levels and further research is still needed to support this stand.

Table 2: Summary of studies which investigated the effectiveness of HFS programmes in increasing participants' self assessed confidence

Author(s)/ Year	Number and description of participants	Programme details	Measurement tools	Results
Batchelder et al. (2009)	12 paramedics and physicians	12-day training course that had 1) 43 practical sessions(each session 30 minutes long) 2) Tutorials 3) Lecture-based teaching sessions 4) Final assessment	Self-administered questionnaire administered pre and post the course which used a three point scale	All participants reported increased confidence in the pre-hospital anaesthesia competencies after the course but no raw or statistical data was provided
Burlacu & Chin (2008)	68 medical practitioners	Duration of training was not provided. Seven scenarios were included in the HFS programme. No further details about the programme was provided	'Candidate Confidence Score' was measured pre and post the course using a 10-point scale	Significant difference between pre- and post course scores favouring the post course scores ($p < 0.0001$)
Nguyen et al. (2009)	63 medical students	Five hour course including: 1) Didactic lectures 2) Skills workshops 3) 20 minutes simulation of a septic shock patient	Questionnaire that measured pre and post course confidence using 5 point Likert scale.	Significant increase in post course confidence levels ($p < 0.05$)
Owen et al. (2006)	64 participants separated into 3 groups to receive 3 types of intervention	Group 1-CSBT only Group 2- Some CSBT with medium fidelity simulators Group 3- Some CSBT resuscitation training with full-mission clinical simulation using a HFS simulator No further details provided about the training programme	16 item 'Skills Confidence Questionnaire' was administered before and after the course.	Significant improvement in self evaluated 'confidence' scores ($p < 0.001$)

Paige et al. (2009)	38 medical personnel	3 hour training session that had 2 simulation scenarios Simulation programme: 1) Orientation 2) Simulation case scenario 3) Debriefing with reflective practice	15 item questionnaire using 6 point Likert scale that was administered before and after the course	Significant increases in 4 out of the 15 items that assesses confidence in teamwork competencies ($p < 0.05$)
Birch, et al. (2007)	36 junior and senior medical and midwifery staff separated into 3 groups	1 day training that had 1 scenario Group 1 - traditional lecture and tutorial based teaching Group 2 - 0.5 day of lectures plus 0.5 day simulation training Group3 - 1 day simulation based training with no theoretical component	Questionnaire using 5 point Likert scale administered after the course and measured post three months	Raw data showed that the lecture and simulation group appeared to have improved the most Only simulation based training group maintained improvement at the three-month retest.
Wenk, et al. (2007)	32 medical students randomised into : - Simulation training - Problem based discussion	Simulation based training had 1) Scenario 2) Instructor guided feedback and participant training during simulated case study Problem based learning had 1) Instructor guided discussion for students to develop case study management strategies No additional information was given about the training programme	12 item 5 point Likert scale confidence questionnaire administered before and after the course	Statistically significant increase in confidence in both groups ($p< 0.001$) Simulation based training performed significantly better than problem based group post-intervention ($p< 0.05$)

Abbreviations: CBST- Computer Screen Based Training, HFS – High Fidelity Simulation

2.5 CONCLUSION

This chapter has evaluated studies which have investigated the use of HFS to develop participants' self assessed competence and confidence in health care professionals. To date, while studies based in other healthcare professions provide limited evidence that HFS programmes may increase the participants' self assessed competence and confidence, there have been no studies that have demonstrated such outcomes within the physiotherapy field. Clarification of whether physiotherapists can benefit from HFS programmes is necessary and this has led to the development of the current study which will be discussed in Chapter 4.

3. GUIDELINES FOR DESIGNING THE HFS PROGRAMME IN THIS PRACTICE PROJECT

The steps required to design an effective HFS programme in healthcare education have been outlined by several authors (Fernandez, et al., 2008; Fuhrmann, Ostergaard, Lippert, & Perner, 2009; Lierman, 1994; Rothgeb, 2008; Shapiro, et al., 2008; Sperlazza & Cangelosi, 2009). These studies have been reviewed in order to guide the development of the physiotherapy HFS programme to be implemented for the purpose of this study. This chapter outlines the preparatory stages in designing the framework of the physiotherapy HFS programme.

3.1 PREPARATIONS REQUIRED BEFORE DESIGNING THE HFS PROGRAMME

The preparation stages involved when developing a HFS programme within the hospital setting include the identification of the participant and organisational needs followed by an evaluation of the level of organisational support. The target participants and the educational contents or skills that are to be embedded in the HFS programme should then be identified. Following that, the measurement tools to evaluate the physiotherapy tasks or competencies that are of interest should be chosen or developed.

When all the above preparations have been made, the framework of the HFS programme can be designed. The total duration of the programme should be decided before sufficient time can be allocated for each component of the HFS programme.

3.1.1 Determine programme objectives

An organisational and personnel needs analysis is the first important step when embarking on the design of a HFS programme (Fernandez, et al., 2008; Scott, et al., 2008). Concurrently, the programme developer should also evaluate and identify the shortcomings of any current institutional programmes in meeting potential participants' educational needs. With this knowledge, the programme developer can ensure the objectives of the HFS programme would overcome any current programmes' deficiencies while meeting the needs of the participants and the organisation. This should increase the effectiveness of the HFS programme

developed (Fernandez, et al., 2008; Fuhrmann, Ostergaard, Lippert, & Perner, 2009; Lierman, 1994; Scott, et al., 2008).

3.1.2 Identifying organisational support

After identifying the needs of the participants and the organisation, it is important to also determine the adequacy of organisational support in implementing the HFS programme. When developing HFS programmes for staff development and training within the hospital setting, identifying and assessing the organisational support should be considered essential. For any HFS programme to be successful, the organisation must recognise and advocate HFS as one of several modes of healthcare education that may improve the quality of patient care and safety; yet understand that there is a current lack of evidence demonstrating actual positive patient outcomes despite the heavy investment of money, physical resources and major logistical arrangements required for HFS programmes (Adler, Trainor, Siddall, & McGaghie, 2007; Farnsworth, Egan, Johnson, & Westenskow, 2000; Gardner & Raemer, 2008; Guimond & Salas, 2009; Naylor, et al., 2009; Savoldelli, Naik, Hamstra, & Morgan, 2005; Wong, 2005). Additionally, the organisation has to play a role in encouraging participation in the HFS programmes as some studies have reported barriers to participation in HFS programmes in hospital settings, which include busy work schedules, consequences for taking time off work to attend training courses and the culture or policies within the institutions considering HFS programmes (Niles, et al., 2009; Tsuda, Scott, Doyle, & Jones, 2009; Undre, et al., 2007). These barriers can be overcome if the organisation provides the appropriate environment (Savoldelli, et al., 2005).

The level of organisational commitment in supporting the HFS programme should be established during these preparatory stages as regular post simulation training sessions have been recommended to ensure that performances of the newly learnt skills can be maintained and translated into the real patient environment (Stefanidis, Korndorffer, Markley, Sierra, & Scott, 2006; Undre, et al., 2007). In all, when designing the HFS programme within the hospital setting, the extent of organisational support is vital.

3.1.3 Identifying logistical support

Studies have identified three key personnel involved in developing and implementing the HFS programme; the curriculum developer, the simulation technician and the debrief facilitator (Lasko, Zamakhshary, & Gerstle, 2009; Tsuda, et al., 2009). It is paramount that the curriculum developer and the simulation technician receive adequate training to ensure a sound understanding of the simulation technology and effective manipulation of the HFS equipment (Rothgeb, 2008). The curriculum developer should ideally have background knowledge about adult education and learning theories so as to be able to incorporate these into the HFS programme (Scott, et al., 2008; Seropian, Brown, Gavilanes, & Driggers, 2004). The debrief facilitator needs to be adequately trained to create a non confrontational and receptive learning environment where feedback can be delivered to a participant sensitively and respectfully so that participants can learn or change behaviours (Fuhrmann, et al., 2009; Kneebone, 2003; Neary, 2000; Wong, 2005). The debrief facilitators are suggested to require extensive knowledge and experience to act as role models (Zausig, et al., 2009; Ziv, Ben-David, & Ziv, 2005; Ziv, Wolpe, Small, & Glick, 2003). Similarly, debrief facilitators should be familiar with the types of discussion strategies to best encourage reflective practice as it is through self reflection that the necessary knowledge and competencies that are required in clinical practice develop (Ti, Tan, Khoo, & Chen, 2006). After the provision of feedback, the debrief facilitator should individualise the HFS learning experience to guide follow up practice sessions to ensure that the participant can develop a range of appropriate skills (Ladyshewsky & Gardner, 2008; Neary, 2000).

3.1.4 Identifying target participants

After the target groups of participants for the HFS programme are selected, the expected level of performance and challenge of the HFS case studies as well as the focus or training strategy of the HFS programme can be determined to suit the learning needs of the participants (McLaughlin, et al., 2008; Paige, et al., 2009). To date, no studies have indicated which groups of participants (based on qualifications, experience levels or age) would benefit the most from HFS programmes.

It is suggested that HFS is suitable for new graduates or postgraduates who would be progressing in their areas of specialities (Black, Nestel, Kneebone, & Wolfe, 2010; Fero, et al., 2010; Kim, Neilipovitz, Cardinal, Chiu, & Clinch, 2006; Nishisaki, et al., 2009). This is probably because these participants have a large potential for improvement in the skills to be taught during the programme and have the need for additional training to gain sufficient experience to provide optimal standards of patient care.

3.1.5 Determining the content of the simulation scenarios

Particular physiotherapy competencies or tasks should be included in the HFS programme because proficiency in the skills is required in clinical practice or because the task is better learnt through actual repeated practice (Satava, 2005). For example, airway suctioning could be a task that is included in physiotherapy HFS programmes because it is a skill that is required by all physiotherapists and it is likely that this skill is achieved faster with hands on practice as compared to didactic lectures.

After deciding on the competencies or tasks required, the psychomotor and cognitive processes of the task, skill or competency should be broken down and specifically described before being validated through the use of literature reviews or expert consensus (Summer, Gonzalez, Jimeno, & Christensen, 2009). These processes need to specify observable actions that the participants are expected to display during the simulation case studies (Higgins, et al., 1997; Lierman, 1994; Rosen, Long, McGrath, & Greer, 2009; Shapiro, et al., 2008; Young, Stokes, Denlinger, & Dubose, 2007).

One of the primary focuses of physiotherapy HFS programmes should be the teaching of appropriate clinical reasoning strategies during different clinical scenarios. Clinical reasoning can be developed by allowing the participants to rationalise their choices of actions and then systematically assess their thinking processes during or after the HFS case studies (Guhde, 2010; Moorthy, Munz, Forrest, et al., 2006). It is suggested that it is through this self reflection that clinical reasoning skills develop (Delany & Bragge, 2009; Prion, 1999). The curriculum developer, therefore, should create a series of questions to guide the participants into self reflection or self assessment through debrief after the HFS case studies. To further build participants' clinical reasoning skills, additional clinical information

can be presented to vary the case studies, which would require the participants to adjust, review or challenge their responses and clinical reasoning strategies (Neary, 2000).

3.1.6 Objective measurement tools to assess performance during the HFS scenario

After breaking down and specifying the psychomotor actions and cognitive processes that are to be observed during the HFS scenario, measurement tools that define the standards expected of the participants' level of expertise should be created (Davoudi & Colt, 2009; Eppich, Adler, & McGaghie, 2006; Lierman, 1994; McGaghie, Issenberg, Petrusa, & Scalese, 2010). It is important that the measurement tools to assess the participant's performance during the HFS programme are evidence based, valid, reliable and objective as this increases the likelihood that the feedback provided during debrief will be accepted and that there will be a transfer of the knowledge gained into the real clinical world (Salas & Burke, 2002).

The validity of any measurement tool also depends on how the tool is used during the simulation case study and how familiar the examiner is with the use of the measuring tool. As such, additional training is necessary so that the examiners know precisely what actions that they are observing for and ensure consistency when rating the participants' performance (McGaghie, et al., 2010; Shapiro, et al., 2008; Young, et al., 2007).

The two main types of measurement tools used during HFS case studies include checklists (which use a dichotomous scale e.g. yes/no) and global assessment scales (which rate performance). The majority of studies identified in the literature review have preferred the use of checklists over global assessment scales to measure their participant's performances during the HFS case studies. Global assessment scales (example shown in Figure 1) differ from checklists as they allow the examiners to distinguish the better performing participants.

Global Rating Scale of Performance				
Circle the appropriate rating for each aspect of the candidate's performance				
1. Initial evaluation of the patient and gathering of the patient's information, history				
64 Major omissions	67	70 Acceptable	73	76 Exemplary
2. Creation of differential diagnosis				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Comprehensive
3. Problem Solving				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
4. Application of knowledge				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
5. Ability to deal with changing situations: Evaluating of the patient and gathering information				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
6. Ability to deal with changing situation: Creation of differential diagnosis				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Comprehensive
7. Ability to deal with changing situation: Problem solving				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
8. Ability to deal with changing situation: Application of knowledge				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
9. Communication skills/ leadership				
64 Illogical and/or inappropriate	67	70 Acceptable	73	76 Exemplary
Overall, should the candidate: **Pass/Fail**				

Figure 1: An example of a global assessment scale used by Savoldelli, et al. (2006)

Checklists might be more objective as the examiners would only need to indicate whether or not an action has been executed, whereas, global assessment scales might introduce some bias and reduce inter-rater reliability as the examiner needs to award points to the participants based on personal judgements (Fernandez, et al., 2008). The choice between the use of the checklists and global assessment scales also depends on the purposes and aims of the HFS programme. If the HFS programme is to be used for summative evaluation, the use of checklists may reduce the pressure

on the participant and make them feel that they are not being judged. This, in turn, may aid in the participant's learning process as the participants may not be fearful of displaying their weaknesses. Checklists are also simpler to implement and can be easily modified such that the examiners can write additional comments to indicate areas for improvement (Adler, et al., 2007; Andreatta & Gruppen, 2009; D. J. Murray, et al., 2004). For these reasons, checklists may be a more suitable measurement tool to evaluate participants' performance during physiotherapy HFS programmes.

3.1.7 Self assessment and reflection tools

Self assessment during HFS programmes can be facilitated using rating scales (such as Likert scales) and/or verbal discussions. Although there is limited evidence to demonstrate the efficacy of using such self assessment tools during HFS programmes, these tools might help to reduce the pressures of external assessments, and therefore facilitate better communication between the debrief facilitator and the participants (Neary, 2000), As such, self assessment tools helps to build a non-threatening and learner focussed environment, which optimises the learning environment and increases the likelihood that the participants will accept the feedback provided and strive to improve.

In addition to fostering a collegial environment, self assessment tools also assist participants in identifying their weaknesses and specific learning needs (Gordon, 1992). This may increase the drive to learn and assist in knowledge retention as participants can see the relevance and application of the knowledge gained during the HFS programme (Fuhrmann, et al., 2009; Kneebone, Scott, Darzi, & Horrocks, 2004; McGaghie, et al., 2010; Ti, et al., 2006). Self assessment scales also allow participants to rate their performance; which can help participants to evaluate their progress and hence, increase their confidence and performance (Day, Iles, & Griffiths, 2009; Fuhrmann, et al., 2009; Neary, 2000; Owen, et al., 2006). Additionally, reflection on action after the HFS scenarios would allow the participants to understand the presumptions they hold and would also potentially provoke emotions that will help in the creation and retention of new knowledge (McGaghie, et al., 2010; Moorthy, Munz, Adams, Pandey, & Darzi, 2006).

Self assessment scales should be supplemented with other objective measurement scales during HFS scenarios as improvements in accuracy of self assessment are

only made when the learner is able to compare their personal assessments with reliable external measurement instruments (Westberg & Jason, 2001). In conclusion, when used in conjunction with the objective checklists developed, self assessment measures in the form of self rating scales or post HFS scenario reflections are valuable tools that support the learning process and may assist in the further development of confidence and competence.

3.2 DESIGNING THE FRAMEWORK OF THE PHYSIOTHERAPY HFS PROGRAMME

After the preparation stages, the curriculum developer can design the framework of the HFS programme. This would include deciding on the components and duration of the HFS programme, the scenarios to elicit the competencies or skills to be displayed, the simulation case study algorithms and the debrief procedure.

3.2.1 Components and duration of the HFS programme

The components of a HFS simulation programme should broadly comprise of an initial orientation to the simulation suite, the execution of the simulation case study, the assessment of the participant during the running of the case study followed by a facilitator led debriefing session (Paige, et al., 2009). Additional supervised repeated practices of the same scenario with feedback provided may be useful so that the participants would be able to perfect the performance of the newly learnt skills. Most of the studies reviewed limited the total duration of their HFS programme (orientation, scenario and debrief) to an hour so as to maximise the learning effect and prevent physical and mental fatigue (Buzink, Goossens, De Ridder, & Jakimowicz, 2010; Crabtree, Chandra, Weiss, Joo, & Naik, 2008; Lerner, Magrane, & Friedman, 2009; Lo, Morrison, Atkins, & Reynolds, 2009; Mayo, Hackney, Mueck, Ribaudo, & Schneider, 2004; Naik, et al., 2001; Tsuda, et al., 2009).

3.2.1.1 Orientation

HFS programmes should commence with an orientation to the simulation suite (Garden, Robinson, Weller, Wilson, & Crone, 2002; Kory, et al., 2007; Rosenthal, et al., 2006; Steadman, et al., 2006) and a briefing about the learning goals of the programme (Fuhrmann, et al., 2009; Westberg & Jason, 2001). This ensures familiarity with the environment, the manikin/ simulator and the purpose of the

programme. Several authors have also suggested that this time should also be used to foster a non judgemental environment by reassuring the participants of the opportunity to reflect and learn prior to the start of the simulation case study (Fuhrmann, et al., 2009; Small, et al., 1999; Wallin, Meurling, Hedman, Hedegard, & Fellannder-Tsai, 2007). Assurance of confidentiality and mutual respect is essential (Kurrek & Fish, 1996; von Wyl, Zuercher, Amsler, Walter, & Ummenhofer, 2009; Welke, et al., 2009) so that the participant can fully benefit from the learning experience.

In order to maximise the learning benefits, the participants would also need to participate in the HFS scenario as if it is real (Adler, et al., 2007; Decker & Rall, 2000; Lerner, et al., 2009; Perkins, 2007; Ziv, et al., 2005). Several authors achieve this by acknowledging the limitations of the simulator and directly requesting that the participants approach the HFS case study seriously (Weller, Wilson, & Robinson, 2003; Zirkle, Blum, Raemer, Healy, & Roberson, 2005). Instructor assistance should be minimised during the HFS scenario (Cheng, et al., 2007). Participants may be encouraged to voice their thoughts to clarify their clinical reasoning processes during the scenario so as to enable the participant to recall their thoughts and facilitate self evaluation after the scenario (Higgs, 1997). This introductory session should last about fifteen minutes (Farnsworth, et al., 2000; Sandroni, et al., 2005; Schwartz, Fernandez, Kouyoumjian, Jones, & Compton, 2007; Wilkerson, Avstreih, Gruppen, Beier, & Woolliscroft, 2008).

3.2.1.2 Case scenario

Most studies identified in the literature review ran case scenarios that lasted between 10 to 30 minutes long (Fraser, et al., 2009; Holzman, et al., 1995; Rosenthal, et al., 2006; Steadman, et al., 2006). The number of scenarios involved in each simulation session varied according to the educational objectives of the HFS programmes.

The type of scenarios selected for the programme should be based on the learning objectives of the programme and relevance to the participants (McIvor, 2004; D. Murray, 2006). The scenarios can be common or unexpected clinically encountered scenarios that carry some risk when executed by less experienced clinicians (Kneebone, Nestel, Vincent, & Darzi, 2007; Maran & Glavin, 2003; Wang, Quinones, et al., 2008). After the scenarios have been selected, a script of the scenario and an algorithm should be written (refer to Appendix 1, 2 and 3 for the objectives and script of the case studies and algorithms used in this study). The script should be provided to

the participants before the HFS case scenario, and contain all the information that the participant requires in order to successfully manage the case scenario (Hammond, Bermann, Chen, & Kushins, 2002; Holzman, et al., 1995; Kim, et al., 2006; Mayo, et al., 2004; Paige, et al., 2009). The script can be written based on real incidents, or be based on textbook examples or clinical experience (Adler, et al., 2007; Berkenstadt, et al., 2003; Campbell, Barozzino, Farrugia, & Sgro, 2009; Kaji, et al., 2008; Lammers, 2008; Zirkle, et al., 2005). The algorithm should list all the possible results from participant's actions during the simulation case study and will assist the simulation technician to manipulate the environment appropriately in response to clinical interventions (Holzman, et al., 1995; Tsai, et al., 2003). Based on this algorithm, the debrief facilitators will use the checklists to evaluate the participant's actions, which then increases the reliability of the measurement tool (Kory, et al., 2007; McGaghie, et al., 2010).

3.2.1.3 Debrief

The participants should be allowed to complete the entire case scenario without interruptions before they are debriefed (Nishisaki, et al., 2009). The debrief session is paramount to the participant's learning experience and it is suggested that debrief is allocated the same amount of time as the simulation case study (Cherry & Ali, 2008; Rothgeb, 2008). The debrief should be instructor guided and provided immediately after the simulated case scenario, as studies have demonstrated that either the delay or non provision of feedback might result in the lack of improvements in the participant's performances and affect the learning experience (Lammers, et al., 2008; Mayo, et al., 2004; Westberg & Jason, 2001).

Debrief sessions should involve performance reviews with discussions between the instructors and participants about the simulation case studies (Boud & Walker, 1998; Ladyshewsky & Gardner, 2008; Moorthy, Munz, Forrest, et al., 2006). The debrief facilitator should engage the participants in self reflection to help the participants identify errors as well as the areas that they have excelled (McLaughlin, et al., 2008; Rothgeb, 2008; Zausig, et al., 2009). Questions should be used to guide participants into critically evaluating and then comparing their clinical reasoning processes to that of an expert (Higgs & Edwards, 1999; Shapiro, et al., 2008; Ziv, et al., 2005) . Additionally, the debrief instructor will need to relate the areas of improvements to the learning objectives of the programme and then provide retraining opportunities after

the debrief session so that the participants can further improve on their performances (Ziv, et al., 2005). As the majority of the debrief should focus on reviewing the participant's performance in a positive manner, feedback needs to be delivered sensitively to the individual (Sperlazza & Cangelosi, 2009; Ziv, et al., 2005).

3.2.1.4 Repeated practices after the HFS scenario

In order to apply the feedback provided and achieve the HFS programme learning goals, the participant should be given the chance to repeatedly practise using the same case study to reach set standards (Davoudi & Colt, 2009; Maran & Glavin, 2003; Wang, Quinones, et al., 2008). The instructor might want the participants to practise the tasks where errors have been made and in those areas that the participants were considered to have demonstrated borderline proficiency. At the same time, the amount of initial continuous feedback provided during these supervised repeated practices should be controlled and then reduced as the participant becomes more proficient so that the participant would be able to complete the task both independently and confidently (Schmidt & Wulf, 1997; Stringer, et al., 2002).

Although studies have shown that distributed practice (practising of the whole task in parts) has been shown to result in better skill acquisition (Tsuda, et al., 2009; Wang, Beaumont, Kharasch, & Vozenilek, 2008), this form of training may not be applicable to clinical reasoning during cardiorespiratory physiotherapy practice. This is because most of the studies reviewed were procedural or protocol based and hence, could be practised individually, whereas it is possible that clinical reasoning in cardiorespiratory physiotherapy might not be suitable to be taught in separate parts, and thus might need to be practised by repeating the entire clinical reasoning process and scenario.

3.3 CONCLUSION

The steps required when designing and executing a HFS programme have been outlined in this chapter. The ideal HFS programme includes an orientation to the simulation suite, the execution of the case scenario, debrief with the participant and finally repeated practices of the skills taught during the HFS programme. The physiotherapy HFS programme created and executed during this project was therefore based on the best available evidence reviewed in this chapter.

4 METHODOLOGY

This chapter first describes the aims of this project. Following this, the study participants, study measurement tools used, the piloting of the simulation case studies and the actual study's procedures are outlined. Finally, the ethical issues surrounding this study and the statistical analyses undertaken are presented.

4.1 AIMS OF THE STUDY

The aims of this study were to:

1) Develop and implement a physiotherapy HFS programme for use in National University Hospital (NUH) in Singapore
2) Evaluate the effectiveness of this HFS programme in increasing participants' self assessed confidence and competence when treating critically ill patients

4.2 STUDY PARTICIPANTS

Ten participants were recruited for this study based on the inclusion and exclusion criteria provided below:

The inclusion criteria for this study were:

1) Physiotherapists who had graduated from his/her physiotherapy degree or diploma less than six months ago

Or

2) Physiotherapists whose weekly caseload does not exceed 10 respiratory patients

The exclusion criteria for this study were:

1) Physiotherapists currently working in the Intensive Care, High Dependency Units or respiratory general wards whose caseload exceeded 10 respiratory patients per week

Or

2) Any experienced physiotherapist (defined for the purposes of this study as having graduated more than six months ago from their physiotherapy diploma or degree) currently working in other clinical areas other than cardiorespiratory physiotherapy field whose weekly caseload exceeded 10 respiratory patients

Or

3) Physiotherapists who were not required to undertake on call duties

4.2.1 Sample size rationale

A convenience sample of 10 participants were chosen to represent a quarter of the total number of physiotherapists in the physiotherapy department .This number of participants was a pragmatic stipulation by the senior manager of the physiotherapy department in order to ensure minimal work flow disruptions to the department, given that the project was implemented during working hours.

4.3 STUDY METHODS TO DESIGN AND IMPLEMENT A PHYSIOTHERAPY HFS PROGRAMME

In order to develop and implement a physiotherapy HFS programme for use in NUH, the following steps (as identified in Chapter 3) were undertaken:

A) Identification of the organisational aims and current cardiorespiratory preceptorship programme deficiencies
B) Identification of organisational support
C) Identification of logistical support
D) Identification of target participants
E) Identification of education content and matching the physiotherapy competencies to be reviewed to the use of HFS
F) Selection of appropriate measurement tools to measure the changes of the participant's self assessed competence and confidence levels
G) Design of the simulation case studies of the HFS physiotherapy programme
H) Conduction of a pilot study
I) Implementation of the study

4.3.1 Identification of the organisational aims and current educational programme deficiencies

National University Hospital is a tertiary public hospital in Singapore that aims to "advance health by integrating excellent clinical care, research and education" and this is achieved through "the provision of quality care and services to its patients" (About us: National University Hospital, n.d.).

With the exception of the principal and chief physiotherapists, it is mandatory that all other physiotherapists undertake on call duties at least once a year (A. Lim & H. Poh, personal communication, November 5, 2010); therefore, all physiotherapists need to be confident that they are able to treat critically ill patients independently. New physiotherapy graduates might have varying levels of prior clinical experiences and thus be unfamiliar with the expected standards of patient treatment and protocols of the NUH physiotherapy department. Consequently, these new graduates

may not be confident in treating critically ill patients independently and need additional exposure to clinical situations to familiarise themselves in the hospital context so as to provide the expected level of patient care. At the same time, all physiotherapists employed by NUH are rotated into different clinical specialities on a six to twelve month basis and can choose to specialise in a particular area after two rotations (A Lim, personal communication, November 5, 2010). Consequently, some physiotherapists may have limited treatment encounters with critically ill patients, which can affect the maintenance of their cardiorespiratory physiotherapy skills, which may result in less confidence when treating critically ill patients. By being provided with further practice opportunities, new and experienced physiotherapists might gain more confidence and feel more competent when treating critically ill patients, which in turn could reduce anxieties associated with this work.

In order to help increase the confidence of physiotherapists involved in treating critically ill patients, the physiotherapy department in NUH currently offers a cardiorespiratory preceptorship programme to provide orientation and additional skill practice opportunities in the Intensive Care Units under the guidance of senior cardiorespiratory physiotherapists. Currently at NUH, physiotherapists are assessed by their preceptors after the completion of this period of preceptorship, before being allocated for on call duties and be able to treat critically ill patients independently.

This preceptorship programme contains certain limitations. The lack of suitable physiotherapy competency assessment tools as well as the dynamic and fluctuating patient conditions means that the assessments of physiotherapists during the preceptorship programme may not be reliable. Without reliable assessments tools, it is difficult to determine in which areas the physiotherapist needs additional practice to be able to provide quality care to the critically ill patients. Concurrently, the preceptorship programme may not have allowed for sufficient repeated practices to enable the physiotherapist to gain adequate confidence to deliver a consistent level of care to critically ill patients. The preceptorship programme also does not expose the physiotherapist to a large range of clinical situations or some of the difficulties encountered during on call duties. Thus, the limitations of the preceptorship training might affect the physiotherapist's ability to deliver high quality patient care for the range of critically ill patients that they may encounter, and thus impact upon their confidence and/or self assessed competence in handling such patients.

The objectives of a physiotherapy HFS programme could overcome the shortcomings in the current physiotherapy preceptorship programme as detailed above by providing an alternative platform where the physiotherapist's skills can be reliably reviewed. Additional training incorporating a larger variety of clinical situations can also be designed to allow for repeated practice until a suitable standard has been achieved. This practice is likely to increase the physiotherapist's self assessed competency and confidence; impacting upon better standards of patient care.

4.3.2 Identifying organisational support

National University Hospital officially established The Mrs Lee Kong Chian Critical Care Simulation Laboratory (Singapore) in May 2009. The primary aim of this simulation laboratory is to provide continuous postgraduate education and training for nurses to develop clinical competency, collaboration, teamwork and communication skills (J. Ho, personal communication, October 31, 2010). The simulation laboratory comprises of a hospital style room with a computer-controlled patient simulator (SimMan, Laerdal Medical Corporation, Wappingers Falls, NY), with an accompanying bedside monitor to display vital signs. The senior manager of the Department of Rehabilitation and the Department of Nursing Education of NUH gave approval in principle for this study to be undertaken.

4.3.3 Identifying target participants

Based on the literature review, the ideal participants for the HFS programme at NUH were determined to be either new or experienced physiotherapists who lack experience in treating critically ill patients. To date, there is no one clear definition to differentiate between novice or experienced physiotherapists of a particular field. An expert cardiorespiratory physiotherapist is assumed to hold relevant qualification in the field and possess strong clinical reasoning and technical skills, which correlates with the amount of experience in their particular area of practice (Noll, Key, & Jensen, 2001; Dickens, Ali, Gent, & Rees, 2003). As such, it is possible to assume that an expert physiotherapist would have much experience in treating a particular category of patients (e.g. cardiorespiratory, neurological or musculoskeletal). It is difficult, and perhaps inappropriate, to numerically define the exact number of cases that a physiotherapist should see in a day or a week so that he or she would be considered experienced or even, expert in that field. However, for

convenience purposes for this research study and time was limited for other forms of assessment of expertise, an arbitrary number of 10 cases per week was set to determine whether a physiotherapist is considered 'experienced' in treating critically ill patients in the cardiorespiratory field.

4.3.4 Identifying logistical support

Due to logistical difficulties, the Department of Nursing Education of NUH indicated that the simulation premises were only available for loan for a total of 10 hours over a two day period. In addition, the nursing educators were unable to provide technical support during the implementation of the planned physiotherapy HFS programme and there were no other personnel in the Rehabilitation Department with prior adequate simulation training to assist in the implementation of the physiotherapy HFS programme. Therefore, the researcher (MK) needed to undertake three roles: simulation technician, programme developer and debrief instructor by

- Undertaking technical training with the Auckland University of Technology (AUT) simulation laboratory technicians to acquire the necessary technical skills to run HFS scenarios.
- Observing debrief sessions provided by AUT academic educators who ran similar HFS programmes in order to develop appropriate debriefing skills
- Using other resources, including book, journal and internet facilities, to further develop teaching skills to enable effective delivery of the physiotherapy HFS programme.

4.3.5 Identifying learning objectives and matching the task to the use of HFS

The physiotherapy assessment and appropriate treatment to be provided for the following patients were selected to be the primary content of the physiotherapy HFS programme

- Patient A , an acutely deteriorating patient with chronic obstructive pulmonary disease with an acute respiratory tract infection

- Patient B, a patient who was mechanically ventilated due to a high spinal cord injury

These case studies were chosen as they involved common physiotherapy treatments with potential complications that physiotherapists at NUH would be expected to undertake for such patients. The case study involving Patient B was also included in the programme because the physiotherapy treatment for spinal cord injured patients was felt to be an area of particular concern by less experienced physiotherapists. The specific learning objectives of each case scenario (Appendix 1) were developed before the script (Appendix 2) for the individual cases, which was to be provided to the participants, was written. The algorithms for both scenarios (listing all the possible participants' actions) were designed by the researcher and validated using a literature review (by the researcher, MK) with expert consensus (primary supervisor, JR). The algorithms are presented in Appendix 3. The physiotherapy skills anticipated to be involved in the treatment of Patient A included positioning, the performance of manual techniques, oral suctioning as well as the recognition of changes to the patient status, which required the participants to modify their physiotherapy treatment techniques. The tasks anticipated to be involved in the treatment of Patient B included the use of manual hyperinflation plus endotracheal tube suctioning. The tasks in both case studies were included because they were suitable to be tested within the HFS environment, and were skills that all physiotherapists are widely expected to be proficient and safe in performing when providing quality care for the critically ill patient.

Both case studies attempted to challenge the participants' higher level skills including clinical reasoning and ability to translate their physiotherapy knowledge into actions. To test the participant's cardiorespiratory clinical reasoning skills, the researcher presented the participant with a predetermined list of questions prior to and following assessment of the patient. Additionally, reflective thinking questions were posed to the participants following the HFS scenario so as to facilitate the development of clinical reasoning skills. This list of questions for each of the case studies is available in Appendix 4.

4.3.6 Designing appropriate measurement tools for use during the simulation case studies

The physiotherapy HFS programme utilised a procedural checklist which provided an objective review of the physiotherapist's skills for each of the two simulation case studies. These two procedural checklists (Appendix 5) contain a list of predetermined actions and the appropriate clinical reasoning processes that the physiotherapist was expected to demonstrate during each of the simulation case studies. The two checklists were face validated using a literature review, with agreement with an expert (primary supervisor, JR).

During the simulation case study, the researcher used the procedural checklist to review the participant's assessment and treatment skills by indicating on the appropriate procedural checklist whether (✓) or not, the physiotherapist demonstrated the required actions. Any deviations from the expected/anticipated procedures were also recorded. This procedural checklist facilitated as a feedback tool during debrief sessions after the simulation case studies.

4.3.7 Components of the physiotherapy HFS programme

Based on the literature review, the physiotherapy HFS programme contained the following components:

A) An orientation to the simulation suite
B) The execution of the simulation case study
C) A debrief with the researcher immediately after the simulation case study
D) Repeated practices with the researcher based on the participant's request

Each case study was designed to last for approximately one hour. The full procedure of the HFS programme will be described in 4.6. Appendix 6 shows a summary of the entire study process.

4.4 SELF ASSESSED COMPETENCE AND CONFIDENCE LEVEL MEASUREMENT TOOLS

A single group experimental design with measurements taken pre and post intervention using the physiotherapy Self Assessed Competency and Confidence Questionnaire was adopted to evaluate if the physiotherapy HFS programme had increased the participant's self assessed competence and confidence in treating critically patients.

4.4.1 Pre and Post Simulation Self Assessed Competency and Confidence Questionnaire

This Pre Simulation Self Assessed Competency and Confidence Questionnaire was adapted and modified from the Acute Respiratory/On Call Physiotherapy Self-evaluation of Competence Questionnaire (Thomas, et al., 2008). To date, this is the only published competence assessment tool that has been specifically developed for use in cardiorespiratory physiotherapy practice. The Acute Respiratory/On Call Physiotherapy Self-evaluation of Competence Questionnaire quantifies participant's responses using a five point scale with regards to a range of cardiorespiratory assessment and treatment competencies, plus self rated confidence levels. Thomas et al.'s (2008) questionnaire has been shown to have high internal consistency and good content validity for on-call physiotherapists. The United Kingdom based Association of Chartered Physiotherapists in Respiratory Care (ACPRC) recommends that the Acute Respiratory/On Call Physiotherapy Self-evaluation of Competence Questionnaire is to be used as a self evaluative questionnaire to help physiotherapists recognise their strengths and weaknesses in acute on call respiratory physiotherapy practice.

The content of the questionnaire was modified by the researcher (MK) in order to match the practice of cardiorespiratory physiotherapy in the context of NUH and was also changed to a seven point scale. This was in an attempt to increase the scale's sensitivity and was undertaken as Pliego et al., (2008) indicated that a five point Likert scale may not be sufficiently sensitive to detect changes in participants' self assessed confidence and competence levels. The modified questionnaire was administered before and after the physiotherapy HFS programme to measure the changes in participant's competence and confidence as a result of the intervention.

The modified pre and post simulation physiotherapy Self Assessed Competency and Confidence Questionnaires used during this study are available as Appendix 7 and 8 respectively. To reduce the repetition in answers, the post simulation questionnaire omitted items that were not included in the educational content of the physiotherapy HFS programme.

For the purpose of this study, the questionnaire (Appendix 7) was divided into five separate domains. Each domain consisted of several items, which required the participant to indicate their self assessed competence or confidence level for that item. The five different domains consisted of:

1) General respiratory assessment skills e.g. case notes interpretation consisting of 16 items
2) General respiratory treatment skills e.g. producing an appropriate treatment plan consisting of 14 items
3) Specific respiratory treatment items e.g. manual hyperinflation consisting of 8 items
4) Range of abilities – e.g. abilities in treating or handling a range of cardiorespiratory physiotherapy conditions such as post cardiac surgery patients etc, consisting of 21 items
5) Confidence – e.g. confidence in treating cardiorespiratory patients such as in the Intensive Care Units etc, consisting of 5 items

For domains 1, 2, 4 and 5, the participants indicated their self assessed competence or confidence level for *each item* on the seven point Likert Scale with *each domain*. A median score in each domain (using all items in that domain) was calculated for each participant and compared pre and post intervention. Unlike the other domains, domain 3 did not utilise the seven point Likert scale for the participants to rate their competence or confidence levels for the specific respiratory treatment items. Therefore, in order to measure the changes for domain 3, the scores of six specific treatment skill items were summed up for each individual participant before the participant's median score was calculated and then compared before and after the intervention. Appendix 9 shows how the median scores for all five domains 1, 2, 4 and 5 were calculated during this study. To distinguish if the HFS programme had particularly benefitted a category of participants (work experience or highest level qualifications), the changes to the total self assessed competence and confidence

scores pre and post intervention were also calculated by summing up all of the participant's responses in all five domains.

4.4.2 Post simulation survey form

A 19 item survey was designed by the researcher (MK) to obtain the participants' feedback regarding the design and content of physiotherapy HFS programme together with the extent of participants' perceived learning. This survey also elicited responses to determine how future simulation programmes could be improved. The survey can be seen in Appendix 8.

4.5 PILOT STUDY

A pilot study was conducted on the 15th of November 2010 in the AUT simulation suite to obtain feedback with regards to the initial design of the programme. Two participants (one experienced clinician and one fourth year physiotherapy student) participated in one case study (Patient A). Based on their feedback, amendments to that case study were made so as to increase the realism of the case.

4.6 STUDY PROCEDURES

Following informed consent (Appendix 10 and 11 for participant information sheet and participant consent form), the participant selected one of the 10 sealed envelopes that contained the pre and post physiotherapy self assessed questionnaires plus an assigned time slot for one of the two simulation case studies developed for this project. Given the small sample size, the envelopes were sealed so that the researcher would not be able to identify the participant based on the participant code on the questionnaires and HFS programme time slot. The participant was then requested to complete and return the pre-simulation questionnaire (Appendix 7) to provide information about their own level of confidence and self rated competence in cardiorespiratory physiotherapy skills and data about their work experiences to the researcher via her letter tray at least two days before the start of their HFS programme.

The physiotherapy HFS programme was implemented on the 6th and 13th of January 2011. On the day of their simulation programme, the participant was given a five minute orientation to the simulation suite by the researcher before being provided with a script (Appendix 1), which contained a case history and information necessary to manage the case study. Following this, the researcher asked the participant a standardised list of questions (Appendix 4), which were particular to their simulated case study to determine the appropriateness of the participant's analysis of the case before starting the simulation case study. The participant was then asked to assess and treat the manikin as if 'in real life'. The researcher then modified the progress of the case studies based on the participants' actions using the computer programme and the case study algorithm (Appendix 3). Concurrently, the researcher also observed and recorded the participant's actions using the procedural checklist (Appendix 5).

After the simulation case study, the participant was debriefed. During the debrief, the participant was guided to reflect on the case study that they had completed using a list of standardised questions (Appendix 4), before being provided feedback by the researcher using the procedural checklist. Following this, the researcher engaged the participant in a discussion to facilitate clinical reasoning and help the participant identify their own areas for improvement before all the participants were provided with the opportunity to repeat the same case scenario with the researcher for practice purposes. The participants were requested to complete and return the post simulation questionnaires to the researcher via her letter tray at least 2 days after completing the HFS programme (Appendix 8).

4.7 ETHICS

Ethics approval for this study was granted by the Auckland University of Technology Ethics Committee and National Healthcare Group Domain Specific Review Board. The ethics approval letters from both institutions are available in Appendix 12.

4.8 STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPSS) Version 17 was used to analyse the data collected in this study. Descriptive statistics were used to analyse data from the pre and post Self Assessed Competence and Confidence Questionnaire (Refer to Appendix 9 for further explanation for score calculation). The Wilcoxon Signed Rank Test was used to measure the changes in the participants' self assessed confidence and competence levels in each of the five domains as a result of the intervention. Additionally, the participant's total scores for self assessed competence (sum of raw scores for the components of general respiratory assessment skills, general respiratory treatment skills, specific treatment items included in the HFS programme and range of abilities) and self assessed confidence (raw score for confidence) were compared pre and post intervention using descriptive statistics. From this, the percentage increase in the self assessed competence and confidence levels were derived and this percentage values were used to analyse the differences in self assessed competence and confidence between participants with varying levels of experience and levels of qualification. This alternative method was used instead of calculating the means and standard deviations of each group (e.g. participants who hold a diploma or degree) because there were too few participants in each group for statistical analysis. Finally, the participants' evaluations of the HFS programme were also collectively analysed using descriptive statistics.

5 RESULTS

This chapter provides an overview of the demographics of the participants who took part in the study and their performances during the physiotherapy HFS programme. Analyses of the participants' self assessed competence and confidence in treating critically ill patients pre and post undertaking the physiotherapy HFS programme are also presented. Finally, the survey results reflecting the participant's feedback regarding the HFS programme is presented.

5.1 PARTICIPANTS

For this study, 10 physiotherapists were recruited from National University Hospital (Singapore). Two participants held a Masters degree in physiotherapy, while five participants held a Bachelor's degree in physiotherapy and three participants held a diploma. Nine participants had less than one year of work experience as a physiotherapist. All of the study participants were currently not working in the intensive care, high dependency or general respiratory wards. Eight participants reported that less than a quarter of their daily caseloads comprised of respiratory patients.

5.2 PARTICIPANT PERFORMANCE DURING THE HFS PROGRAMME

Five participants had randomly selected to undertake the assessment and treatment of Patient A (Case Study One) and another five participants had randomly selected to undertake Patient B (Case Study Two) during the HFS programme. Appendix 1 presents the objectives and rationalises the appropriate patient treatment approaches for each of the case studies.

5.2.1 Case Study One (Patient A)

Figure 2 provides an overview of the five participants' performances during Case Study One. During the first case study, all five participants successfully proceeded to the treatment stage after completing their subjective assessments. Three participants chose what was designated by the research team (MK and JR) to be the most appropriate treatment position and approach; and four participants demonstrated what was considered the correct (safest) oral suctioning technique. All

participants concluded the case study by correctly repositioning and reassessing the "patient".

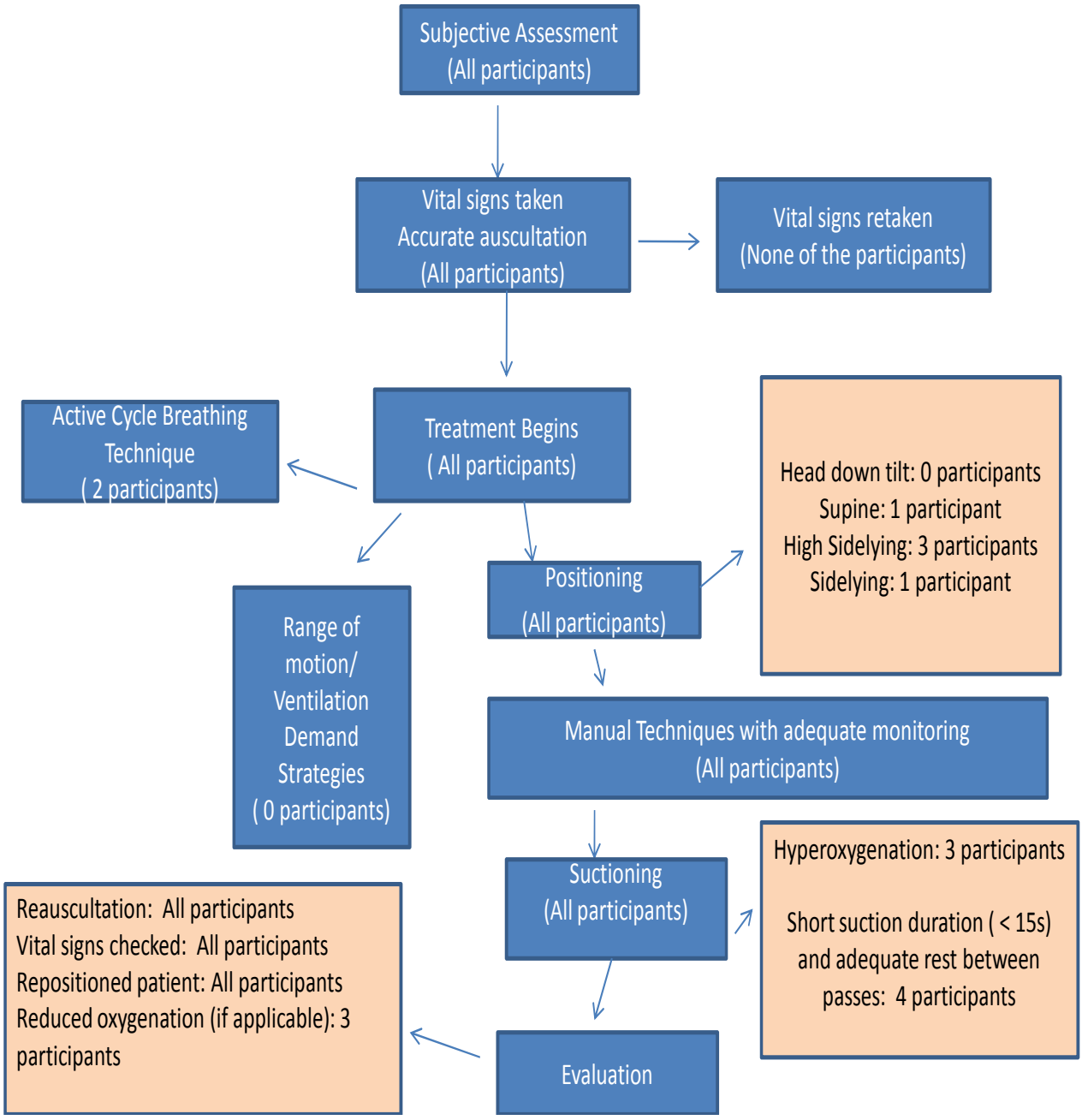


Figure 2: Participants' performances during Case Study One (Patient A)

5.2.2 Case Study Two (Patient B)

Figure 3 summarises participants' performances during Case Study Two (Patient B). Only four out of five participants who were allocated this case study completed the scenario; one participant requested that the case study be terminated prematurely as the participant was unclear about how to execute some treatment techniques. Two participants required reminders from the researcher that the "patient" could not be moved from the spinal nursing positions for safety purposes. All participants showed a lack of familiarity in the correct assembly and application of the equipment needed to perform manual hyperinflation procedures but managed to perform the technique appropriately and safely for treatment purposes. In addition, one participant performed an endotracheal suctioning technique considered to be inappropriate during the treatment.

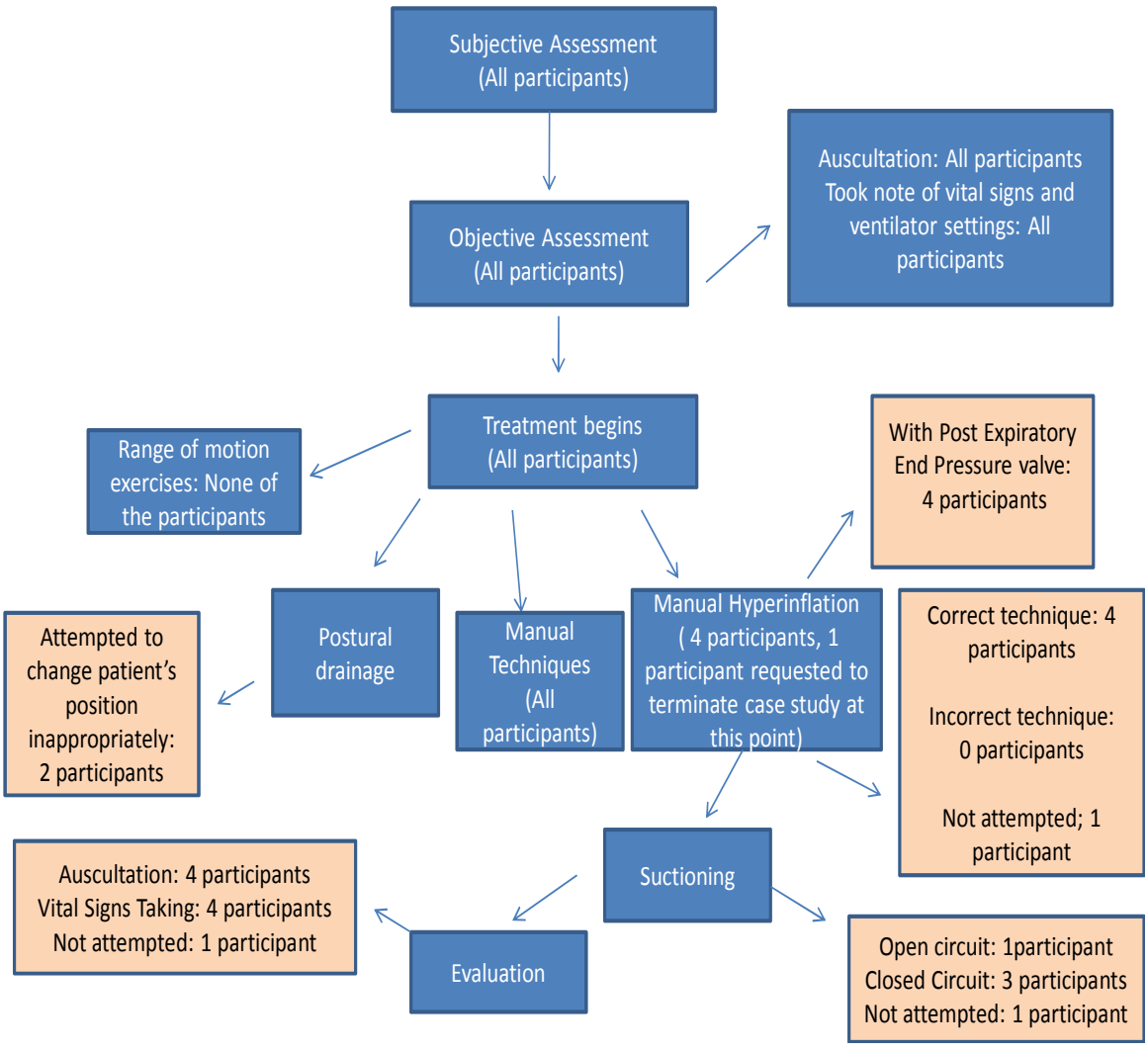


Figure 3: Participants' performances during Case Study Two (Patient B)

5.3 SELF ASSESSED COMPETENCE

Self assessed competence was measured using the pre and post simulation questionnaire (See 4.4.1) The domains contributing to self assessed competency were general respiratory assessment skills (domain 1), general respiratory treatment skills (domain 2), specific respiratory treatment items (domain 3) and range of abilities (domain 4). Analyses using the Wilcoxon Signed Rank Test indicated that, following HFS, the participants reported a significant increase in their self assessed competence levels for their general respiratory assessment skills (Z=-3.04, *p*=0.001), general respiratory treatment skills (Z=-3.18, *p*=0.002), specific respiratory treatment items included in the HFS programme (Z=2.3, *p*=0.021) and range of abilities (Z=-2.83, *p*=0.005). Table 3 shows the changes in the participants' self assessed competence for these measures pre and post undertaking the HFS programme.

Table 3: Overall changes in self assessed competency levels before and after the physiotherapy HFS programme

Item	**Pre intervention median (Range, IQR)**	**Post intervention median (Range, IQR)**	**Z value**	**p value (* indicates significant values)**
General Respiratory Assessment Skills	5 (5-6,0.25)	6 (5-6,1.0)	-3.04	p = 0.002*
General Respiratory Treatment Skills	5 (4-6,0.25)	6 (5-6,1.0)	-3.18	p = 0.001 *
Specific Treatment Items included in the HFS programme	38 (31-44, 13)	46 (32-48,7.25)	2.30	p = 0.021 *
Range of abilities	5 (4-6,0.5)	6 (4-6,1.0)	-2.83	p = 0.005 *

Key: HFS – High Fidelity Simulation, IRQ- Inter Quartile Range

Each individual participant's total self assessed competence score was calculated pre and post intervention (see Table 4) to observe for trends to indicate which particular groups of participants, based on educational qualifications or work experience levels, had benefitted more from the programme. Figure 4 shows the changes in participants' self assessed competence levels based on their qualifications. Figure 4 highlights that the participants who held a diploma or Bachelor's degree seemed to have a higher percentage increase in their self assessed competence scores. Figure 5 shows the changes in participants' self assessed competence levels based on their amount of working experience. Figure 5 indicates that the participants who had less than a year of working experience also tend to report greater percentage changes in their self assessed competence levels. This seems to suggest that the physiotherapy HFS programme is likely to be more beneficial for physiotherapists who hold either a diploma or Bachelor's degree and/or have less than one year of working experience.

Table 4: Changes in total score for self assessed competence of each participant as a result of their participation in the HFS programme

Participant Code	Pre intervention self assessed competence score (Score out of 398)	Post intervention self assessed competence score (Score out of 398)	Absolute Change (Percentage change)	Qualifications	Work Experience
1	262	279	+17 (6.49%)	Degree	Less than 1 year
2	290	329	+37 (12.8%)	Diploma	Less than 1 year
3	242	287	+45 (18.6%)	Degree	Less than 1 year
4	272	326	+54 (19.9%)	Degree	Less than 6 months
5	248	304	+56 (22.6%)	Degree	Less than 6 months
A	306	327	+21 (6.86%)	Masters	More than 1 year
B	295	333	+38 (12.9%)	Diploma	Less than 1 year
C	297	296	-1(-0.34%)	Diploma	Less than 6 months
D	325	333	+8 (2.46%)	Masters	Less than 1 year
E	262	290	+28 (10.7%)	Degree	Less than 6 months

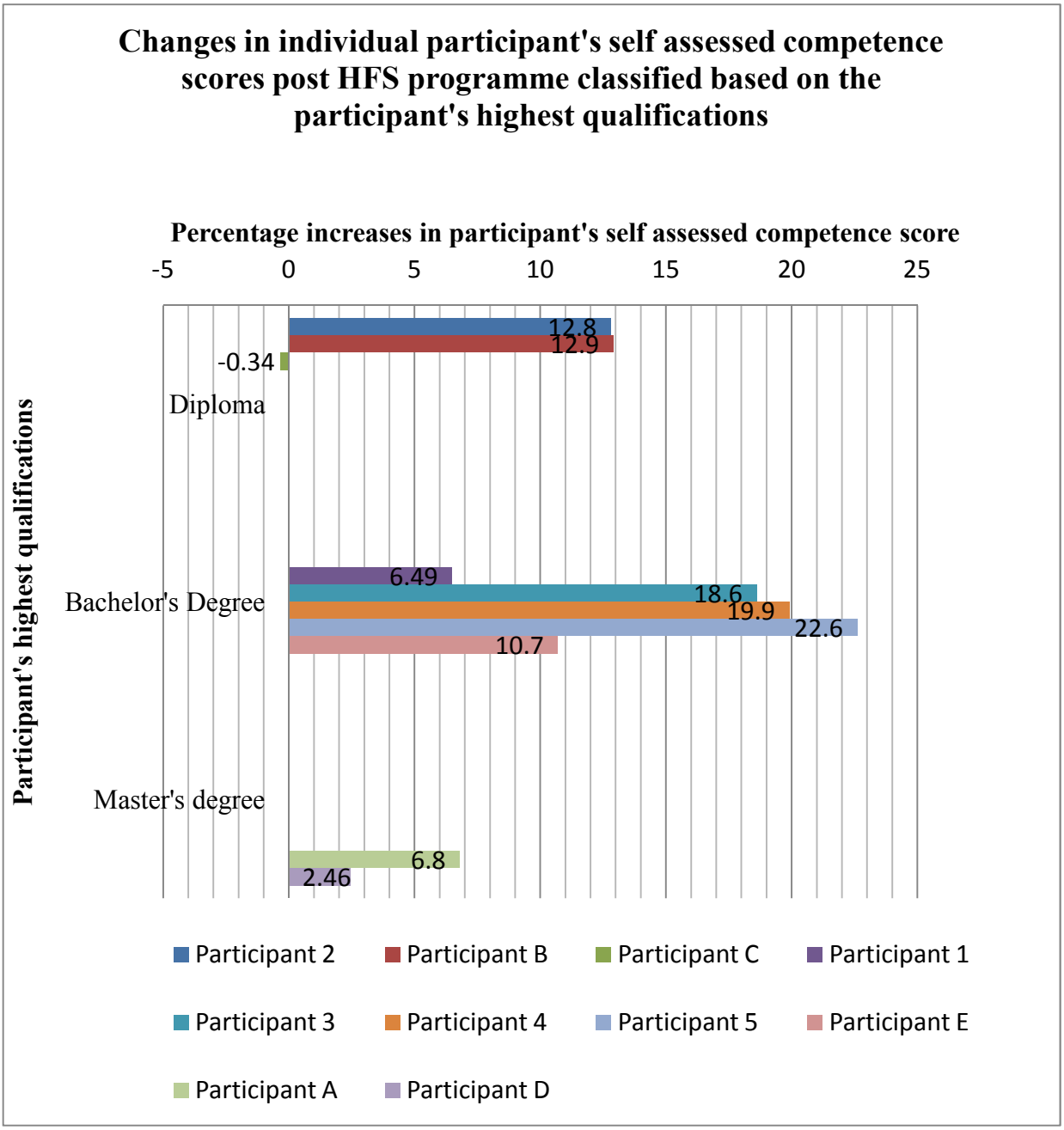


Figure 4: Changes in self assessed competency levels before and after the physiotherapy HFS intervention based on qualifications

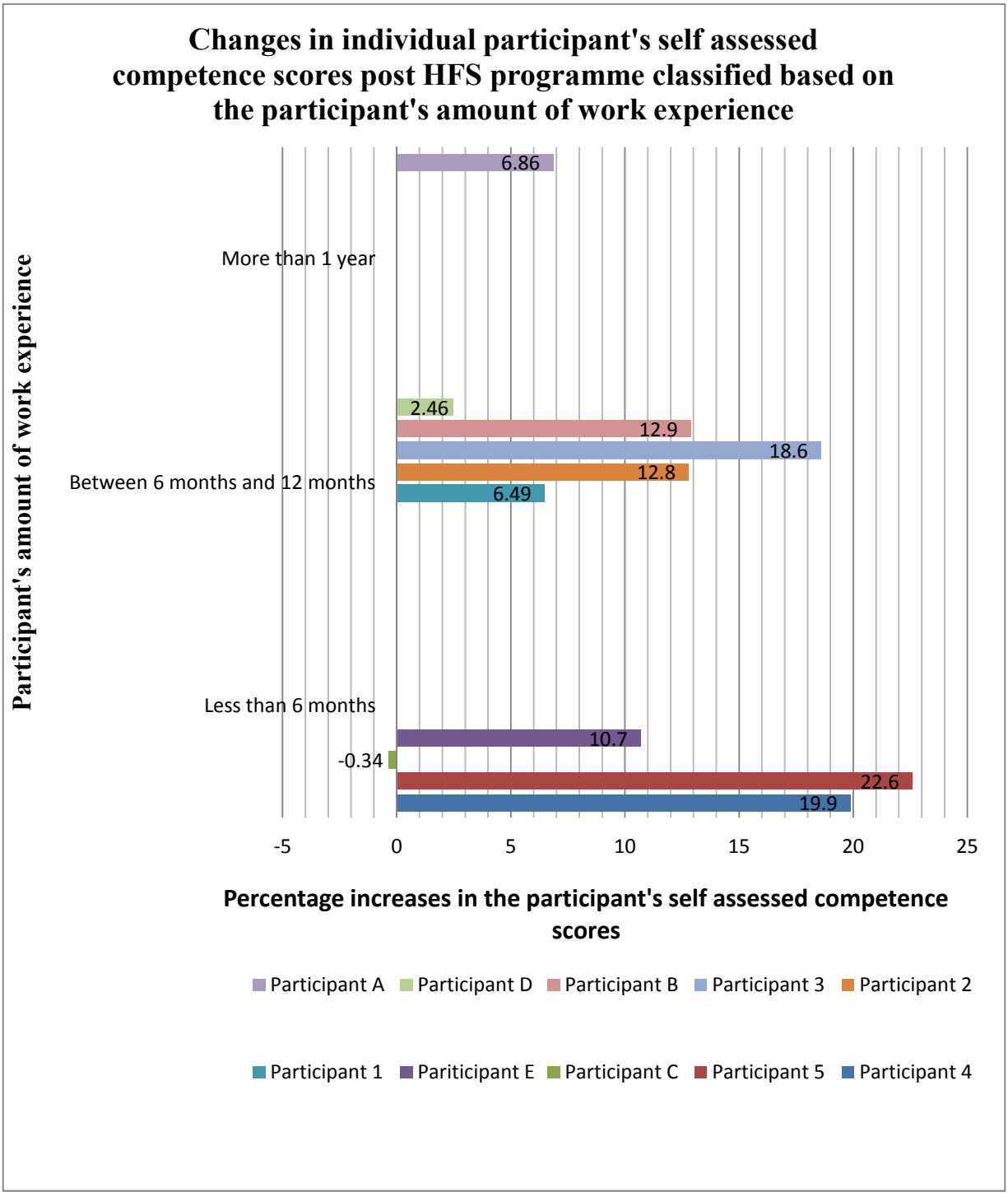


Figure 5: Changes in self assessed competency levels before and after the physiotherapy HFS programmes based on amount of work experience

5.4 SELF ASSESSED CONFIDENCE

The Wilcoxson Signed Rank test was used to determine the changes in the participant's self assessed confidence scores as a result of the HFS programme. There was no significant difference in the participants' pre and post HFS self assessed confidence scores (Z= -2.449, p= 0.068). Trends in the data (See Table 5) suggest that most of the participants who held a Bachelor's degree reported a greater increase in their self assessed confidence levels when compared with the participants who held a Diploma or Masters degree (see Figure 6).

Table 5: Changes in total score for self assessed confidence of each participant as a result of their participation in the HFS programme

Participant Code	Pre intervention self assessed confidence score (score out of 35)	Post intervention self assessed confidence score (score out of 35)	Change (Percentage)	Qualifications	Work Experience
1	17	21	+4 (23.5%)	Degree	Less than 1 year
2	25	27	+3 (12.0%)	Diploma	Less than 1 year
3	20	23	+3 (15%)	Degree	Less than 1 year
4	19	26	+7 (36.8%)	Degree	Less than 6 months
5	19	26	+7 (36.8%)	Degree	Less than 6 months
A	24	26	+2 (8.33%)	Masters	More than 1 year
B	28	30	+2 (7.14%)	Diploma	Less than 1 year
C	27	27	0 (0%)	Diploma	Less than 6 months
D	25	25	0 (0%)	Masters	Less than 1 year
E	16	19	+3 (15.8%)	Degree	Less than 6 months

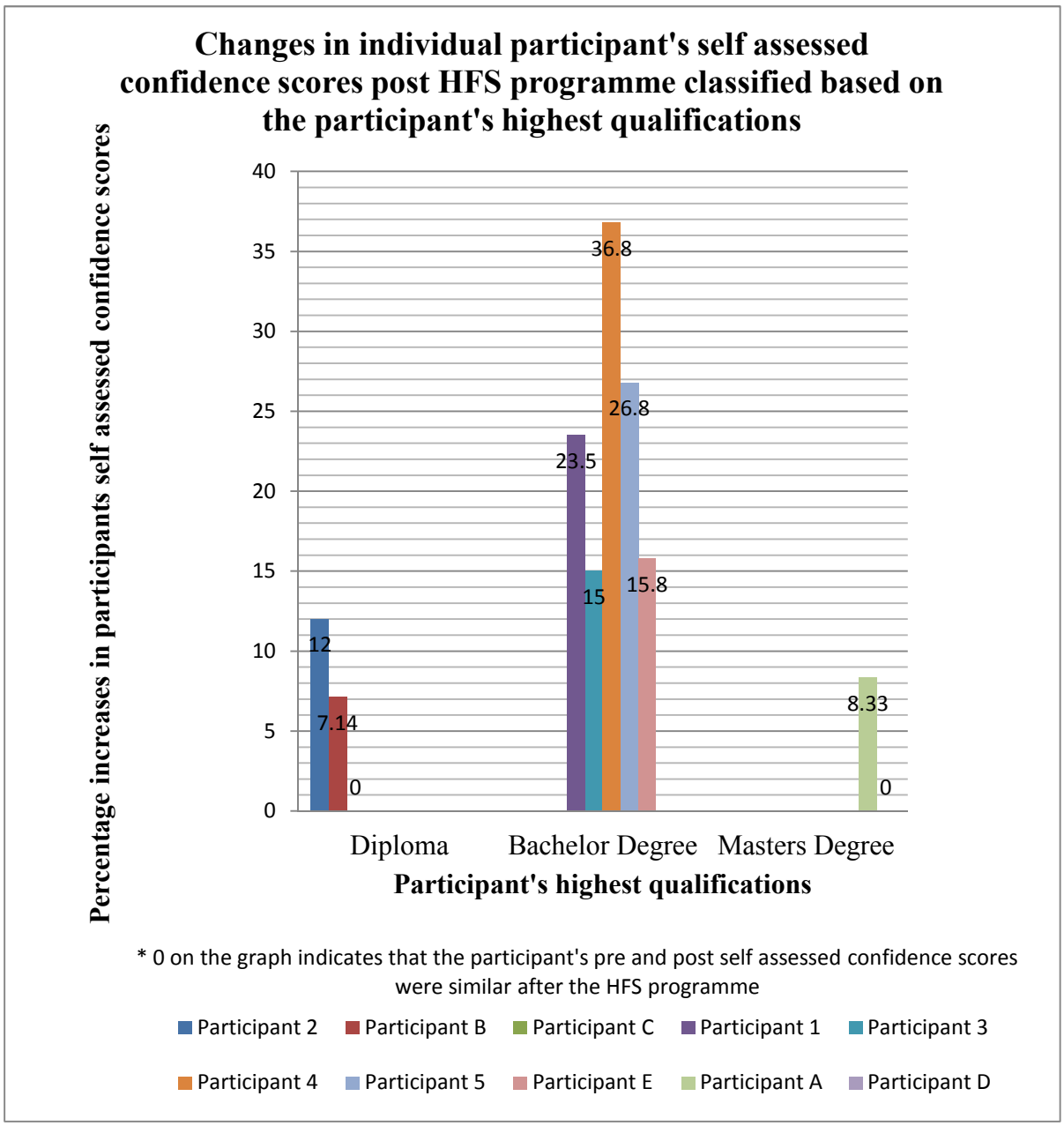


Figure 6: Changes in individual participant's self assessed confidence levels before and after the physiotherapy HFS programme based on qualifications

Figure 7 shows the changes in participants' self assessed confidence levels after the physiotherapy HFS programme based on the participants' work experience levels. Only two of the participants (see Figure 7) reported no change in self assessed competency score. All other participants, regardless of experience, showed increases in self assessed confidence scores.

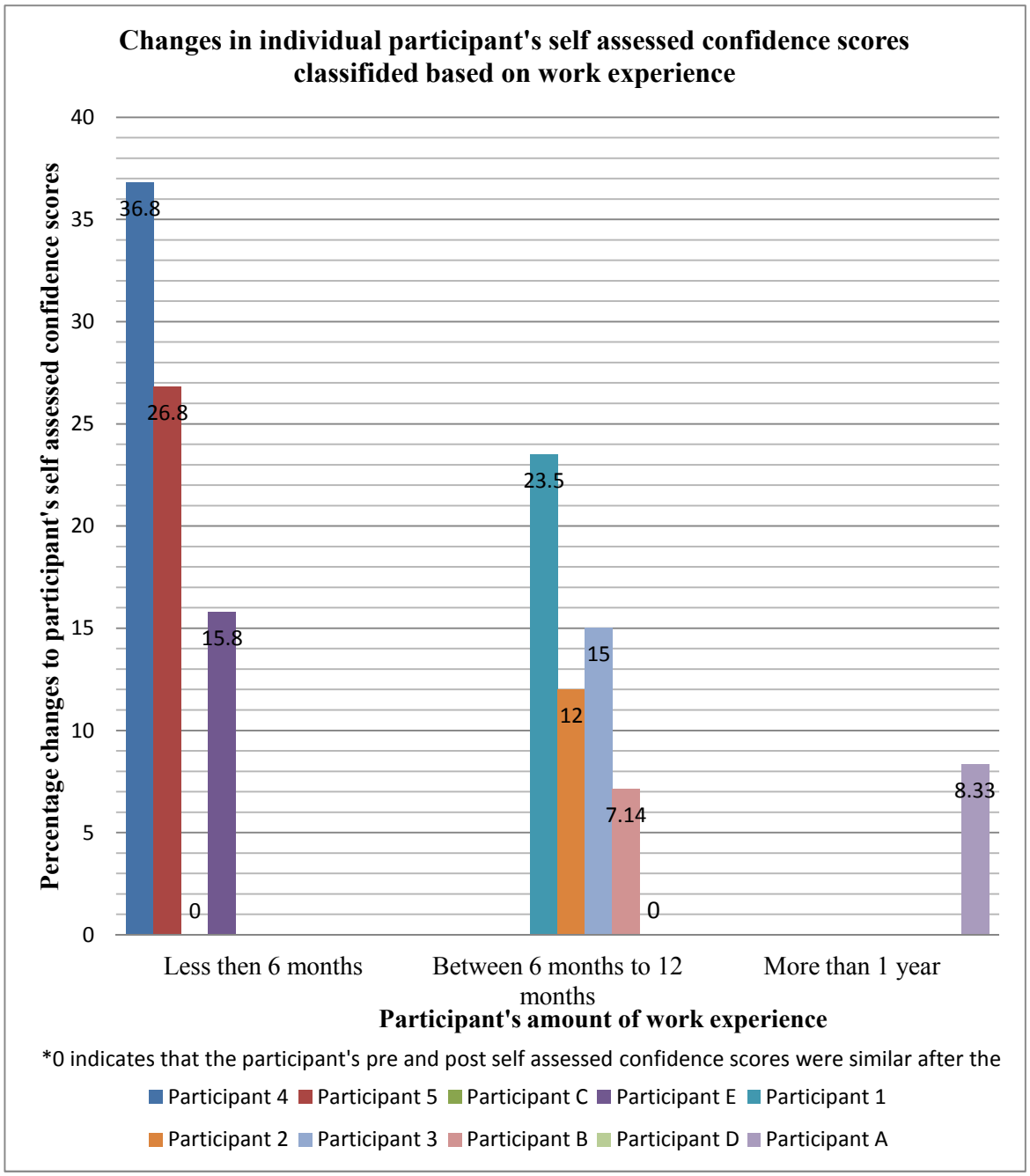


Figure 7: Changes in individual participant's self assessed confidence levels before and after the physiotherapy HFS programme based on work experience levels

5.5 SURVEY RESULTS

Table 6 on the next page provides a brief summary of the participants' responses in the post HFS programme survey form. All ten participants strongly agreed or agreed that the HFS programme was a positive learning experience. The survey results also showed that all ten participants felt that the HFS programme had improved their skills in treating respiratory patients. Although no significant differences were found in the participants' self assessed confidence as measured

from the Self Assessed Competence and Confidence Questionnaire, when asked using a question in the survey, nine of the participants indicated that they felt that the HFS programme had increased their confidence when encountering respiratory patients. Nine participants strongly felt that the provision of further opportunities to practise during the HFS programme would improve their ability to manage similar case scenarios in real life.

All participants strongly agreed or agreed that the content of the simulated case studies was relevant to their practice and the duration of the HFS programme had been adequate. Furthermore, nine of the participants strongly agreed and one of the participants agreed that the feedback during debrief was useful, respectful and adequate. All participants agreed that the HFS programme should be made into a compulsory component of the NUH's cardiorespiratory team preceptorship programme; with eight participants agreeing that physiotherapists should attend the HFS programme before actual patient encounters. All participants would recommend this HFS programme to new NUH physiotherapists but only seven of the participants, all of whom had less than one year working experience, would recommend experienced physiotherapists should also attend the HFS physiotherapy programme.

Table 6: Summary of the participants' responses to the survey questions

Item	Strongly Agree	Agree	Neutral	Strongly Disagree / Disagree
I enjoyed the simulation session	4	6	0	0
The simulation session was a useful learning experience	6	4	0	0
The simulation session will influence my clinical practice	4	6	0	0
The simulation programme was realistic and I would behave the same way in real life	6	4	0	0
The level of difficulty of the case was appropriate	7	3	0	0
The content of the case was relevant	7	3	0	0
The duration of the simulation session was sufficient	5	5	0	0
The HFS session improved my confidence to treat respiratory patients	3	7	0	0
The HFS session improved my skills to treat respiratory patients	2	7	1	0
The orientation to the simulation suite and manikin was in sufficient detail	6	4	0	0
The instructor provided adequate feedback and discussion about the case after the HFS session	9	1	0	0
The feedback provided to me is useful	8	2	0	0
The discussion and debriefing environment after the case scenario was comfortable and non judgemental	8	2	0	0
Further opportunities to practise during the programme will improve my ability to manage the same situation in real life	9	1	0	0
I would recommend this programme to new physiotherapists in the department	8	2	0	0
I would recommend this programme to experienced physiotherapists in the department	3	4	3	0
This HFS programme should be made a compulsory component in NUH cardiopulmonary team's preceptorship programme	6	4	0	0
Physiotherapists should attend this HFS programme before seeing a real patient	5	3	2	0

6 DISCUSSION

The primary aim of this study was to develop and implement a physiotherapy HFS programme in NUH. The second aim of this study was to evaluate the effectiveness of this programme in increasing a physiotherapist's self assessed competence and confidence in treating critically ill patients.

The study results show that the one hour HFS programme implemented during this study significantly increased the participants' self assessed competence. There appeared to be no significant difference in self assessed confidence when treating critically ill patients using HFS in our study. Several factors may explain these results.

Firstly, the study recruited participants who were not working the Intensive Care Units, High Dependency Units and respiratory general wards. As such, at the time of this study, the participants would have limited encounters with the critically ill respiratory patients; and would, therefore have potentially been the most likely participants to have benefitted from an opportunity to practise their cardiorespiratory physiotherapy skills and discuss about their clinical decision making processes using a HFS treatment and feedback session. It is possible that the participants might have gained more knowledge from discussions or practices with the researcher during the HFS programme; which might have made the participants feel that they can perform better (more competent) when they treat critically ill patients. Subsequently, this might have contributed to the findings of significant increases in self assessed competence levels of the study participants.

Checklists were utilised during the simulated case studies to review the participant's actions. By being able to clarify and compare their own clinical reasoning and treatment approaches with that of a cardiorespiratory specialist and evidence based literature; the participants may feel more competent when treating critically ill patients. The design of the HFS programme used in this current study also incorporated the principles of adult learning theories such as being experiential, relevant and goal orientated learning. Basing the HFS programme on these adult learning principles may have increased the effectiveness of the HFS programme, resulting in a significant increase of the participants' self assessed competence.

Finally, it is postulated that the necessary knowledge and competencies required of clinical practice is primarily developed through debriefs and discussions after the simulated case studies (Ti, et al., 2006). As such, it is possible that the careful planning of the debrief process may have guided participants into appropriate self evaluation and reflection on their actions, thus, learning from the feedback provided. As the value of both the HFS and debrief session were highly rated by the participants, it is also possible that the 'style of delivery' of the programme might have also played a role in supporting the learning process. During the physiotherapy HFS programme, the participants took part in the case studies individually and had a personalised individual debrief with the researcher. Consequently, these factors might have reduced the stress on participants, which aided learning and led in an increase in participants' self assessed competence levels.

Interestingly, the study results also indicated that that there had been no significant increase in the participants' self assessed confidence. It is possible that no significant increases in the participants' self assessed confidence levels were found because the content covered in the HFS programme was not sufficiently challenging for participants. As a result, the participants may not feel as if they had gained any additional information from the HFS programme, thus reporting little change in their self assessed confidence levels (as indicated from the pre and post simulation questionnaire). It is also possible that the lack of familiarity or fear with the use of technology could influence the acquisition of skills and therefore, the rating of self assessed confidence levels (Adler, et al., 2007; Akhtar-Danesh, Baxter, Valaitis, Stanyon, & Sproul, 2009). Compared to the HFS programmes of other studies evaluated in the literature review such as that of Ngyuen and colleagues (2009), the current study did not utilise other educational interventions like lectures or provide additional reading materials in addition to HFS. Such additional educational materials might serve as a reference for participants to review, which might contribute to increased confidence levels. Additionally, this study's HFS programme was of a shorter duration and covered a smaller range of simulated case studies in comparison to other studies which did find significant differences in their participants' confidence levels (Burlacu et al., 2008; Paige et al., 2009; Ngyuen et al., 2008). Due to time constraints, there were limited simulation scenarios for the participants to experience and restricted time for repeated training sessions. Consequently it is possible that these differences in the HFS programme design and

style of delivery could have resulted in the non significant increase in the participants' self assessed confidence in treating critically ill patients. Some participants indicated that further practice sessions (using the same case) might increase their familiarity with the real life work environment and felt that this may increase their confidence in treating critically ill patients. Furthermore, some participants also indicated that they would feel more confident if they had been able to either practise with a real patient or in the actual ward environment during the simulation programme. In all, a combination of the above flaws in the study procedures and the design of the HFS programme used in the study could have resulted in the non significant findings in the participants' self assessed confidence levels. Finally, as this study had only 10 participants, it is possible that a significant change in the participants' self rated confidence was unable to be detected because of the small sample size (Type II error). Future studies may need to recruit a larger number of participants to more accurately determine if such changes are statistically significant.

The study results showed that the participant's highest educational qualifications and work experience levels were factors that influenced the changes in self assessed competence and/or confidence levels after the intervention. Trends from the data seem to indicate that the HFS programme did not have a large effect on the participants who held a diploma or Master's degree as compared to the participants who held a Bachelor's degree. This is might be because the participants who held a diploma or Master's degree had already reported higher levels of self assessed competence and confidence scores prior to undertaking the HFS programme (refer to Table 4 and Table 5). This might have created a 'ceiling effect', whereby the study results may have been impacted upon by those participants who already had high self assessed competence and confidence rating before the programme, might have influenced the study results and conclusions. It is also difficult to conclude whether the HFS programme is more beneficial for participants who have less than one year of working experience as there was only 1 participant (participant A) who had more than one year of working experience.

Surprisingly, during the study, one participant reported a decrease in self assessed competence levels. Upon reviewing the participant's raw data, it was noted that that the decrease in scores were particular to the specific respiratory treatment items that were tested in that participant's case study (closed and open endotracheal tube

suctioning). Therefore, it is possible that this participant may have initially thought that that he/she was already fully competent in these treatment techniques; however, with his/her participation in the HFS programme, he/she might have realised a need to review his/her knowledge on those specific treatment items. This indicates that HFS programmes could be a powerful tool to help participants reflect on the areas they need further practice on.

Lastly, it is important to note that the statistical and absolute changes in participants' self assessed competence and confidence were achieved as a result of their participation in a single simulation case during a short one hour HFS programme. Therefore, it is possible that the further development of the HFS programme, such as increasing the number of cases or increasing the duration of the programme, might result in greater changes in self assessed competence and confidence levels. Additionally, other styles of executing the HFS programme such as group based participation during the case studies and debriefs by a more senior physiotherapist might have a different effect on the participant's performances during the case studies and influence the changes in self assessed competence and confidence levels differently. These require further investigation.

Although this current study indicates that participation in this HFS programme increased the participants' self assessed competence levels, it is also acknowledged that these findings might be false positive as the participants might give socially desirable answers as they may not be comfortable in revealing actual sensitive information in the self assessment questionnaire. Similarly, even though the study results indicate that the HFS programme significantly increases the participant's self assessed competence levels; however, given the study sample size (ten participants); there might have been a Type I error.

It is not clear whether increases in participants' self assessed competence and confidence levels will translate to actual better standards of patient care and safety. There are several factors, such as the applicability of the skills taught, that can affect the translation of the learnt skills into the real life world. Similarly, the indicators to measure quality of patient care can be ambiguous and, thus it would be difficult to quantify the changes in the quality of patient care provided by the physiotherapists following the HFS programme. The sustainability of the increases in the

participants' self assessed competence and confidence levels as a result of their participation in the physiotherapy HFS programme is also unknown.

It is important to highlight that the results of this current research study should not be generalised to that of other countries or healthcare institutions as this was a small study conducted in a single institution, consisting of ten participants. Additionally, physiotherapy practices can vary between different countries and institutions. As such, the chosen appropriate treatment approach in this research study's HFS case studies might not necessarily be considered to be appropriate to practice in other units.

The design and development of HFS programmes require much time and effort from both the HFS programme developer and the participants. High fidelity simulation programmes can also be expensive to run as compared to other methods of teaching due to the preparations, logistics, level of technology involved as well as the lack of suitable instructors and limitations of class sizes. In all, the benefits over the costs of running HFS physiotherapy programmes needs to be clarified to justify the heavy investment of money, time and labour involved.

7 STUDY LIMITATIONS

As the premise of this study was to investigate how participation in a physiotherapy HFS programme affects physiotherapists' self assessed confidence and competence, the methodology of a pre post design was appropriate. However, given the small sample size of this study, it is suggested that future studies should recruit additional participants from a range of hospitals to increase the statistical power of the study. In addition, the participants who attend the HFS programme can also be randomly stratified based on factors like experience and qualifications levels to minimise the possibilities of bias contributing to the study results. At the same time, there was no evaluator blinding of the participant performance in this current study which might have introduced potential measurement bias to the participant performances during the HFS programme (Murray, et al., 2002; Perkins, Hulme, & Tweed, 2001). Therefore, this might have affected the review of the participant's performance during debrief after the HFS case study; which in turn, may affect how the participant perceives their own competence or confidence in treating a respiratory patient.

To date, there is no clear existing definition to distinguish an experienced cardiorespiratory physiotherapist. Expertise in a particular physiotherapy field can be defined by many other factors such as experience, background knowledge or one's ability to pick out the primary patient problem to address and to appropriately clinically reason (Case, Harrison & Roskell, 2000). However, this research study has considered only one factor; which is how regularly the physiotherapist currently treats a patient with respiratory problems, to determine whether a physiotherapist is experienced in cardiorespiratory physiotherapy. Future studies might wish to consider including other criterions to define an experienced cardiorespiratory physiotherapist in their studies.

The modified Self Assessed Competency and Confidence Questionnaires used in this study have not been tested for their reliability and validity in the Singapore context. This study also assumes that the intervals of the Likert scales used to measure the participants' self assessed competence and confidence are equal; which may not be true in real life. Given that participants may respond to questionnaires using socially desirable answers, this may make it more difficult to accurately measure the true changes in the participants' self assessed confidence and

competence levels. Additionally, the minimum value change of the scale used in this study to represent clinical improvements is not known. As such, it is difficult to ascertain whether the increases in participants' self assessed competence or confidence levels are genuine or clinically significant.

Finally and most importantly, this study did not evaluate whether the improvements in the participants' self assessed competence and confidence levels have translated into actual changes in the participants' real life performances. This is crucial as the eventual aim of the HFS programme would be to influence and improve the standards of physiotherapy care for the patient.

8 FUTURE RECOMMENDATIONS

In order to provide stronger evidence that HFS programmes can significantly increase a physiotherapist's self assessed competence and confidence levels in treating critically ill patients, researchers might wish to consider conducting larger cohort studies by recruiting more participants from multi institutions. Similarly, future studies might wish to consider randomising the participants into a control (traditional teaching methods) and experimental (HFS) group to determine whether there are any additional benefits of HFS in aiding learning by modelling after previous similar studies methods (e.g. Owen, et al., 2006; Birch, et al., 2007; Wenk, et al., 2007). Future studies might also wish to compare and analyse how different HFS programme designs, such as how the inclusion of other educational interventions like lectures, can affect a physiotherapist's self assessed confidence and competence levels when treating critically ill patients. As most of the studies identified in the literature review adopted a group based approach during the HFS scenarios future studies should investigate whether any gains in confidence or competence are greater when the participant is involved in the HFS scenario individually or within a group.

Future studies should also attempt to test any questionnaires that are administered to measure the changes in participants' self assessed competence and confidence levels for their validity and reliability according to the country's physiotherapy practice context. These studies should also investigate the minimum value changes on the scale used in the questionnaire that would represent clinically significant changes. Furthermore, future studies using HFS should assess the duration, frequency and diversity of cases that would result in maximal gains in the physiotherapist's self assessed competence and confidence. The ideal inter training interval for maintenance of participant's self assessed competence and confidence levels should also be investigated.

It is suggested that future studies should have a minimum number of two simulation personnel (a manikin controller and the debrief facilitator) in order to run HFS programmes more effectively. It may also be useful to limit the number of objectives when planning the case scenarios so that the participant can achieve the learning outcomes more readily during the programme. The coordinator might also wish to predetermine (using the current pre simulation questionnaire in this study)

whether the programme participants have the necessary background knowledge and practical skills for undertaking the tasks involved (for example, how to set up a manual hyperinflation circuit) before attending the HFS programme. By ensuring that the participants already have the required skills required for the case study, then the debrief facilitator can focus on assessing and teaching the appropriate clinical reasoning during the HFS programme.

Additionally, future studies might wish to investigate how and the extent to which the increases in the participants' self assessed competence and confidence levels can be translated into real life to determine how physiotherapy HFS programme have impacted on actual patient care. Finally, and importantly, studies should investigate cost benefit analysis in order to demonstrate that the effort and resources allocated to developing, commencing and continuing these programmes is worthwhile.

9 CONCLUSION

HFS has been shown to develop both the non technical and technical skills competencies in some healthcare professions. However, non physiotherapy studies which have investigated the use of HFS programmes have adopted a variety of programme designs, which makes it difficult to ascertain if the HFS programme was the primary contributor to the changes in the participant's self assessed competence and confidence levels. Furthermore, these studies have used non validated measuring instruments to assess the self rated changes in their participants' competence and confidence. On the other hand, there has been scant literature to provide evidence to guide the development of a physiotherapy HFS programme and no evidence to demonstrate that participation in a cardiorespiratory physiotherapy HFS programme increases in a participant's self assessed competence and confidence. Given that HFS has only been recently introduced into physiotherapy education, the effect of a HFS programme on physiotherapists has been yet to be investigated. In all, the effectiveness of a physiotherapy HFS programme in increasing a physiotherapist's self assessed competence and confidence is unknown.

During this study, an evidence based physiotherapy HFS programme was designed and implemented in a tertiary hospital in Singapore. Changes in the self assessed competence and confidence levels in treating critically ill patients of 10 physiotherapists who participated in the HFS programme were measured using a modified and previously validated physiotherapy self assessed competence and confidence questionnaire. The overall results of this study indicate that a one hour physiotherapy HFS programme significantly increased participants' self assessed competence but not their confidence in treating critically ill patients. Trends from the data indicated that participants' highest level of educational qualifications and work experience levels were not factors that influenced the increases in participants' self assessed competence and confidence levels. Based on the post programme survey, all of the participants rated the HFS experience and the programme design highly, and indicated that their participation in the programme had improved their skills and confidence in treating critically ill patients.

Due to the limitations of this study, it is suggested that further larger and multi-institutional studies using context specific validated measuring instruments are needed to provide more evidence that the participation in a HFS programme can

significantly increase a physiotherapist's self assessed competence and confidence levels when treating a critically ill patient. Furthermore, studies should also investigate if and how, any increases in the participants' self assessed competence and confidence levels translates to better standards of patient care requires clarification given the resources involved in implementing HFS programmes.

10 REFLECTIONS

The proposal for this study first evolved when the NUH cardiorespiratory physiotherapy team wanted to adopt a different approach (using HFS programmes) to increase the confidence and competence levels of fellow physiotherapists working in other areas of physiotherapy (neurological and musculoskeletal) when they have to treat critically ill respiratory patients independently. I felt that these standardised training opportunities in a less stressful environment were more likely to be successful in helping fellow physiotherapy colleagues feel more competent and confident because of the lack of stress to have to manage a very ill patient and also because of the unique chance to prepare physiotherapists on the actions to undertake should an adverse event occurs. Initially, I thought that this task of "assessing and teaching" would not be any different or difficult as compared to what the cardiorespiratory physiotherapy team seniors and myself had been practising all along. This view, however, was proven to be incorrect.

It was during this project that I realised that even the first aspect of the HFS programme which comprises of the assessment of the physiotherapist's competence, already gave rise to several fundamental questions without any clear answers. These questions are whether this form of assessment in the HFS environment is the most appropriate to assess the physiotherapist's ability in the actual real life clinical setting and what are the minimum expectations of performance to define competency for clinical practice. Another debatable issue was also to determine who should be the appropriate authority to decide whether a physiotherapist has achieved competency to practise independently on real patients. These grey areas had been worth pondering over as their answers would directly impact upon patient care and safety as well as by whom and how future HFS physiotherapy programmes would be utilised and conducted.

During this research study, there had been no difficulty in recruiting sufficient participants. This might be because the psychological barriers to participation might have been reduced as there had been a strong emphasis to all the participants that the HFS programme was not be used as a competency assessment tool. Additionally, the participants knew that they were participating in the case studies individually and there was a promise of confidentiality and non disclousure of the participant's performance. Furthermore, encouragement from the senior physiotherapists and the

departmental culture to promote continual learning and development of the skills of all physiotherapists may have also persuaded participants to be more willing to come forward and view the HFS programme as a learning experience. These factors had been vital for the learning experience and these characteristics of the programme should not be grossly overlooked in future HFS programmes as the participants would have feel less judged and be more willing to see their mistakes as a learning opportunity. This is also a crucial factor that will determine the success of the HFS programme as the participants would be more open to suggestions proposed by the debrief facilitator.

The HFS programme also involves the teaching of physiotherapy skills. During this study, it became apparent to me that teaching in the clinical setting requires the ultilisation and personalisation of approaches according to the learner's needs and personality so as to achieve the learning objectives of the programme. This is an important skill that I had very little understanding about or formal training in and did not even realise that I had to develop these crucial skills to teach effectively. Although book materials and observations sessions of other healthcare educator's debrief sessions did manage to assist me in gaining some understanding on how to appriopriately conduct debrief sessions, but there still could be more room for improvements. Further opportunities to practise debrief skills and having a mentor to provide feedback with suggestions of changes for the better could have better equipped me to be able to effectively faciliate the participants' learning. Nevertheless, I feel that this project has allowed me to gain some understanding on how I can help both my colleagues and myself learn better in the clinical setting.

Even though a third of the HFS programme's time was allocated to debriefing the participants, I often had insufficient time to adequately address their queries and complete the debrief questions. Therefore, future HFS programmes should either allocate a larger proportion of time to this component or increase the duration of the whole programme so that more teaching and participant self reflection could be done. It might also have been useful to provide the participants with the self reflective questions on paper immediately after the HFS programme and then give the participants some individual time after the case study for the participants to slowly reflect about the entire case study and put their thoughts in writing as it might help the participants recall more pointers that they wish to discuss with the researcher easily.

Due to logistical difficulties, I had to single handedly manipulate the computer controls while observing and recording the participant's actions on the checklists during the simulation case studies before conducting the debrief session. This had been challenging me as I could not concentrate on watching the participant only. As such, future HFS programmes would need to have at least one additional personnel to assist in manipulating the computer to progress the case study so that the rater can focus solely on the participant. Even though I had emphasized to the participants to engage in the case study as if it was real, some participants still tend to directly converse with me instead of the "patient" during the case study. Therefore, further reinforcement from the researcher might be needed to encourage the future participants to engage in the case studies more actively.

Finally, there is a definite need for physiotherapy educators to be provided training to use HFS effectively and also learn to embrace the use of this form of technology to teach. Even though I had undergone attachments in AUT to learn to use the programme and to set up the manikin, but the attachment programme was not specific to field of physiotherapy and were not with simulation experts. In order to gain more expertise in designing and using HFS, it might have been more ideal if I had undergone attachments with either simulation experts who have designed programmes or attended courses ran by the equipment vendors. It might have also been beneficial if the I had been also able to observe some physiotherapy HFS programmes that have already been conducted in other hospitals and educational instutitions. With additional training, I might have been able to refine the current study's programme further and probably better achieve the educational objectives of the HFS programme.

11 REFERENCES

About us: National University Hospital. (n.d.). Retrieved October 30, 2010, from http://www.nuh.com.sg/about-us.html

Adler, M. D., Trainor, J. L., Siddall, V. J., & McGaghie, W. C. (2007). Development and evaluation of high-fidelity simulation case scenarios for pediatric resident education. *Ambulatory Pediatrics, 7*(2), 182-186.

Aggarwal, R., Undre, S., Moorthy, K., Vincent, C., & Darzi, A. (2004). The simulated operating theatre: comprehensive training for surgical teams. *Quality & Safety in Health Care, 13*, I27-I32. doi:10.1136/qshc.2004.010009

Akhtar-Danesh, N., Baxter, P., Valaitis, R. K., Stanyon, W., & Sproul, S. (2009). Nurse faculty perceptions of simulation use in nursing education. *Western Journal of Nursing Research, 31*(3), 312-329. doi:10.1177/0193945908328264

Andreatta, P. B., & Gruppen, L. D. (2009). Conceptualising and classifying validity evidence for simulation. *Medical Education, 43*(11), 1028-1035. doi:10.1111/j.1365-2923.2009.03454.x

Aucar, J. A., Groch, N. R., Troxel, S. A., & Eubanks, S. W. (2005). A review of surgical simulation with attention to validation methodology. *Surgical Laparoscopy Endoscopy & Percutaneous Techniques, 15*(2), 82-89.

Barach, P., Ziv, A., Bloch, M., & Maze, M. (2000). Simulation in anaesthesia. *Minimally Invasive Therapy & Allied Technologies*, 9(5), 321-324.

Barsuk, J. H., McGaghie, W. C., Cohen, E. R., O'Leary, K. J., & Wayne, D. B. (2009). Simulation-based mastery learning reduces complications during central venous catheter insertion in a medical intensive care unit. *Critical Care Medicine, 37*(10), 2697-2701. doi:10.1097/CCM.0b013e3181a57bc1

Batchelder, A. J., Steel, A., Mackenzie, R., Hormis, A. P., Daniels, T. S., & Holding, N. (2009). Simulation as a tool to improve the safety of pre-hospital anaesthesia - A pilot study. *Anaesthesia, 64*(9), 978-983. doi:10.1111/j.1365-2044.2009.05990.x

Berkenstadt, H., Ziv, A., Barsuk, D., Levine, I., Cohen, A., & Vardi, A. (2003). The use of advanced simulation in the training of anesthesiologists to treat chemical warfare casualties. *Anesthesia and Analgesia, 96*(6), 1739-1742. doi:10.1213/01.ane.0000057027.52664.0b

Birch, L., Jones, N., Doyle, P. M., Green, P., McLaughlin, A., Champney, C., et al. (2007). Obstetric skills drills: Evaluation of teaching methods. *Nurse Education Today, 27*(8), 915-922. doi:10.1016/j.nedt.2007.01.006

Black, S. A., Nestel, D. F., Kneebone, R. L., & Wolfe, J. H. N. (2010). Assessment of surgical competence at carotid endarterectomy under local anaesthesia in a simulated operating theatre. *British Journal of Surgery, 97*(4), 511-516. doi:10.1002/bjs.6938

Blackstock, F. C., & Jull, G. A. (2007). High-fidelity patient simulation in physiotherapy education. *Australian Journal of Physiotherapy, 53*(1), 2 - 5.

Bond, W. F., Lammers, R. L., Spillane, L. L., Smith-Coggins, R., Fernandez, R., Reznek, M. A., et al. (2007). The use of simulation in emergency medicine: A research agenda. *Academic Emergency Medicine, 14*(4), 353-363. doi:10.1197/j.aem.2006.11.021

Boud, D., & Walker, D. (1998). Promoting reflection in professional courses: The challenge of context. *Studies in Higher Education, 23*(2), 191-206.

Bradley, P. (2006). The history of simulation in medical education and possible future directions. *Medical Education, 40*(3), 254-262. doi:10.1111/j.1365-2929.2006.02394.x

Britt, R. C., Novosel, T. J., Britt, L. D., & Sullivan, M. (2009). The impact of central line simulation before the ICU experience. *American Journal of Surgery, 197*(4), 533-536. doi:10.1016/j.amjsurg.2008.11.016

Burlacu, C. L., & Chin, C. (2008). Effect of pediatric simulation training on candidate's confidence. *Pediatric Anesthesia, 18*(6), 566-567. doi:10.1111/j.1460-9592.2008.02466.x

Buzink, S. N., Goossens, R. H. M., De Ridder, H., & Jakimowicz, J. J. (2010). Training of basic laparoscopy skills on SimSurgery SEP. *Minimally Invasive Therapy & Allied Technologies, 19*(1), 35-41. doi:10.3109/13645700903384468

Calaman, S., McGregor, R. S., & Spector, N. D. (2010). How can we assure procedural competence in pediatric residents in an era of diminishing opportunities? The answer is simulation-based training. *Journal of Pediatrics, 156*(6), 865-U824. doi:10.1016/j.jpeds.2010.02.058

Campbell, D. M., Barozzino, T., Farrugia, M., & Sgro, M. (2009). High-fidelity simulation in neonatal resuscitation. *Paediatrics & Child Health, 14*(1), 19-23.

Carr, J., Jones, M., & Higgs, J. (1999). Learning reasoning in physiotherapy programs. In J. Higgs & M. Jones (Eds.), *Clinical reasoning in the health professions* (2nd ed.). Woburn, MA: Butterworth-Heinemann.

Carroll, J. D., & Messenger, J. C. (2008). Medical simulation - The new tool for training and skill assessment. *Perspectives in Biology and Medicine, 51*(1), 47-60.

Cheng, A., Duff, J., Grant, E., Kissoon, N., & Grant, V. J. (2007). Simulation in paediatrics: An educational revolution. *Paediatrics & Child Health, 12*(6), 465-468.

Cherry, R. A., & Ali, J. (2008). Current concepts in simulation-based trauma education . *Journal of Trauma-Injury Infection and Critical Care, 65*(5), 1186-1193. doi:10.1097/TA.0b013e318170a75e

Crabtree, N. A., Chandra, D. B., Weiss, I. D., Joo, H. S., & Naik, V. N. (2008). Fibreoptic airway training: Correlation of simulator performance and clinical skill. *Canadian Journal of Anaesthesia, 55*(2), 100-104.

Davoudi, M., & Colt, H. G. (2009). Bronchoscopy simulation: A brief review. *Advances in Health Sciences Education, 14*(2), 287-296. doi:10.1007/s10459-007-9095-x

Day, T., Iles, N., & Griffiths, P. (2009). Effect of performance feedback on tracheal suctioning knowledge and skills: Randomized controlled trial. *Journal of Advanced Nursing, 65*(7), 1423-1431. doi:10.1111/j.1365-2648.2009.04997.x

Decker, C., & Rall, M. (2000). Simulation in anaesthesia: A step towards improved patient safety. *Minimally Invasive Therapy & Allied Technologies, 9*(5), 325-332.

Delany, C., & Bragge, P. (2009). A study of physiotherapy students' and clinical educators' perceptions of learning and teaching. *Medical Teacher, 31*(9), e402-e411.

Dickens, V., Ali, F., Gent, H., & Rees, A. (2003). Assessment and diagnosis of knee injuries: The value of an experienced physiotherapist. *Physiotherapy, 89*(7), 417-422.

Eppich, W. J., Adler, M. D., & McGaghie, W. C. (2006). Emergency and critical care pediatrics: use of medical simulation for training in acute pediatric emergencies. *Current Opinion in Pediatrics, 18*(3), 266-271.

Farnsworth, S. T., Egan, T. D., Johnson, S. E., & Westenskow, D. (2000). Teaching sedation and analgesia with simulation. *Journal of Clinical Monitoring and Computing, 16*(4), 273-285.

Fernandez, R., Vozenilek, J. A., Hegarty, C. B., Motola, I., Reznek, M., Phrampus, P. E., et al. (2008). Developing expert medical teams: Toward an evidence-based approach. *Academic Emergency Medicine, 15*(11), 1025-1036. doi:10.1111/j.1553-2712.2008.00232.x

Fero, L. J., O'Donnell, J. M., Zullo, T. G., Dabbs, A. D., Kitutu, J., Samosky, J. T., et al. (2010). Critical thinking skills in nursing students: Comparison of simulation-based performance with metrics. *Journal of Advanced Nursing, 66*(10), 2182-2193. doi:10.1111/j.1365-2648.2010.05385.x

Fraser, K., Peets, A., Walker, I., Tworek, J., Paget, M., Wright, B., et al. (2009). The effect of simulator training on clinical skills acquisition, retention and transfer. *Medical Education, 43*(8), 784-789. doi:10.1111/j.1365-2923.2009.03412.x

Fried, M. P., Sadoughi, B., Gibber, M. J., Jacobs, J. B., Lebowitz, R. A., Ross, D. A., et al. (2010). From virtual reality to the operating room: The endoscopic sinus surgery simulator experiment. *Otolaryngology-Head and Neck Surgery, 142*(2), 202-207. doi:10.1016/j.otohns.2009.11.023

Fuhrmann, L., Ostergaard, D., Lippert, A., & Perner, A. (2009). A multi-professional full-scale simulation course in the recognition and management of deteriorating hospital patients. *Resuscitation, 80*(6), 669-673. doi:10.1016/j.resuscitation.2009.03.013

Garden, A., Robinson, B., Weller, J., Wilson, L., & Crone, D. (2002). Education to address medical error - A role for high fidelity patient simulation. *New Zealand Medical Journal, 115*(1150), 133-134.

Gardner, R., & Raemer, D. B. (2008). Simulation in obstetrics and gynecology. *Obstetrics and Gynecology Clinics of North America, 35*(1), 97-127. doi:10.1016/j.ogc.2007.12.008

Gordon, M. (1992). Self-assessment programs and their implications for health professions training. *Academic Medicine, 67*(10), 672-679.

Guhde, J. (2010). Combining simulation, instructor-produced videos, and online discussions to stimulate critical thinking in nursing students. *Cin-Computers Informatics Nursing, 28*(5), 274-279. doi:10.1097/NCN.0b013e3181ec2540

Guimond, M. E., & Salas, E. (2009). Linking the science of training to nursing simulation. *Nurse Educator, 34*(3), 105-106.

Hammond, J., Bermann, M., Chen, B., & Kushins, L. (2002). Incorporation of a computerized human patient simulator in critical care training: A preliminary report. *Journal of Trauma-Injury Infection and Critical Care, 53*(6), 1064-1067. doi:10.1097/01.ta.0000028886.68760.3c

Higgins, G. A., Merrill, G. L., Hettinger, L. J., Kaufmann, C. R., Champion, H. R., & Satava, R. M. (1997). New simulation technologies for surgical training and certification current status and future projections. *Teleoperators and Virtual Environments, 6*(2), 160-172.

Higgs, J. (1997). Learning to make clinical decisions. In L. McAllister, M. Lincoln, S. McLeod & D. Maloney (Eds.), *Facilitating learning in clinical settings* Cheltenham, UK: Stanley Thornes (Publishers) Ltd.

Higgs, J., & Edwards, H. (1999). *Educating beginning practitioners: Challenges for health professional education*. Woburn, MA: Butterworth-Heinemann.

Holzman, R. S., Cooper, J. B., Gaba, D. M., Philip, J. H., Small, S. D., & Feinstein, D. (1995). Anesthesia crisis resource management: Real-life simulation training in operating room crises. *Journal of Clinical Anesthesia, 7*(8), 675-687.

Jones, A., & Sheppard, L. (2007). Can human patient simulators be used in physiotherapy education? *The Internet Journal of Allied Health Sciences and Practice, 5*(2), 1-5.

Jones, A., & Sheppard, L. (2008). Physiotherapy education: A proposed evidence-based model. *Advances in Physiotherapy, 10*, 9-13. doi:10.1080/14038190701470250

Jones, M., Jensen, G., & Edwards, I. (1999). Clinical reasoning in physiotherapy. In J. Higgs & M. Jones (Eds.), *Clinical reasoning in the health professions* (2nd ed.). Woburn, MA: Butterworth-Heinemann.

Kabanza, F., Bisson, G., Charneau, A., & Jang, T. S. (2006). Implementing tutoring strategies into a patient simulator for clinical reasoning learning. *Artificial Intelligence in Medicine, 38*(1), 79-96. doi:10.1016/j.artmed.2006.01.003

Kaji, A. H., Bair, A., Okuda, Y., Kobayashi, L., Khare, R., & Vozenilek, J. (2008). Defining systems expertise: Effective simulation at the organizational level-implications for patient safety, disaster surge capacity, and facilitating the systems interface. *Academic Emergency Medicine, 15*(11), 1098-1103. doi:10.1111/j.1553-2712.2008.00209.x

Kim, J., Neilipovitz, D., Cardinal, P., Chiu, M., & Clinch, J. (2006). A pilot study using high-fidelity simulation to formally evaluate performance in the resuscitation of critically ill patients: The University of Ottawa Critical Care Medicine, High-Fidelity Simulation, and Crisis Resource Management I Study. *Critical Care Medicine, 34*(8), 2167-2174. doi:10.1097/01.ccm.0000229877.45125.cc

Kneebone, R. L. (2003). Simulation in surgical training: Educational issues and practical implications. *Medical Education, 37*(3), 267-277.

Kneebone, R. L., Nestel, D., Vincent, C., & Darzi, A. (2007). Complexity, risk and simulation in learning procedural skills. *Medical Education, 41*(8), 808-814. doi:10.1111/j.1365-2923.2007.02799.x

Kneebone, R. L., Scott, W., Darzi, A., & Horrocks, M. (2004). Simulation and clinical practice: Strengthening the relationship. *Medical Education, 38*(10), 1095-1102. doi:10.1111/j.1365-2929.2004.01959.x

Kory, P. D., Eisen, L. A., Adachi, M., Ribaudo, V. A., Rosenthal, M. E., & Mayo, P. H. (2007). Initial airway management skills of senior residents - Simulation training compared with traditional training. *Chest, 132*(6), 1927-1931.

Kurrek, M. M., & Fish, K. J. (1996). Anaesthesia crisis resource management training: An intimidating concept, a rewarding experience. *Canadian Journal of Anaesthesia-Journal Canadien D Anesthesie, 43*(5), 430-434.

Laack, T. A., Newman, J. S., Goyal, D. G., & Torsher, L. C. (2010). A 1-week simulated internship course helps prepare medical students for transition to residency. *Simulation in Healthcare, 5*(3), 127-132. doi:10.1097/SIH.0b013e3181cd0679

Ladyshewsky, R., & Gardner, P. (2008). Peer assisted learning and blogging: A strategy to promote reflective practice during clinical fieldwork. *Australasian Journal of Educational Technology, 24*(3), 241-257.

Lammers, R. L. (2008). Learning and retention rates after training in posterior epistaxis management. *Academic Emergency Medicine, 15*(11), 1181-1189. doi:10.1111/j.1553-2712.2008.00220.x

Lasater, K. (2007). High-fidelity simulation and the development of clinical judgment: Students' experiences. *Journal of Nursing Education, 46*(6), 269-276.

Lasko, D., Zamakhshary, M., & Gerstle, J. T. (2009). Perception and use of minimal access surgery simulators in pediatric surgery training programs . *Journal of Pediatric Surgery, 44*(5), 1009-1012. doi:10.1016/j.jpedsurg.2009.01.040

Lerner, S., Magrane, D., & Friedman, E. (2009). Teaching teamwork in medical education. *Mount Sinai Journal of Medicine, 76*(4), 318-329. doi:10.1002/msj.20129

Lierman, B. (1994). How to develop a training simulation. *Training & Development, 48*(2), 50-52.

Lincoln, M., Stockhausen, L., & Maloney, D. (1997). Learning processes in clinical education. In L. McAllister, M. Lincoln, S. McLeod & D. Maloney (Eds.), *Facilitating learning in clinical settings*. Cheltenham, UK: Stanley Thornes (Publishers) Ltd.

Lo, T. Y. M., Morrison, R., Atkins, K., & Reynolds, F. (2009). Novel manikin for chest re-opening simulation training. *Intensive Care Medicine, 35*(6), 1143-1144. doi:10.1007/s00134-008-1391-2

MacDonald, J., Williams, R. G., & Rogers, D. A. (2003). Self-assessment in simulation-based surgical skills training. *American Journal of Surgery, 185*(4), 319-322. doi:10.1016/s0002-9610(02)01420-4

Maran, N. J., & Glavin, R. J. (2003). Low- to high-fidelity simulation - A continuum of medical education? *Medical Education, 37*, 22-28.

Mayo, P. H., Hackney, J. E., Mueck, J. T., Ribaudo, V., & Schneider, R. F. (2004). Achieving house staff competence in emergency airway management: Results of a teaching program using a computerized patient simulator. *Critical Care Medicine, 32*(12), 2422-2427. doi:10.1097/01.ccm.0000147768.42813.a2

McGaghie, W. C., Issenberg, S. B., Petrusa, E. R., & Scalese, R. J. (2010). A critical review of simulation-based medical education research: 2003-2009. *Medical Education, 44*(1), 50-63. doi:10.1111/j.1365-2923.2009.03547.x

McIvor, W. R. (2004). Experience with medical student simulation education. *Critical Care Medicine, 32*(2), S66-S69. doi:10.1097/01.ccm.0000110737.83477.0f

McLaughlin, S., Fitch, M. T., Goyal, D. G., Hayden, E., Kauh, C. Y., Laack, T. A., et al. (2008). Simulation in graduate medical education 2008: A review for emergency medicine. *Academic Emergency Medicine, 15*(11), 1117-1129. doi:10.1111/j.1553-2712.2008.00188.x

Moorthy, K., Munz, Y., Adams, S., Pandey, V., & Darzi, A. (2006). Self-assessment of performance among surgical trainees during simulated procedures in a simulated operating theater. *American Journal of Surgery, 192*(1), 114-118. doi:10.1016/j.amjsurg.2005.09.017

Moorthy, K., Munz, Y., Forrest, D., Pandey, V., Undre, S., Vincent, C., et al. (2006). Surgical crisis management skills training and assessment - A stimulation-based approach to enhancing operating room performance. *Annals of Surgery, 244*(1), 139-147. doi:10.1097/01.sla.0000217618.30744.61

Murray, D. (2006). Clinical skills in acute care: A role for simulation training. *Critical Care Medicine, 34*(1), 252-253. doi:10.1097/01.ccm.0000191129.02958.82

Murray, D., Boulet, J., Ziv, A., Woodhouse, J., Kras, J., & McAllister, J. (2002). An acute care skills evaluation for graduating medical students: A pilot study using clinical simulation. *Medical Education, 36*(9), 833-841.

Murray, D. J., Boulet, J. R., Kras, J. F., Woodhouse, J. A., Cox, T., & McAllister, J. D. (2004). Acute care skills in anesthesia practice - A simulation-based resident performance assessment. *Anesthesiology, 101*(5), 1084-1095.

Naik, V. N., Matsumoto, E. D., Houston, P. L., Hamstra, S. J., Yeung, R. Y., Mallon, J. S., et al. (2001). Fiberoptic orotracheal intubation on anesthetized patients: Do manipulation skills learned on a simple model transfer into the operating room? *Anesthesiology, 95*, 343-348.

Naylor, R. A., Hollett, L. A., Valentine, M., Mitchell, I. C., Bowling, M. W., Ma, A. M., et al. (2009). Can medical students achieve skills proficiency through simulation training? *American Journal of Surgery, 198*(2), 277-282. doi:10.1016/j.amjsurg.2008.11.036

Neary, M. (2000). *Teaching, assessing and evaluation for clinical competence: A practical guide for practioners and teachers*. Cheltenham, United Kingdom: Stanley Thornes (Publishers) Ltd.

Newbie, D., Norman, G., & Vleuten, C. V. D. (1999). Assessing clinical reasoning. In J. Higgs & M. Jones (Eds.), *Clinical reasoning in health professions* (2nd ed.). Woburn, MA: Butterworth-Heinemann.

Nguyen, H. B., Daniel-Underwood, L., Van Ginkel, C., Wong, M., Lee, D., San Lucas, A., et al. (2009). An educational course including medical simulation for early goal-directed therapy and the severe sepsis resuscitation bundle: An evaluation for medical student training. *Resuscitation, 80*(6), 674-679. doi:10.1016/j.resuscitation.2009.02.021

Niles, D., Sutton, R. M., Donoghue, A., Kalsi, M. S., Roberts, K., Boyle, L., et al. (2009). "Rolling Refreshers": A novel approach to maintain CPR psychomotor skill competence. *Resuscitation, 80*(8), 909-912. doi:10.1016/j.resuscitation.2009.04.021

Nishisaki, A., Hales, R., Biagas, K., Cheifetz, I., Corriveau, C., Garber, N., et al. (2009). A multi-institutional high-fidelity simulation "boot camp" orientation and training program for first year pediatric critical care fellows. *Pediatric Critical Care Medicine, 10*(2), 157-162. doi:10.1097/PCC.0b013e3181956d29

Noll, E., Key, A., & Jensen, G. (2001). Clinical reasoning of an experienced physiotherapist: Insight into clinician decision-making regarding low back pain. *Physiotherapy Research International, 6*(1), 40-51.

Owen, H., Mugford, B., Follows, V., & Plummer, J. L. (2006). Comparison of three simulation-based training methods for management of medical emergencies. *Resuscitation, 71*(2), 204-211. doi:10.1016/j.resuscitation.2006.04.007

Paige, J. T., Kozmenko, V., Yang, T., Gururaja, R. P., Hilton, C. W., Cohn, I., et al. (2009). High-fidelity, simulation-based, interdisciplinary operating room team training at the point of care. *Surgery, 145*(2), 138-146. doi:10.1016/j.surg.2008.09.010

Perkins, G. D. (2007). Simulation in resuscitation training. *Resuscitation, 73*(2), 202-211. doi:10.1016/j.resuscitation.2007.01.005

Perkins, G. D., Hulme, J., & Tweed, M. J. (2001). Variability in the assessment of advanced life support skills. *Resuscitation, 50*(3), 281-286.

Pliego, J. F., Wehbe-Janek, H., Rajab, M. H., Browning, J. L., & Fothergill, R. E. (2008). Ob/Gyn boot camp using high-fidelity human simulators: Enhancing residents' perceived competency, confidence in taking a leadership role, and stress hardiness. *Simulation in Healthcare, 3*, 82–89. doi:10.1097/SIH.0b013e3181658188

Prion, S. (1999). The case study as an instructional method to teach clinical reasoning. In J. Higgs & M. Jones (Eds.), *Clinical reasoning in the health professions* (2nd ed.). Woburn, MA: Butterworth-Heinemann.

Robertson, B., Schumacher, L., Gosman, G., Kanfer, R., Kelley, M., & DeVita, M. (2009). Simulation-based crisis team training for multidisciplinary obstetric providers. *Simulation in Healthcare, 4*(2), 77–83. doi:10.1097/SIH.0b013e31819171cd

Rodgers, D. L., Securro, S., & Pauley, R. D. (2009). The effect of high-fidelity simulation on educational outcomes in an advanced cardiovascular life support course. *Simulation in Healthcare, 4*(4), 200-206. doi:10.1097/SIH.0b013e3181b1b877

Rosen, J. M., Long, S. A., McGrath, D. M., & Greer, S. E. (2009). Simulation in plastic surgery training and education: The path forward. *Plastic and Reconstructive Surgery, 123*(2), 729-738. doi:10.1097/PRS.0b013e3181958ec4

Rosenthal, M. E., Adachi, M., Ribaudo, V., Mueck, J. T., Schneider, R. F., & Mayo, P. H. (2006). Achieving housestaff competence in emergency airway management using scenario based simulation training - Comparison of attending vs housestaff trainers. *Chest, 129*(6), 1453-1458.

Rothgeb, M. K. (2008). Creating a nursing simulation laboratory: A literature review. *Journal of Nursing Education, 47*(11), 489-494.

Salas, E., & Burke, C. S. (2002). Simulation for training is effective when. *Quality & Safety in Health Care, 11*(2), 119-120.

Sandroni, C., Fenici, P., Cavallaro, F., Bocci, M. G., Scapigliati, A., & Antonelli, M. (2005). Haemodynamic effects of mental stress during cardiac arrest simulation testing on advanced life support courses. *Resuscitation, 66*(1), 39-44. doi:10.1016/j.resuscitation.2004.12.021

Sarker, S. K., & Patel, B. (2007). Simulation and surgical training. *International Journal of Clinical Practice, 61*(12), 2120-2125. doi:10.1111/j.1742-1241.2007.01435.x

Satava, R. M. (2001). Accomplishments and challenges of surgical simulation - Dawning of the next-generation surgical education. *Surgical Endoscopy and Other Interventional Techniques, 15*(3), 232-241. doi:10.1007/s004640000369

Satava, R. M. (2005). Identification and reduction of surgical error using simulation. *Minimally Invasive Therapy & Allied Technologies, 14*(4-5), 257-261. doi:10.1080/13645700500274112

Savoldelli, G. L., Naik, V. N., Hamstra, S. J., & Morgan, P. J. (2005). Barriers to use of simulation-based education. *Canadian Journal of Anaesthesia, 52*(9), 944-950.

Schmidt, R. A., & Wulf, G. (1997). Continuous concurrent feedback degrades skill learning: Implications for training and simulation. *Human Factors, 39*(4), 509-525.

Schwartz, L. R., Fernandez, R., Kouyoumjian, S. R., Jones, K. A., & Compton, S. (2007). A randomized comparison trial of case-based learning versus human patient simulation in medical student education. *Academic Emergency Medicine, 14*(2), 130-137. doi:10.1197/j.aem.2006.09.052

Scott, D. J., Cendan, J. C., Pugh, C. M., Minter, R. M., Dunnington, G. L., & Kozar, R. A. (2008). The changing face of surgical education: Simulation as the new paradigm. *Journal of Surgical Research, 147*(2), 189-193. doi:10.1016/j.jss.2008.02.014

Seropian, M. A., Brown, K., Gavilanes, J. S., & Driggers, B. (2004). An approach to simulation program development. *Journal of Nursing Education, 43*(4), 170-174.

Shapiro, M. J., Gardner, R., Godwin, S. A., Jay, G. D., Lindquist, D. G., Salisbury, M. L., et al. (2008). Defining team performance for simulation-based training: Methodology, metrics, and opportunities for emergency medicine. *Academic Emergency Medicine, 15*(11), 1088-1097. doi:10.1111/j.1553-2712.2008.00251.x

Small, S. D., Wuerz, R. C., Simon, R., Shapiro, N., Conn, A., & Setnik, G. (1999). Demonstration of high-fidelity simulation team training for emergency medicine. *Academic Emergency Medicine, 6*(4), 312-323.

Sperlazza, E., & Cangelosi, P. R. (2009). The power of pretend using simulation to teach end-of-life care. *Nurse Educator, 34*(6), 276-280.

Steadman, R. H., Coates, W. C., Huang, Y. M., Matevosian, R., Larmon, B. R., McCullough, L., et al. (2006). Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills. *Critical Care Medicine, 34*(1), 151-157. doi:10.1097/01.ccm.0000190619.42013.94

Stringer, K. R., Bajenov, S., & Yentis, S. M. (2002). Training in airway management. *Anaesthesia, 57*(10), 967-983.

Summer, L., Gonzalez, L., Jimeno, M., & Christensen, K. (2009). Development of a nasogastric tube insertion simulator: A collaborative interdisciplinary effort. *Computers, Informatics, Nursing, 27*(2), 105-113.

Thomas, S., Goughb, S., Broad, M., Cross, J., Harden, B., Ritson, P., et al. (2008). On-call competence: Developing a tool for self-assessment. *Physiotherapy, 94*, 204–211. doi:10.1016/j.physio.2008.02.006

Ti, L. K., Tan, G. M., Khoo, S., & Chen, F. G. (2006). The impact of experiential learning on NUS medical students: Our experience with task trainers and human-patient simulation. *Annals Academy of Medicine Singapore, 35*(9), 619-623.

Tsai, T. C., Harasym, P. H., Nijssen-Jordan, C., Jennett, P., & Powell, G. (2003). The quality of a simulation examination using a high-fidelity child manikin. *Medical Education, 37*, 72-78.

Tsuda, S., Scott, D., Doyle, J., & Jones, D. B. (2009). Surgical Skills Training and Simulation. *Current Problems in Surgery, 46*(4), 271-370. doi:10.1067/j.cpsurg.2008.12.003

Undre, S., Koutantji, M., Sevdalis, N., Gautama, S., Selvapatt, N., Williams, S., et al. (2007). Multidisciplinary crisis simulations: The way forward for training surgical teams. *World Journal of Surgery, 31*(9), 1843-1853. doi:10.1007/s00268-007-9128-x

von Wyl, T., Zuercher, M., Amsler, F., Walter, B., & Ummenhofer, W. (2009). Technical and non-technical skills can be reliably assessed during paramedic simulation training. *Acta Anaesthesiologica Scandinavica, 53*(1), 121-127. doi:10.1111/j.1399-6576.2008.01797.x

Wallin, C. J., Meurling, L., Hedman, L., Hedegard, J., & Fellannder-Tsai, L. (2007). Target-focused medical emergency team training using a human patient simulator: effects on behaviour and attitude. *Medical Education, 41*(2), 173-180. doi:10.1111/j.1365-2929.2006.02670.x

Wang, E. E., Beaumont, J., Kharasch, M., & Vozenilek, J. A. (2008). Resident response to integration of simulation-based education into emergency medicine conference. *Academic Emergency Medicine, 15*(11), 1207-1210. doi:10.1111/j.1553-2712.2008.00208.x

Wang, E. E., Quinones, J., Fitch, M. T., Dooley-Hash, S., Griswold-Theodorson, S., Medzon, R., et al. (2008). Developing technical expertise in emergency medicine - The role of simulation in procedural skill acquisition. *Academic Emergency Medicine, 15*(11), 1046-1057. doi:10.1111/j.1553-2712.2008.00218.x

Watterson, L., Flanagan, B., Donovan, B., & Robinson, B. (2000). Anaesthetic simulators: Training for the broader health-care profession. *Australian and New Zealand Journal of Surgery, 70*(10), 735-737.

Welke, T. M., LeBlanc, V. R., Savoldelli, G. L., Joo, H. S., Chandra, D. B., Crabtree, N. A., et al. (2009). Personalized oral debriefing versus standardized multimedia instruction after patient crisis simulation . *Anesthesia and Analgesia, 109*(1), 183-189. doi:10.1213/ane.0b013e3181a324ab

Weller, J. M., Wilson, L., & Robinson, B. (2003). Survey of change in practice following simulation-based training in crisis management. *Anaesthesia, 58*(5), 471-473.

Wenk, M., Waurick, R., Schotes, D., Wenk, M., Gerdes, C., Van Aken, H. K., et al. (2009). Simulation-based medical education is no better than problem-based discussions and induces misjudgment in self-assessment. *Advances in Health Science Education, 14*, 159–171. doi:10.1007/s10459-008-9098-2

Westberg, J., & Jason, H. (2001). *Fostering reflection and providing feedback: Helping others learn from experience* New York, NY: Springer Publishing Company.

Wilkerson, W., Avstreih, D., Gruppen, L., Beier, K. P., & Woolliscroft, J. (2008). Using immersive simulation for training first responders for mass casualty incidents. *Academic Emergency Medicine, 15*(11), 1152-1159. doi:10.1111/j.1553-2712.2008.00223.x

Wong, N. (2005). Medical education in critical care. *Journal of Critical Care, 20*(3), 270-273. doi:10.1016/j.jcrc.2005.08.001

Young, J. S., Stokes, J. B., Denlinger, C. E., & Dubose, J. E. (2007). Proactive versus reactive: the effect of experience on performance in a critical care simulator. *American Journal of Surgery, 193*(1), 100-104. doi:10.1016/j.amjsurg.2006.08.066

Zausig, Y. A., Grube, C., Boeker-Blum, T., Busch, C. J., Bayer, Y., Sinner, B., et al. (2009). Inefficacy of simulator-based training on anaesthesiologists' non-technical skills. *Acta Anaesthesiologica Scandinavica, 53*(5), 611-619. doi:10.1111/j.1399-6576.2009.01946.x

Zirkle, M., Blum, R., Raemer, D. B., Healy, G., & Roberson, D. W. (2005). Teaching emergency airway management using medical simulation: A pilot program. *Laryngoscope, 115*(3), 495-500. doi:10.1097/01.mlg.0000157834.69121.b1

Ziv, A., Ben-David, S., & Ziv, M. (2005). Simulation based medical education: An opportunity to learn from errors. *Medical Teacher, 27*(3), 193-199. doi:10.1080/01421590500126718

Ziv, A., Small, S. D., & Wolpe, P. R. (2000). Patient safety and simulation-based medical education. *Medical Teacher, 22*(5), 489-495.

Ziv, A., Wolpe, P. R., Small, S. D., & Glick, S. (2003). Simulation-based medical education: An ethical imperative. *Academic Medicine, 78*(8), 783-788.

12 APPENDICES

Appendix 1: Objectives of simulation case study 1 (Patient A) and 2 (Patient B)

OBJECTIVES OF SIMULATION CASE 1 (Patient A):

1) ***To be able to obtain the following important history from the patient and case notes and evaluate them in the following pattern***

Information from the case notes	*Interpretation by the participants*
Patient was admitted for 2 days of shortness of breath and had increasing amount of sputum	There is a possible acute bout of respiratory infection that is increasing in severity (Wilkins, Dexter, & Gold, 2007)
Patient presented with chest pain that increases on breathing	There might be pleuritic pain but there is a need to rule out a possible cardiac event (Wilkins, Dexter, & Heuer, 2010)
Patient has crackles heard over upper lobes	The findings might be a contribution from either the presence of COPD (emphysema) or secretions but it is not clear as the timing of the added sounds are not defined (Wilkins, et al., 2010)
Patient has expiratory wheezes	There is narrowing of the airways present which indicates partial airway closure that can result from bronchospasm, mucosal edema or excessive airway secretions (Wilkins, et al., 2007; Wilkins, et al., 2010) and these are commonly present during acute COPD exacerbations (Wilkins, et al., 2007)
Patient has elevated blood pressure and heart rate	The blood pressure values might be normal as the patient has hypertension. However, it is more likely that the higher metabolism rate due to the respiratory infection and fever leads to the elevated heart rate, which leads to a corresponding increase in blood pressure (Wilkins, et al., 2007; Wilkins, et al., 2010)
Patient has low SpO2 and an increase in respiratory rate	The increase in respiratory rate might be in response to hypoxemia(Wilkins, et al., 2007) as the patient needs to maintain adequate oxygenation. The oxygen transport deficits can be due to 1) Airway obstruction due to bronchospasm or excessive secretions 2) Lungs – ineffective breathing pattern due to COPD or ineffective airway clearance due to combination of factors like airway infection, smoking history , ineffective cough and retained secretions 3) Poor gaseous exchange due to shallow breathing and tenacious secretions , consolidation or collapse (Dean & Frownfelter, 1996)
Patient was an ex smoker with 40 pack years history	Smoking has a close relationship with chronic pulmonary diseases, respiratory infections, lung cancer and cardiovascular diseases (Wilkins, et al., 2010). Generally a smoking history greater than 20 pack years is required before symptoms of dyspnea and COPD begin to occur (Wilkins, et al., 2007)

Based on the patient's previous ABG, to note that the patient depends on his hypoxic drive to breathe	If the treatment requires the PT to increase the oxygen supplied to the patient, high levels of oxygen should not be given as it can decrease the patient's respiratory drive
Treatment ordered was 4L of O2 via nasal prongs and to keep SpO2 between 88 to 92%	To note treatment orders
Patient is currently deteriorating: Case notes documents that patient was initially able to ambulate short distance at 12am but complained of weakness and had disorientation	Acute, severe hypoxemia and hypercapnia can change the patient's level of consciousness or can be caused by low levels of potassium as a result of vomiting (Wilkins, et al., 2010).
Patient's blood pressure and heart rate was high with low SpO2 at 7am	Interventions such as manual techniques and suctioning are used if more physiological interventions do not produce the desired results or if the interventions cannot be applied as necessary to effect the response desired (Dean & Frownfelter, 1996) Due to the high blood pressure and heart rate, active exercises may lead to an increase for oxygen demand resulting in over exertion and thus, should not be undertaken now. The patient's vital signs must be reassessed to see if the patient is suitable for PT treatment and should be monitored throughout the entire treatment period. The PT techniques should not cause a significant rise in heart rate or blood pressure. The SpO2 (saturation) has decreased despite prior oxygen prescription. This might be due to acute excessive secretion retention that might be a result of probably an increase in severity of the infection or change in the thickness of the sputum or the patient having more shallow breaths as a consequence of diaphragmatic fatigue due to Chronic Obstructive Pulmonary Disease (COPD).
Respiratory team's recommendations "Crackles heard all over, non productive chesty cough. Stat normal saline nebs, up to Venturi Mask 35%, chest PT and mobilisation"	The patient's condition seems to have worsened as the crackles are heard all over now. The doctors also noted that the patient is unable to expectorate sputum. Mobilisation would not be a suitable treatment technique now. Normal saline nebulisers would help to loosen secretions. The thick secretions cause secretion retention leading to decrease in SpO2. This results in compensatory increase in respiratory rate and the sensation of shortness of breath that the patient complains of. This hypoxemia can lead to Arterial Blood Gas (ABG) changes and then result in changes to the patient's cognitive status. Due to the respiratory distress, the patient's heart rate and blood pressure rises. Hypoxemia can lead to hypoxia of the heart which causes dysrhythmias and poor contractility (Wilkins, et al., 2010). Initial treatment for hypoxemia is elevation of FiO2 which corrects hypoxemia associated with V/Q mismatch or hypoventilation (Wilkins, et al., 2010). The Fraction of

	Inspired Oxygen (FiO2) might been increased from 30% to 35% (West, 2008) but current oxygen therapy guarantees 35% FiO2 unlike using NP(Hough, 1996) .

2) ***<u>To evaluate the findings from the following cardiovascular system review as well as the tests and measures to make clinical judgements</u>***

Vital signs chart	Due to the high blood pressure and heart rate, active exercises may lead to over exertion and should not be undertaken now. The patient's vital signs must be reassessed to see if the patient is suitable for PT treatment and should be monitored throughout the entire treatment period. The PT techniques should not cause a significant rise in heart rate or blood pressure.
ABG	Deduce that the patient has uncompensated respiratory acidosis with hypoxemia (Wilkins, et al., 2010). However, the patient's carbon dioxide and oxygen levels might be normal as the patient has COPD (Wilkins, et al., 2007). Oxygenation is useful when hypoxemia is present but it does not help if the resting PaO2 is greater than 60 mmHg (Wilkins, et al., 2007). The changes in ABG can explain the patient's disorientation. Hypoxemia can lead to hypoxia of the heart which causes dysrhythmias and poor contractility.
FBC	To note that K+ (potassium) and Na+ (sodium) values are normal. Low or high K+ can lead to abnormalities of heart rhythm while low Na+ can lead to abnormal sensorium and seizures (Wilkins, et al., 2010). The patient's vital signs including heart regularity needs to be checked regularly if there are any abnormalities present. With any abnormalities present, PT treatments that affect HR like suctioning or percussion have to undertaken with precaution. Note that cardiac enzymes are normal which indicates that the patient did not experience a cardiac event. White blood cells are high which confirms that the patient is having a respiratory infection (Wilkins, et al., 2010)and this respiratory infection might be causing an acute on chronic COPD exacerbation
CXR	No abnormalities detected with no focal consolidation but the PT must note that the X-ray was taken at admission and hence it can change within the few hours

3) ***To perform primarily a cardiovascular systems review and examine the patient using the following instruments or tests***

Use of the Blood Pressure, Pulse Oximetry and Heart Rate monitors	To measure the patient's blood pressure (BP), heart rate (HR), SpO2 and regularity of the heart rate
Use of observation and palpation	To note the patient's respiratory rate, breathing pattern, use of accessory muscles of inspiration, chest shape and chest expansion
Use of the stethoscope	To assess the pulmonary signs of ventilation or pulmonary symptoms via the breath sounds or presence of added sounds
Use of cough assessment	To determine the patient's ability to successfully expectorate sputum to reduce sputum retention

4) ***To evaluate the findings from the cardiovascular systems review to make clinical judgements and formulate a diagnosis with clinical reasoning***

Vital signs **1)** BP: 140/97 **2)** HR : 110 **3)** SpO2: 88% on 6L of O2 via Venturi mask **4)** RR :40	Although there has been a drop in BP, but it is still high. Any physiotherapy treatment intervention that can increase BP or HR should not be taken. There has been no significant increase in SpO2 despite increasing FiO2 which indicates that the hypoxemia is probably not due to ventilatory failure but oxygenation failure. The PT should recheck the patient's vital signs before treatment and double check if the initial readings are high. The patient's respiratory rate is high and hence treatment that may increase the patient's respiratory rate further should not be taken.
Observation **1)** Patient is drowsy **2)** Decreased chest expansion bibasally **3)** Barrel shaped chest	The patient most likely would not able to cooperate with ACBT or active techniques (Wilkins, et al., 2010). The decreased chest expansion might be due to COPD or possibly consolidation.
Auscultation **1)** Fair breath sounds **2)** Coarse inspiratory and expiratory crackles heard bibasally	Decreased air entry might be normal for a COPD patient. The coarse crackles indicate excessive sputum present but may also be contributed by emphysema (Wilkins, et al., 2007; Wilkins, et al., 2010)
Cough **1)** Weak, moist, non productive	The ineffective cough might cause acute sputum retention. The patient's cough may be weak due to obstruction or collapsibility of the airways in COPD, decrease in lung recoil due to stiff ribs during COPD or changes in quantity or quality of sputum (Wilkins, et al., 2010).

Diagnosis	Acute sputum retention as a result of acute RTI complicated with underlying COPD, weak cough as well as possible thick sputum. The patient's parameters need to be closely monitored throughout the treatment with PT treatment modified to ensure that vital signs do not increase significantly.

5) ***To identify the most appropriate intervention strategies for the patient that is safe, effective and evidence based, while delivering the plan of care with outcomes goals***

Interventions such as manual techniques and suctioning are used selectively when more physiological interventions like upright mobilisation do not produce the desired results or if the interventions cannot be applied as necessary to affect the response desired. Multiple interventions are often indicated to address multiple goals identified in the assessment. The selection of each intervention is based on its indications, determined from the history and assessment and consideration of contraindications and side effects (Dean & Frownfelter, 1996).

Interventions (in order of priority)	*Goal*	*Reason for non-use/use*
Positioning	1) To facilitate airway clearance using gravitational effects	***Use*** To mobilise secretions, remove accumulated secretions, reduce work of breathing and work of the heart, optimise alveolar volume, improve ventilation and decrease shunt
Coughing manoeuvres	1) To facilitate mucociliary clearance with the least effect on dynamic airway compression and adverse cardiovascular effects	***Use but may not be effective*** The patient may not be able to generate a sufficient inspiratory capacity to have an effective cough or diaphragmatic weakness due to drowsiness or poor inspiratory capacity.
Manual techniques	1) To facilitate airway clearance in conjunction with specific body position	***Use with precautions in view of increased oxygen demand on the patient*** To mobilise secretions, remove accumulated secretions
Suctioning	1) To facilitate the removal of airway secretions collected centrally	***Use with precaution*** To aid in secretion removal

Mobilisation and ventilation demand strategies	1) To elicit an exercise stimulus that addresses one of the three effects on the various steps in the oxygen transport pathway or some combination 2) To elicit a gravitational stimulus that simulates being upright and moving as much as possible, that is, active, active assisted or passive 3) To relieve dyspnea	***Non use:*** The patient is in acute respiratory distress, these manoeuvres may over exert the patient due to an increase in need for oxygen, which is dangerous
ROM exercises	1) To stimulate alveolar ventilation and alter its distribution	***Non- use*** The patient is in acute respiratory distress, these manoeuvres may increase the patient's oxygen demand, which is dangerous

(Dean & Frownfelter, 1996)

6) ***<u>To adjust the intervention in response to the patient's status</u>***

If ventilation demand strategies are undertaken resulting in increase in blood pressure or heart rate	The physiotherapist should stop to minimise ill effects of treatment (Dean & Frownfelter, 1996)
If HDT is used	The physiotherapist should recognise that it is causing increasing distress to the patient and vital signs to increase. Some patients benefit from head down position secondary to enhance viscera-diaphragmatic action and caudal displacement of diaphragm but some patients may experience extreme distress in supine or HDT positions (Dean & Frownfelter, 1996). The physiotherapist should stop and modify the position and wait for blood pressure and heart rate to drop before continuing with further treatment.
If the patient's SpO2 levels are low	Increase oxygen by only 1 litre per minute. This low flow is oxygen is necessary as the patient depends on his hypoxic drive to breathe (Dean & Frownfelter, 1996).
If the patient runs into respiratory arrest	The physiotherapist should immediately activate code blue while beginning to administer treatment as per Basic Cardiac Life Support protocol

When performing manual techniques	The physiotherapist should give the patient rest in between based on heart rate changes to minimise ill effects of treatment (Dean & Frownfelter, 1996)
When performing suctioning	The physiotherapist should monitor the patient's parameters, give sufficient rest to the patient and avoid prolong suctioning while providing supplementary oxygen.
On re-evaluation	The physiotherapist should recognise that the patient has post treatment bronchospasm and inform medical team regarding treatment or suggest for patient to use salbutamol inhaler to reduce the ill effects of treatment (Dean & Frownfelter, 1996). The physiotherapist should also reposition the patient in upright position to maximise V/Q matching

7) ***After executing treatment, to re-examine the patient to evaluate the effectiveness of treatment***

Vital signs	The patient's blood pressure and heart rate did not rise significantly which makes the treatment safe. The SpO2 increases which indicates that the treatment is effective in reversing hypoxia and the respiratory rate decreases due to decreased efforts to maintain ventilation.
Observation	The patient reports feeling better and more alert, no change in chest expansion
Auscultation in the same test position	Fair breath sounds (possibly normal for a COPD patient) , the initial crackles heard are no longer present which indicates that the sputum that was causing the patient's distress is gone but only expiratory wheezes heard all over indicates that bronchospasm is present and it might be due to suctioning
Cough	Fair cough is present probably due to the decrease in respiratory rate allowing a better IC, dry indicates that there is no sputum in the upper respiratory tract

OBJECTIVES OF SIMULATION CASE 2 (Patient B)

1) ***To be able to obtain the following important history from the patient and case notes and evaluate them in the following pattern***

Information from case notes	Evaluation of history
Patient dived into the pool but rescued in 10s	There is a possibility of some aspiration pneumonia
Patient was unable to move all 4 limbs	It might be a consequence of spinal shock/ spinal cord injury
Sinus bradycardia and low ABG	The patient is experiencing spinal shock or spinal cord injury with consequential hypoventilation leading to respiratory acidosis
BP and HR did not change despite interventions	This is likely due to spinal shock
Dopamine given (8mg/hr)	Dopamine boosts BP by causing vasoconstriction of the renal arteries.
Patient was sent to SICU post surgery and today is POD 1	This is might possibly be due to a high need of dopamine, intraoperative issues which requires closer monitoring of the patient or because the patient needs ventilation
Smoker	Smoking predisposes the patient to postoperative pulmonary complications
Tear drop fracture of C4	Possible spinal cord injury. The main inspiratory muscles might be slightly affected as the phrenic nerve comes from C3 to C5 but there is a high chance that the patient might have paralysis of the all the intercostals and abdominal muscles which affects cough efforts (Wilkins, et al., 2007). Based on the level of injury, the patient is likely to be quadriplegic but usually retain some use of the respiratory muscles. Vital capacity is markedly reduced immediately after the injury. Pneumonia and atelectasis complicates the care of patients with spinal cord injury because of their inability to breathe deeply and cough effectively (Wilkins, et al., 2007). The lack of effective breathing causes a rapid onset of respiratory acidosis and hypoxemia.
Spinal nursing	The PT is not allowed to move the patient out of the spinal nursing positions

2) ***To evaluate the findings from the following cardiovascular system review as well as the tests and measures to make clinical judgements***

Tests and measures	Clinical judgements
Vital signs ECG: sinus bradycardia temperature 38 SpO2 95% despite FiO2 of 0.5	This patient might still be in spinal shock or have an overactive parasympathetic dominance resulting in the low heart rate, blood pressure. The fever might be indicative of a postoperative infection. The heart rate range stable but low, BP is also low probably as a result of low HR despite the patient being supported by dopamine. Therefore, PT treatment must be closely monitored and any treatment that might cause a decrease in BP or HR must be done with care (Dean & Frownfelter, 1996). The patient may have possible postoperative pneumonia.
Ventilator settings SIMV with 15 set breaths PEEP +10	The setting is as such probably because the patient is hypoventilating. High level of PEEP is currently needed to splint airways open, the PT cannot disconnect the patient from ventilator unless using PEEP valve
Suction Moderate amount of thick whitish sputum and suction was 1 hour ago	Treatment can commence now as it has been 1 hour since the last suction. The patient would probably have sufficient rest since last procedure (Dean & Frownfelter, 1996)
ABG	The patient has partially compensated respiratory acidosis. The initial respiratory acidosis might be due to hypoventilation secondary to spinal shock. With severe weakness of the respiratory muscles, the ABG values demonstrate hypoxemia, an increased PaCO2 (partial pressure of carbon dioxide) and decreased pH. Hypoxemia is common because of V/Q mismatch and the increase in partial pressure of carbon dioxide(Wilkins, et al., 2007).
FBC Borderline Hb	Borderline Hb might imply low blood volume which can affect CVP and blood pressure. This needs to be double checked with CVP readings.
CXR Consolidation of left lower lobe with patchy changes to right middle zone	This might be caused by aspiration pneumonia or postoperative complications due to predisposing smoking factors) this patient needs aggressive CPT but limited by spinal nursing positions

3) ***To perform primarily a cardiovascular systems review and examine the patient using the following instruments or tests***

Instruments	Purpose
Use of the BP/SpO2/HR monitors	To measure the patient's BP, HR, SpO2 and regularity of the HR throughout treatment (Dean & Frownfelter, 1996)
Use of observation and palpation	To note the patient's respiratory rate, breathing pattern, use of accessory muscles of inspiration, chest shape and chest expansion
Use of the stethoscope	To assess the pulmonary signs of ventilation or pulmonary symptoms via the breath sounds or presence of added sounds

4) ***To evaluate the findings from the cardiovascular systems review to make clinical judgements and formulate a diagnosis with clinical reasoning***

Findings	Diagnosis
Vital signs **BP: 93/45, HR: 55, SpO2: 100%**	The patient is currently stable but any physiotherapy treatment should proceed with precaution and not cause significant changes in vital signs
Observation	Patient is in spinal nursing position. Physiotherapy treatment should not deviate from the positions that are allowed which are left, right and supine 30 degrees head up positions
Auscultation **Fair breath sounds, bronchial breath sounds over left lower lobe**	Breath sounds can be reduced when there is airway obstruction. Bronchial breath sounds indicate an increase in lung density as it occurs in pneumonia (Wilkins, et al., 2010). This patient has a consolidation over the left lower lobe, which is the target for treatment
Palpation **Decreased over left basal segment**	Possible consolidation over left lower lobe
Diagnosis	Possible postoperative left lower lobe consolidation secondary to mucous plugging that might be contributed from smoking history or aspiration

5) ***<u>To identify the most appropriate intervention strategies for the patient that is safe, effective and evidence based, while delivering the plan of care with outcomes goals</u>***

Intervention strategies (in order of priority)	***Goal***	***Rationale for use or non use***
Positioning	To facilitate airway clearance using gravitational effects	**Use but within spinal nursing position** 1) Bronchopulmonary segmental drainage positions Effects on alveolar volume of the non dependent lung, alveolar ventilation, perfusion and ventilation and perfusion matching overall and chest wall motion and respiratory mechanics
Manual techniques	To facilitate airway clearance in conjunction with specific body position	**Use but with precautions** 2) Autogenic drainage 3) Manual percussions 1) Shaking and vibrations 2) Deep breathing and coughing
Manual hyperinflation and bagging	To improve alveolar ventilation	**Use but with precautions** **No end inspiratory hold and deep breaths should be between small tidal volume breaths**
Suctioning	Suctioning to clear tracheal, bronchial and oral secretions to maintain clear airways To minimise the adverse effects of airway clearance with suctioning	**Use but with precautions** 1) Closed circuit suctioning
ROM exercises	To stimulate alveolar ventilation and alter its distribution	**Use but with precautions** 1) Passive
Mobilisation and ventilation demand strategies	To elicit an exercise stimulus that addresses one of the three effects on the various steps in the oxygen transport pathway or some combination	**Non-use due to spinal nursing** 3) Acute effects – increased alveolar ventilation, mucociliary transport and airway clearance 4) Long term effects – enhanced oxygen transport efficiency at all steps in the pathway 5) Preventive effects- to counter negative effects of restricted mobility

6) ***To adjust the intervention in response to the patient's status***

Patient's response	Adjustments
When the patient's SpO2 level falls as a result of non use of the Positive End Expiratory Pressure (PEEP) valve	1) Reconnection back to ventilator circuit 2) Bagging with PEEP valve
When the patient's blood pressure and heart rate falls in response to Manual Hyper-Inflation (MHI)	1) Stop MHI and continue with bagging 2) Reconnection back to ventilator circuit if necessary 3) Change wrong technique of MHI
When the patient's heart rate falls in response to vagal nerve stimulation during suctioning	1) Give the patient rest in between and allow heart rate to recover during suctioning 2) Avoid prolong suctioning

7) ***After executing treatment, to re-examine the patient to evaluate the effectiveness of treatment***

Assessments	Effectiveness
Vital signs BP: 93/45, HR: 55, SpO2: 96%	There were no major changes to pre and post treatment vital signs
Observation Increase in left chest expansion	Possibly reopening of the left lower lobe post treatment
Auscultation Fair breath sounds, bronchial breath sounds still heard over left lower lobe	Treatment was probably not effective as the right postural drainage position was not used, suction could not be done too frequently or for long periods of time, MHI techniques would also cause cardiac instabilities. The physiotherapist might suggest for more regular suctioning or to see the patient later after the nurses have placed the patient in the right side lying position for a while. The PT should position the patient in right side lying to optimise Ventilation/Perfusion ratios.

Appendix 2: Script provided to the participants which provided the simulation case study information

Case 1(Patient A):

It is 8am in the morning and you just walked into Ward 44 (Respiratory ward). The nurse in charge of bed 3 comes up to you and informs you that there is a new patient in bed 3 needs Chest PT now because the patient is not doing very well. The respiratory MO comes up to you and mentions that the patient is really chesty but getting quite drowsy, he may not be able to respond to your questions. They have just finished administering normal saline nebulisers to the patient.

(NUH Emergency department doctor's clerking notes)

Demographics

Mr A is a 65 year old Chinese gentleman who presented at ED at 10.55pm for increasing shortness of breath with inability to expectorate sputum.

History of presenting illness

He started feeling short of breath since 7am yesterday and mentioned that he has noticed an increase in the amount of sputum he would usually expectorate over the past week. Mr A attempted to use his salbutamol inhaler to control his shortness of breath but it did not provide any relief. Patient reported a few episodes of vomiting as well as chest pains that increases on breathing.

Assessments at Emergency Department

PEARL

Respiratory: crackles heard over upper lobes, expiratory wheeze

Cough: productive with thick greenish sputum

BP: 134/86, HR : 108, SpO2: 91% RA, RR about 26 per minute, Fever: 38 ^{o}C

Past Medical History

COPD (Stage II/III) and hypertension

Past Social History

Smoker X 40 pack years, stopped 1 year ago. The patient says last admission was 4 months ago because of same problem

Medications

Salbutamol (inhaler), Ventolin (inhaler), Atenolol, Enalapril

Last ABG taken before discharge during previous hospitalisation stay

pH (7.35-7.45)	7.36
pCO2 (35-45mmHg)	48
pO2 (80- 100 mmHg)	50
HCO3- (24-28 mmHg)	28
Base excess (-2 to +2)	+2

Diagnosis given by ED doctor: Acute exacerbation of COPD

Treatment rendered by ED: Nasal prongs 4L, for admission to respiratory ward, call for respiratory medical officer consult, Keep SpO2 between 88-92%

(General Ward clerking notes)

Nurses documentation and notes:

12am: Patient received in Ward 44 and admitted to bed 3. Patient orientated, able to obey commands and is able to ambulate short distance around the bed, compliant to use of nasal prongs. On 6 hourly vital signs parameter monitoring.

3am: Patient did not sleep well; coughing on and off, able to expectorate sputum.

7am: Patient complained of increasing SOB, feeling "weak" and seems slightly disorientated. Parameters assessment: Temperature: 37^{o}C, SpO2: 86% with NP 4L, HR: 113, BP: 150/90. Respiratory team alerted.

Respiratory team review and recommendations:

Crackles heard all over, non productive chesty cough. Stat normal saline nebs, up to Venturi mask 35%, chest PT and mobilisation, ABG, CXR, ECG please

---

(Tests to be clipped to the case notes file)

Time	BP	HR	SpO2	Oxygen therapy
12am	126/85	105	93	Np 4L
6am	150/90	113	86	NP 4L

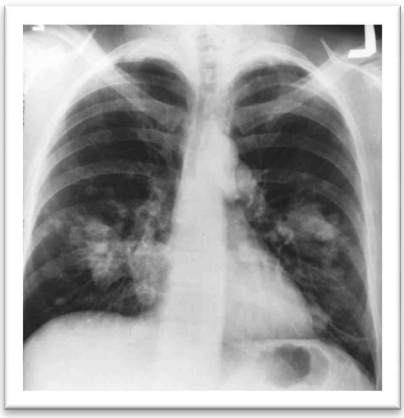
ABG at 7.30am

pH (7.35-7.45)	7.33
pCO2 (35-45mmHg)	50
pO2 (80- 100 mmHg)	50
HCO3- (24-28 mmhg)	28
Base excess (-2 to +2)	+2

FBC: only abnormality is WBC high, K+: 3.5, Na+: 142, Trop T: < 0.03, CKMB: 2.1 [normal values to be stated beside the form]

ECG: Sinus tachycardia

Chest X-ray:



Case 2 (Patient B)

You are on call on a Sunday morning. This is a new admission to the Surgical Intensive Care Unit.

NUH Emergency Department doctor's notes:

History of presenting illness:

Mr B is a 25 year old Indian Male, admitted via ambulance to NUH ED at 8.57pm yesterday. History provided by paramedics and friends. He was drinking with friends at a pool party and dived into the shallow end of the pool. He was unconscious and was rescued by his friends. His friends claimed that patient was rescued within 10 seconds. Patient was unconscious on arrival but recovered consciousness and was noted to not be able to move all 4 limbs. Sinus bradycardia on arrival. IV fluids started and ABG taken. ABG pH was 7.19 and hence patient was intubated. Ortho trauma and Neurosurgery team called in for assessment. Patient noted to be hypotensive despite fluids resus (BP: 90/40) and HR maintained at 50. Dopamine started and after patient stabilised, C-spine X ray taken and noted to have tear drop fracture of C4/5. Op (Anterior approach) done immediately by orthopaedics team and patient was sent to SICU for further management.

Past medical history: Nil of note

Past social history: Smoker (unable to determine further history), construction worker, minimal English

SICU team recommendation: Maintain sedation, watch BP and HR, Chest PT, transfuse 1 pint of blood

Orthopaedics team recommendation: keep hard neck collar, keep spinal nursing for now. As per SICU team recommendations.

Multidisciplinary team notes:

Orthopaedics Medical Officer's notes: Level and extent of spinal cord injury is not known yet. To assess level of spinal cord injury when patient is awake.

Ventilator settings: SIMV FiO2: 0.5, PEEP +10, TV: 0.55L, Rate: 25 (15 delivered breaths)

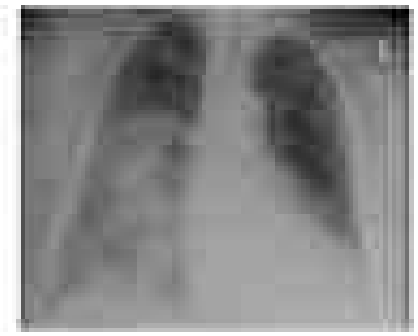
ECG: sinus bradycardia

Temperature: 38^{o}C, HR range between 50 to 60 bpm last 24 hours, BP: 90/40 range, SpO2: 95%, CVP +10

Drugs: Propofol (10ml/hr), Dopamine (8mg/hr)

Last suction: 1 hour ago yielding moderate amount of thick, whitish sputum

Chest X ray: consolidation of Left lower lobe with patchy changes to right middle zone. No rib fractures



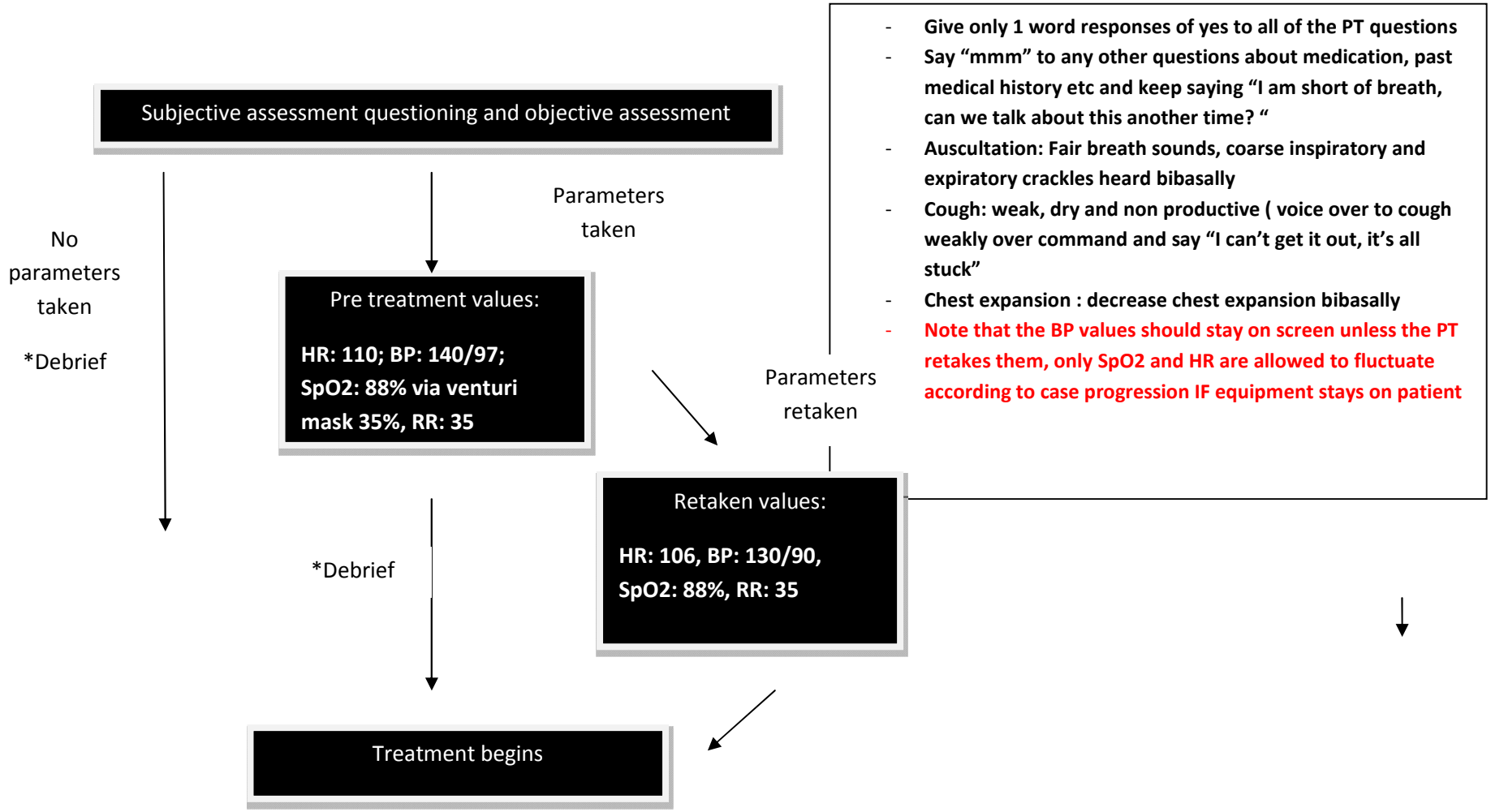
FBC: Hb borderline: 10.7, platelets normal, K and Na normal values [normal values would be provided at the other side]

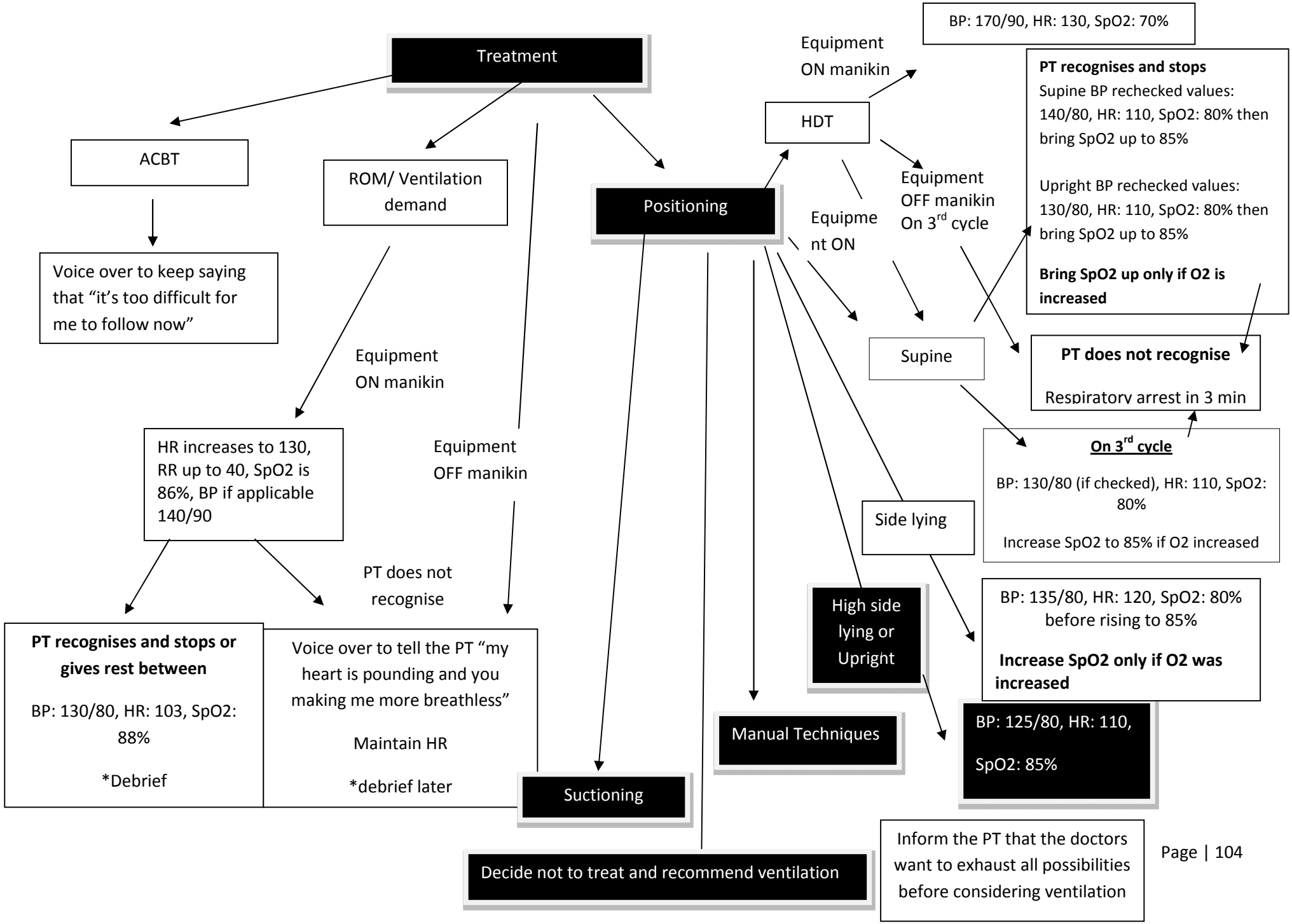
ABG values: pH: 7.32, pCO2: 50, pO2: 120, HCO3-: 30, BE +1

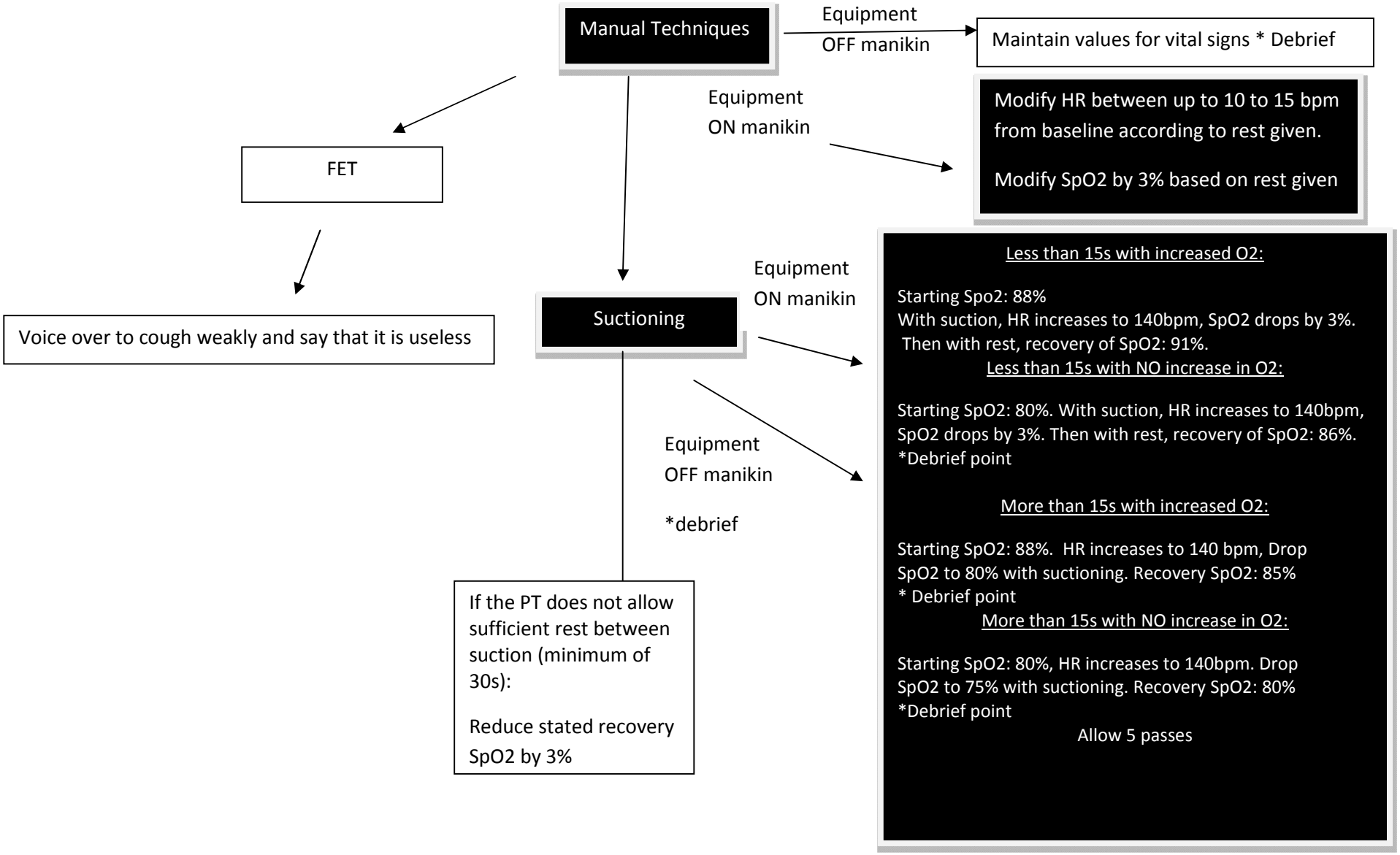
Nurses' documentation: Patient on 2 hourly suctioning yielding moderate amount of thick whitish sputum. Sedated and restrained. Nursing care rendered as necessary. Blood transfusion in progress. No voluntary movement of all 4 limbs noted

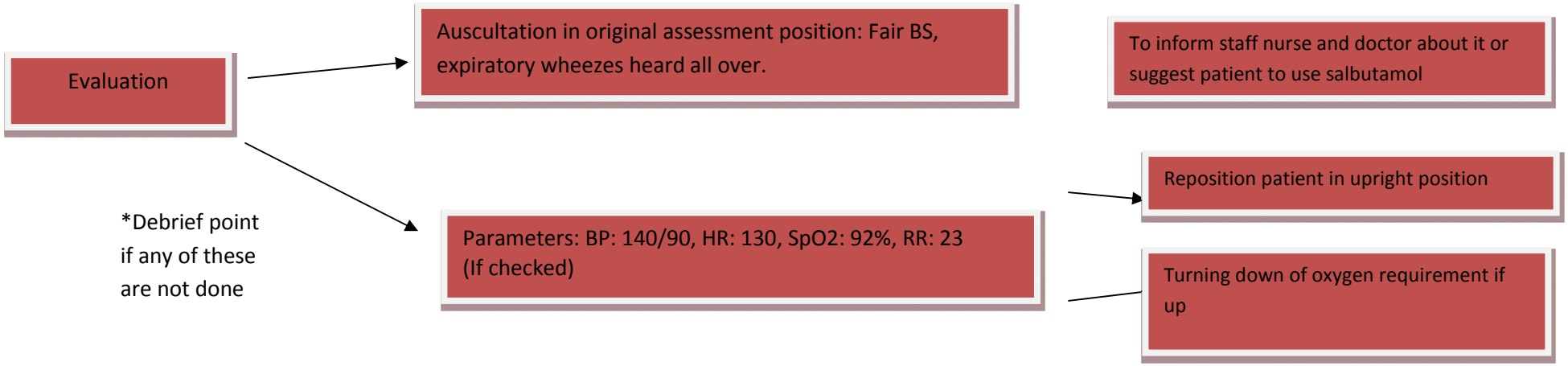
Appendix 3: Simulation case study algorithms

Simulation Process for Case Study 1 (Patient A)




Treatment
ACBT
Voice over to keep saying that "it's too difficult for me to follow now"
ROM/ Ventilation demand
Equipment ON manikin
HR increases to 130, RR up to 40, SpO2 is 86%, BP if applicable 140/90
PT does not recognise
PT recognises and stops or gives rest between
BP: 130/80, HR: 103, SpO2: 88%
*Debrief
Voice over to tell the PT "my heart is pounding and you making me more breathless"
Maintain HR
*debrief later
Equipment OFF manikin
Suctioning
Positioning
HDT
Equipment ON manikin
BP: 170/90, HR: 130, SpO2: 70%
PT recognises and stops
Supine BP rechecked values: 140/80, HR: 110, SpO2: 80% then bring SpO2 up to 85%
Upright BP rechecked values: 130/80, HR: 110, SpO2: 80% then bring SpO2 up to 85%
Bring SpO2 up only if O2 is increased
Equipment OFF manikin On 3rd cycle
Equipment ON
Supine
PT does not recognise
Respiratory arrest in 3 min
On 3rd cycle
BP: 130/80 (if checked), HR: 110, SpO2: 80%
Increase SpO2 to 85% if O2 increased
Side lying
BP: 135/80, HR: 120, SpO2: 80% before rising to 85%
Increase SpO2 only if O2 was increased
High side lying or Upright
BP: 125/80, HR: 110, SpO2: 85%
Manual Techniques
Decide not to treat and recommend ventilation
Inform the PT that the doctors want to exhaust all possibilities before considering ventilation


Manual Techniques
Equipment
OFF manikin
Maintain values for vital signs * Debrief
Equipment
ON manikin
Modify HR between up to 10 to 15 bpm from baseline according to rest given.
Modify SpO2 by 3% based on rest given
FET
Voice over to cough weakly and say that it is useless
Suctioning
Equipment
ON manikin
Less than 15s with increased O2:
Starting Spo2: 88%
With suction, HR increases to 140bpm, SpO2 drops by 3%.
Then with rest, recovery of SpO2: 91%.
Less than 15s with NO increase in O2:
Starting SpO2: 80%. With suction, HR increases to 140bpm, SpO2 drops by 3%. Then with rest, recovery of SpO2: 86%.
*Debrief point
Equipment
OFF manikin
*debrief
More than 15s with increased O2:
Starting SpO2: 88%. HR increases to 140 bpm, Drop SpO2 to 80% with suctioning. Recovery SpO2: 85%
* Debrief point
More than 15s with NO increase in O2:
Starting SpO2: 80%, HR increases to 140bpm. Drop SpO2 to 75% with suctioning. Recovery SpO2: 80%
*Debrief point
Allow 5 passes
If the PT does not allow sufficient rest between suction (minimum of 30s):
Reduce stated recovery SpO2 by 3%



Other expectations from the case study

Suctioning Procedure

1) **Prepare sterile fluid**
2) **Turning on the appropriate pressure of the vacuum (80 to 100mmHg)**
3) **Preparation by connecting the tubes together and ensuring that the circuit is working before treatment begins**
4) **Before performing suctioning, removing the catheter with master hand and controlling vacuum tip with other hand**
5) **Suctioning should be done smoothly and not more than 15 seconds**
6) **Keep parameter monitoring**

Procedure if the patient has a respiratory arrest

1) Recognise that the patient has stopped breathing within **30s**
2) Press Code Blue button or call for external help
3) Lie the patient supine
4) Attempt to arouse the patient
5) Assess airway, breathing and circulation
6) Perform rescue breath X 1
7) Reposition the patient's head and perform rescue breath again
8) Perform suctioning
9) Assess airway, breathing and circulation
10) Perform rescue breaths X 2
11) Commence chest compressions (PT to do 3 cycles)

Voice over to tell the PT

1st assessment of ABC: there is nothing in the airway, no breaths heard, pulse present

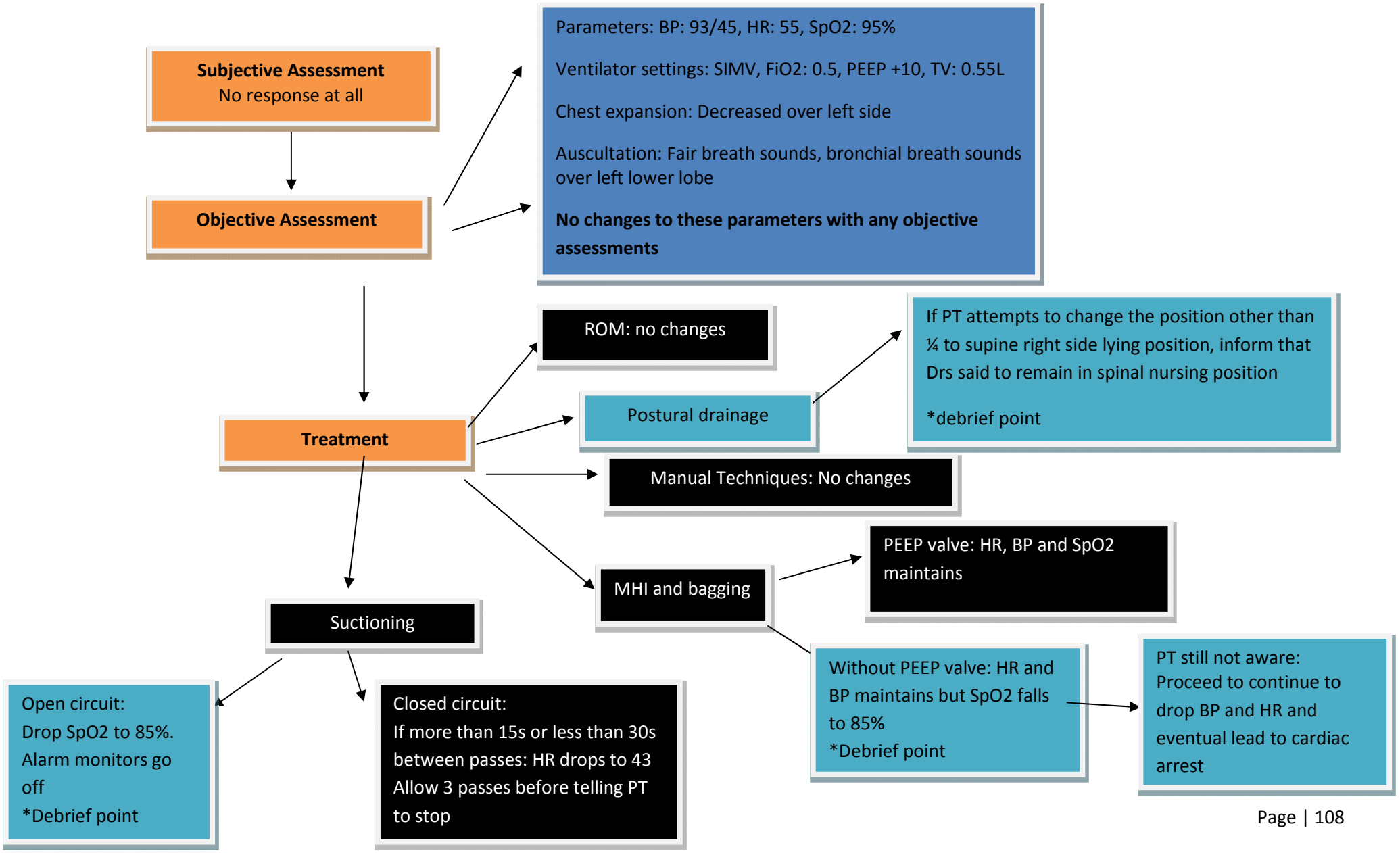
When the PT delivers 1st rescue breath, repositions or attempts further rescue breaths: say "Chest does not rise"

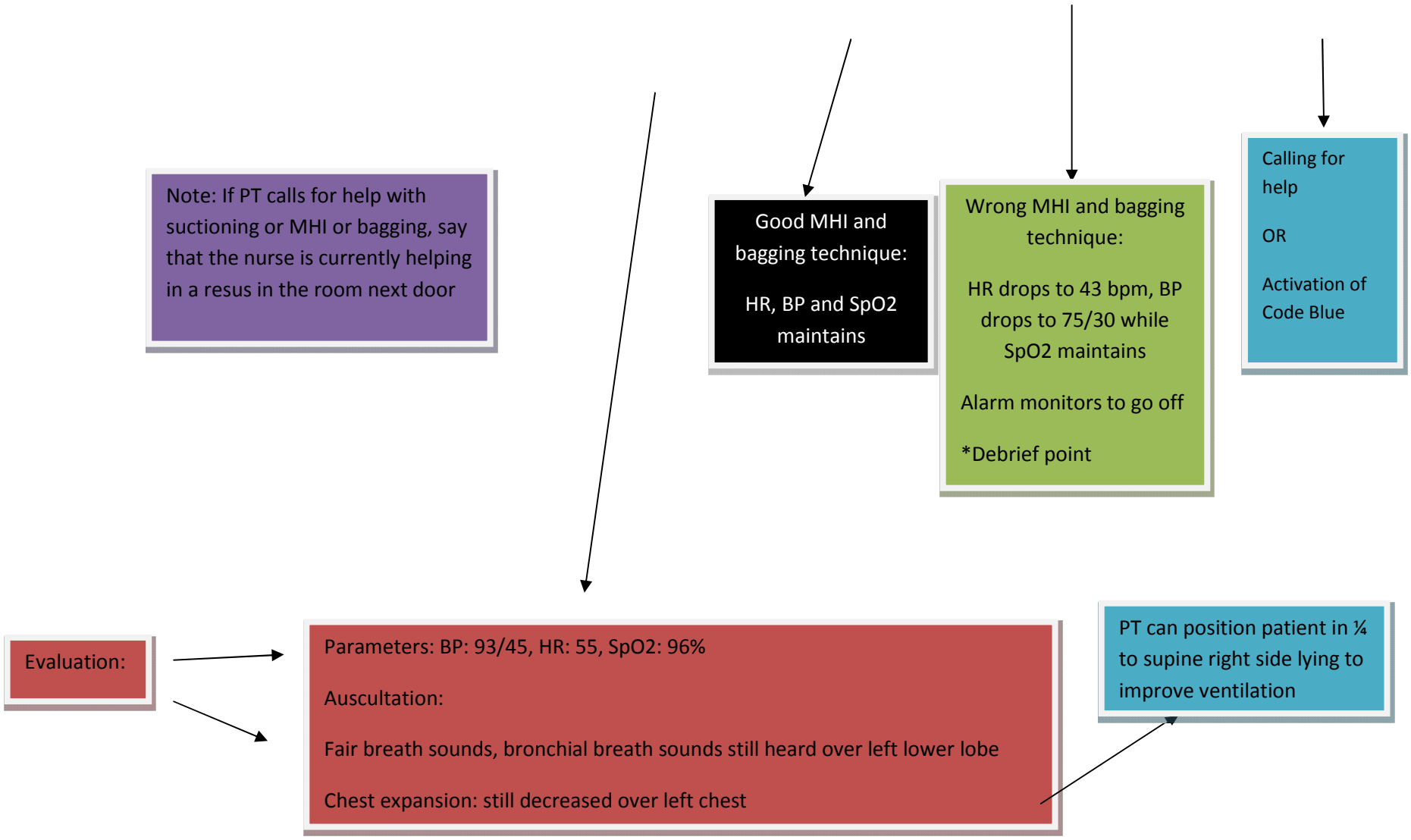
2nd assessment of ABC: there is nothing in the airway, no breaths, no pulse

Only when PT has performed suctioning: say "Chest rises"

Announce to PT that the medical team has come in to assist in CPR and the simulation case has ended

Simulation Process for Case Study 2




Note: If PT calls for help with suctioning or MHI or bagging, say that the nurse is currently helping in a resus in the room next door
Good MHI and bagging technique:
HR, BP and SpO2 maintains
Wrong MHI and bagging technique:
HR drops to 43 bpm, BP drops to 75/30 while SpO2 maintains
Alarm monitors to go off
*Debrief point
Calling for help
OR
Activation of Code Blue
Evaluation:
Parameters: BP: 93/45, HR: 55, SpO2: 96%
Auscultation:
Fair breath sounds, bronchial breath sounds still heard over left lower lobe
Chest expansion: still decreased over left chest
PT can position patient in ¼ to supine right side lying to improve ventilation

Expectations:

Process of Manual Hyperinflation/Bagging technique

1) Remove the ambu bag from the plastic bag
2) Obtain PEEP valve from the table and connect it to the portion towards the patient
3) Remove oxygen port connecting tube from plastic bag and connect to oxygen port and to the other end of the ambu bag
4) Open the oxygen fully to fill the reservoir bag of the ambu bag
5) Observe chest expansion.
6) Turn off the low pressure alarm and disconnect the patient from the ventilator and connect him or her to the bag
7) Give slow deep breaths
8) Hemodynamic compromised patients should not be given end inspiratory holds and are best given one deep breath interspersed with several tidal breaths
9) Release the bag sharply to stimulate a huff
10) Watch for chest expansion. Ensuring that the inflation is slow will reduce the chance of reaching excessive pressures. Complications are greatest if bagging uses large tidal volumes or is too vigorous but too gentle can lead to hypoxemia
11) Continue for 3 cycles of ACBT

(Hough, 1996)

Process of setting up the closed circuit suctioning

1) Prepare sterile water and syringe used to wash inline catheter
2) Stick the syringe to corner of ETT tube for washing later
3) Prepare the external catheter for suctioning and the connector for oral suction after inline suction
4) Silence alarms for ventilator and the monitors
5) 100% oxygenate using ventilator
6) Ensure that the bottom connecting tubing is connected to a suctioning unit and the locking mechanism is open
7) Hold the ETT with non master hand, fully insert suction catheter
8) Hold suction button with master hand and withdraw catheter
9) Monitor the patient's HR and BP
10) After finishing suctioning, to flush suction catheter before withdrawing syringe from ETT
11) Perform oral suctioning

Procedure if the patient has a cardiac arrest

12) Recognise that the patient has stopped breathing within **10s**
13) Press Code Blue button or call for external help
14) Lie the patient supine
15) Attempt to arouse the patient
16) Assess airway, breathing and circulation
17) Perform rescue breaths with ambu bag X 2
18) Commence chest compressions (PT to do 3 cycles)

Appendix 4: Questions that were asked before and after Simulation Case Study 1 (Patient A) and 2 (Patient B)

Questions that were asked **before** Simulation Case Study 1 (Patient A) began

Questions to accompany **emergency case notes to ask the physiotherapist**
1) Based on the emergency case notes, what do you think is happening to this patient?
2) What do the vital signs of the patient at the emergency department show? What do you think is the cause of it?
3) Are there any particular information that you would take note of? Why?
4) Based on the ward case notes, what do you think is happening to this patient now? Why do you think this is happening?
5) Are there any particular information that you would take note of? Why?

Questions to accompany **vital signs chart**:
1) What do you think of the patient's vital signs? Are there any implications to treatment? If there are, what are they?
2) How will you interpret the Arterial Blood Gas (ABG) values? Is this value normal?
3) How will you interpret the Full Blood Count (FBC) values?
4) What do you think about the patient's chest X-ray findings?

Questions that were asked **during** the Simulation Case Study 1(Patient A)

Questions after the patient's **assessment:**
1) What is your diagnosis based on your auscultation findings?
2) Are there any precautions or contraindications to your treatment?

Reflective questions
1) **What are your thoughts about this case?**
2) **Was it really stressful inside there? Why?**
3) **What are the things that you did well in?**
4) **What are some of the things that you have learnt from this case scenario that you have just experienced?**

Questions that were asked **after** Simulation Case Study 1(Patient A)

Clinical reasoning questions
1. **What do you think you could have improved on?** - **Was there any particular reason why you chose to use that particular technique or chose not to do this certain action (take BP)?** - **Why do you think this consequence happened when you chose to use this technique?**
2. **If the patient still did not show any improvements after your treatment, what would you suggest? Why do you think the patient needs that additional treatment?**
3. **Do you think there are some other reasons why your treatment would not be effective?**
4. **Let's say for example the patient has a K+ of 3.1. What would you do? Why would you do that?**
5. **What were your findings on re-evaluation of the patient? What will you recommend?**

Questions that were asked **before** Simulation Case Study 2 (Patient B)

Questions to accompany emergency department case notes:
1) What do you think are the possible consequences of a Spinal Cord Injury (SCI)?
2) Would the information about the patient diving into the pool and being rescued within 10 seconds be important to you? Why?
3) Is there any other information that might be of interest to you that would affect your treatment? **Hint → ventilator settings, chest x ray findings, last suction timing**
4) Why do you think that patient is in the Surgical Intensive Care Unit?
5) How will you interpret the patient's Arterial Blood Gas (ABG) values? Why do you think the patient's ABG values present as such?

Questions that were asked **during** Simulation Case Study 2 (Patient B)

Questions after the PT assesses the patient
1) What are your findings and your diagnosis?
2) How will you evaluate the patient's vital signs? What does this mean to you?
3) What are some of the precautions or contraindications to treatment?
4) Based on your problem, how would you like to treat the patient? **➔ Hint towards Manual Hyper-Inflation (MHI) if they do not state so**

Questions that were asked **after** Simulation Case Study 2 (Patient B)

Reflective questions
1) **What are your thoughts about this case?**
2) **Was it really stressful inside there? Why?**
3) **What are the things that you did well in?**
4) **What do you think you could have improved on?**
5) **What have you learnt from this case scenario that you have just experienced?**

Clinical reasoning questions
6. **What do you think you could have improved on?** - **Was there any particular reason why you chose to use that particular technique or chose not to do this certain action (take blood pressure)?** - **Why do you think this consequence happened when you chose to use this technique?**
7. **If the patient still did not show any improvements after your treatment, what would you suggest? Why do you think the patient needs that additional treatment?**
8. **Do you think there are some other reasons why your treatment would not be effective?**
9. **Let's say for example the patient has a K+ (Potassium level) of 3.1. What would you do? Why would you do that?**
10. **What were your findings on re-evaluation of the patient? What will you recommend?**

Appendix 5: Simulation case study procedural checklists

CHECKLIST FOR SIMULATION CASE 1 (Patient A)

Objective 1:***To be able to obtain the following important history from the patient and case notes and evaluate them in the following pattern***

No.	Action by physiotherapist	Yes	No
1	Based on history of presenting illness, deduce that the patient has a possible acute bout of respiratory infection that resulted in excessive secretion production and retention, which led to a COPD exacerbation		
2	Based on the emergency case notes, deduce that the patient's vital signs are abnormal and hypothesize that these abnormal vital signs were caused by the acute bout of respiratory infection and complicated by underlying COPD		
3	Based on history of presenting illness, deduce that the patient might have an acute cardiac event or pleuritic chest pain. Vigorous treatment is contraindicated and treatment must proceed with precaution if the patient has an acute coronary event.		
4	Based on the previous ABG values, the patient depends on his hypoxic drive to breathe. This indicates that the patient cannot be provided with high levels of oxygen during PT treatment.		
5	Based on the emergency case notes, recognise that the patient has a PMHx of COPD and a long smoking history which probably indicates that greater pulmonary damage		
6	Based on ward case notes, deduce that the patient is acutely deteriorating as indicated by vital sign changes, doctors and nurses documentations		
7	Based on ward case notes, hypothesize that the patient might be experiencing potential respiratory failure due to acute secretion retention and/or diaphragmatic fatigue		
8	Based on vital signs charts, recognise that the patient's vital signs are currently unsuitable for treatment and will need reassessment to determine suitability for treatment		

Comments:

Objective 2: ***To evaluate the findings from the following cardiovascular system review as well as the tests and measures to make clinical judgements***

No.	Action by the physiotherapist	Yes	No
1	Based on the patient's vital signs chart, deduce that the patient's vital signs abnormal and that PT treatment may be contraindicated since the patient's BP is high. PT treatment should proceed with precaution with vital signs retaken		
2	Based on the patient's ABG values, deduce that the patient has acute uncompensated respiratory acidosis. The patient is depending on his hypoxic drive to breathe.		
6	Based on the patient's full blood count results, deduce that the patient is having an active infection		
7	Based on the patient's full blood count results, deduce that the patient did not suffer from a cardiac event		
8	Recognise that the chest X ray findings and that it may not reflect the patient's current status		
Comments:			

Objective 3:***To perform primarily a cardiovascular systems review and examine the patient using the following instruments or tests***

No	Action by physiotherapist	Yes	No
1	To use the machines to measure the patient's blood pressure, heart rate, SpO2 and respiratory rate		
2	To retake the patient's above parameters when the first reading is high		
3	To commence treatment only when the patient's parameters are suitable for treatment after the retaking of parameters		
4	Via observation, to note the patient's respiratory rate, breathing pattern, and amount of chest expansion		
5	Via auscultation in the correct sequence, to assess the pulmonary signs of ventilation or pulmonary symptoms via the breath sounds or presence of added sounds accurately		
6	Via a cough assessment, to accurately determine the patient's ability to successfully expectorate sputum		
Comments:			

Objective 4 to 6:

4) ***To evaluate the findings from the cardiovascular systems review to make clinical judgements and formulate a diagnosis with clinical reasoning***
5) ***To identify the most appropriate intervention strategies for the patient that is safe, effective and evidence based, while delivering the plan of care with outcomes goals***
6) ***To adjust the intervention in response to the patient's status***

No	Actions by physiotherapist	Yes	No
1	To formulate a possible diagnosis of **acute sputum retention** in the **lower lobes** likely secondary to respiratory tract infection, ineffective cough and thick sputum		
2	To state the following precautions to take during treatment		
	(i) Monitoring the patient's vital signs during treatment		
	(ii) Avoiding or modifying manoeuvres that can cause an increase in BP		
	(iii) Avoiding or modifying manoeuvres that can cause an increase in HR		
	(iv) Avoiding or modifying manoeuvres that can cause an increase in RR		
	(v) Providing supplementary oxygen to the patient before/during treatment		
3	To perform the following treatment (i) Positioning in the appropriate position High side lying or side lying		Position chosen:
	(ii) Manual techniques with ACBT (x 3 cycles)		
	(iii) Attempting forced expiratory techniques		
	(iv) Suctioning		
	(v) Monitoring the patient's status regularly		
	(vi) Increasing the oxygen supply to the patient by **1litre**		

4	To **RECOGNISE the changes** in vital signs when executing treatment **(i)** Mobilisation (if applicable)		
	(ii) ROM/Ventilation demand strategies (if applicable)		
	(iii) Postural drainage positions		
	(iv) Manual techniques		
	(v) Suctioning		
5	To **MODIFY** treatment techniques **appropriately** based on patient's response if applicable to the following treatment		
	(i) Mobilisation		
	(ii) ROM/Ventilation demand strategies		
	(iii) Postural drainage positions	Initial position:	Initial position:
	- Changing the position		
	- Monitoring the patient's status after the change before continuing with treatment		
	- Increasing the patient's oxygen level when the patient desaturates and prepare to suction (maximum increase of 1L)		
	(iv) Manual techniques - Gives 30s rest in between cycles		
	(v) Suctioning		
	- Avoiding prolonged suctioning (15s maximum)		
	- Gives rest in between cycles - (30s minimum for SpO2 to rise to at least 91% before continuing)		
6	To modify the treatment **within 10 seconds**	Timing:	Timing:
7	**Suctioning Procedure** **Ideally should be done before commencing treatment** 1) Prepare sterile fluid 2) Turning on the pressure of the vacuum to 80 to 100 mmHg		

	3) Preparation by connecting the tubes together and ensuring that the circuit is working before treatment begins 4) Before performing suctioning, removing the catheter with master hand and controlling vacuum tip with other hand 5) Suctioning should be done smoothly and not more than 15 seconds **6)** Keep monitoring the patient's parameters		
8	**To activate code blue with 30s of respiratory arrest** 1) Pressing code blue button/ calling for external help 2) Lie the patient supine 3) Try arousing the patient 4) Checking of airway, breathing and circulation 5) Perform rescue breathing 6) Note that chest does not rise 7) Reposition head 8) Perform rescue breathing 9) Performs suctioning 10) Reassess patient by checking airway, breathing and circulation 11) Performs rescue breathing X 2 **12)** Begins chest compressions X 3 cycles		
Comments: psychomotor processes, ergonomic handling			

Objective 7:

After executing treatment, to re-examine the patient to evaluate the effectiveness of treatment

No	Action by physiotherapist	Yes	No
1	Reassessment of vital signs of BP, HR, RR and SpO2 using machines		
2	Reassessment of pulmonary signs using auscultation in the **same test position**		
3	Reassessment of cough		
4	Reassessment of chest expansion and patient's level of alertness		
5	If appropriate, reduce the amount of supplementary oxygen given to the patient AND monitor SpO2 after turning it down		
6	Repositioning the patient in an upright position		
7	Recommend the use of the salbutamol inhaler and to inform doctors/nurses about post treatment bronchospasm		
Comments:			

CHECKLIST FOR SIMULATION CASE 2 (Patient B)

Objective 1:

To be able to obtain the following important history from the patient and case notes and evaluate them in the following pattern

No.	Action by physiotherapist	Yes	No
1	Based on emergency case notes, recognise that the significance of the possible level of SCI on respiratory function		
2	Based on history of presenting illness, deduce that the patient might have aspiration pneumonia		
4	Based on the emergency case notes, deduce that the patient's vital signs are abnormal and hypothesize that these abnormal vital signs were caused by spinal shock		
5	Based on the emergency case notes, recognise that the patient has a PSHx of smoking and recognise that this may affect pulmonary function		
6	Based on the doctor's orders, recognise that the patient is currently on spinal nursing and that the patient should be turned with assistance and not allowed to move out of the spinal nursing positions		
7	Based on the case notes, recognise that the patient's vital signs generally lower as compared to the normal values even though dopamine was given to the patient.		
8	Based on the case notes, recognise that the patient may be in SICU on POD 1 because his vital signs need closer monitoring or because he still requires ventilation as given by the ABG values		
Comments:			

Objective 2:

To evaluate the findings from the following cardiovascular system review as well as the tests and measures to make clinical judgements			
No.	Action by the physiotherapist	Yes	No
1	Based on the patient's vital signs chart, deduce that the patient's vital signs abnormal and treatment must proceed with precaution not to cause further falls in HR or BP		
2	Based on the patient's ABG values, deduce that the patient has partially compensated respiratory acidosis		
3	Based on the patient's ABG values, deduce that the initial respiratory acidosis might be due to respiratory muscle dysfunction		
4	Based on the patient's ventilator settings, recognise that the PEEP level is 10 - Able to state that this means that the patient should not be disconnected from the ventilator except with the use of a PEEP valve - Able to state that suctioning should be done ideally via closed circuit system		
5	Based on the nurses' documentation, suctioning was conducted 1 hour ago and treatment can begin now		
6	Recognise that the chest X ray findings shows consolidation of left lower lobe with patchy changes to right middle zone may indicate that the patient needs aggressive chest PT		
Comments:			

Objective 3:

To perform primarily a cardiovascular systems review and examine the patient using the following instruments or tests			
No	Action by physiotherapist	Yes	No
1	To use the machines to measure the patient's blood pressure, heart rate, SpO2 and respiratory rate		
2	Via observation, to note the patient's respiratory rate, breathing pattern, and amount of chest expansion		
5	Via auscultation in the correct sequence, to assess the pulmonary signs of ventilation or pulmonary symptoms via the breath sounds or presence of added sounds accurately		
Comments:			

Objective 4 to 6

7) To evaluate the findings from the cardiovascular systems review to make clinical judgements and formulate a diagnosis with clinical reasoning

8) To identify the most appropriate intervention strategies for the patient that is safe, effective and evidence based, while delivering the plan of care with outcomes goals

9) To adjust the intervention in response to the patient's status

No	Actions by physiotherapist	Yes	No
1	To formulate a possible diagnosis of postoperative left lower lobe consolidation secondary to mucous plugging that might be contributed from smoking history or aspiration		
2	To state the following precautions to take during treatment		
	(vi) Monitoring the patient's vital signs during treatment		
	(vii) Avoiding or modifying manoeuvres that can cause a fall in BP		
	(viii) Avoiding or modifying manoeuvres that can cause a fall in HR		
	(ix) Maintain spinal nursing positions at all times		
3	To perform the following treatment (vii) Postural drainage in modified right side lying spinal nursing position		Position chosen:
	(viii) Manual techniques with ACBT (x 3 cycles)		
	(ix) **Right** technique of MHI/ Bagging with PEEP valve <u>Manual hyperinflation and bagging procedure</u> 1) Remove the ambu bag from the plastic bag 2) Obtain PEEP valve from the table and connect it to the portion towards the patient 3) Remove oxygen port connecting tube from plastic bag and connect to oxygen port and to the other end of the ambu bag 4) Open the oxygen fully to fill the		

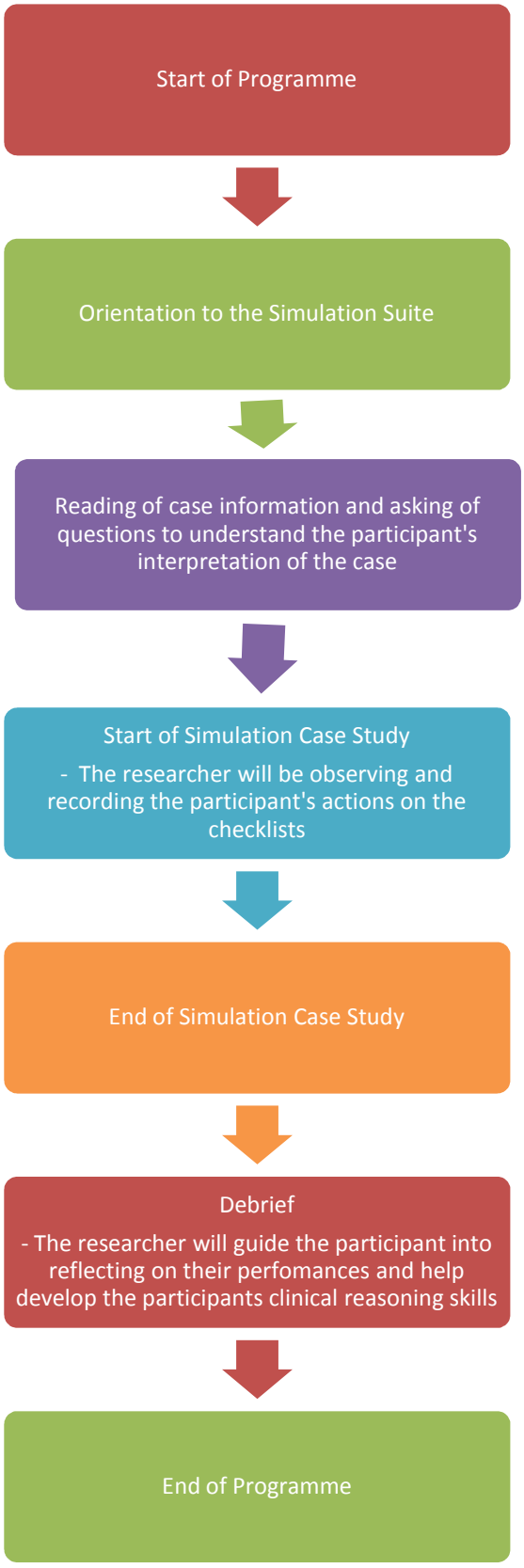
	reservoir bag of the ambu bag 5) Perform 10 times of bagging with 3 times of MHI X 3 cycles 6) MHI - Slow - Deep up to 50% more than delivered tidal volume - Up to 25 breaths per minute - No end inspiratory hold 7) Monitor patient via chest expansion		
	(x) Closed suctioning <u>Suctioning Procedure</u> Ideally should be prepared before commencing treatment 1) Prepare sterile water and syringe used to wash inline catheter 2) Stick the syringe to corner of ETT tube for washing later 3) Prepare the external catheter for suctioning and the connector for oral suction after inline suction 4) Silence alarms for ventilator and the monitors 5) 100% oxygenate using ventilator 6) Ensure that the bottom connecting tubing is connected to a suctioning unit and the locking mechanism is open 7) Hold the ETT with non master hand, fully insert suction catheter 8) Hold suction button with master hand and withdraw catheter 9) Monitor the patient's HR and BP 10) After finishing suctioning, to flush suction catheter before withdrawing syringe from ETT 11) Perform oral suctioning		
	12) Monitoring the patient's status regularly		
Comments:			

4	To **monitor and recognise** the changes in vital signs when executing treatment		
	(vi) MHI and bagging **with** PEEP valve (if applicable)		
	(vii) MHI and bagging **without** PEEP valve		
	(viii) during suctioning procedure	Type: closed	Type: open/closed
5	To **recognise** the changes within 10 seconds	Timing:	Timing:
6	To **modify** treatment techniques **appropriately** based on patient's response if applicable to the following treatment		
	(vi) MHI and bagging **with** PEEP valve		
	- Stop and allow recovery before continuing		
	- Change techniques		
	(vii) MHI and bagging **without** PEEP valve		
	- Put on PEEP valve		
	- Stop and allow recovery before continuing		
	- Change techniques		
	(viii) Suctioning		
	- Avoiding prolonged suctioning (15s maximum)		
	- Gives rest in between cycles		
7	To modify the treatment **within 10s**	Timing:	Timing:
8	**To activate code blue with 10s of respiratory arrest** 13) Pressing code blue button/ calling for external help 14) Lie the patient supine 15) Checking of airway, breathing and circulation 16) Perform rescue breathing X 2 with ambu bag **17)** Begins chest compressions X 3 cycles		
Comments: psychomotor processes, ergonomic handling			

Objective 7:

To re-examine the patient to evaluate the effectiveness of treatment			
No	Action by physiotherapist	Yes	No
1	Reassessment of vital signs of BP, HR, RR and SpO2 using machines		
2	Reassessment of pulmonary signs using auscultation in the **same test position**		
4	Reassessment of chest expansion		
5	Able to give reasons for non effective treatment and suggest appropriate follow up treatment		
Comments:			

Appendix 6: Study Process



Appendix 7: Pre Simulation Self Assessed Competency and Confidence Questionnaire

Physiotherapy Self Assessed Competency Questionnaire

Thank you for participating in this project. By participating in this project, you will provide important information on how a high fidelity simulation (HFS) training programme affects a physiotherapist's self assessed confidence and skills in treating critically ill patients. The results of this questionnaire and project will be used as part of a Master's research report due in late February 2011. The results of this project will available from Melissa Khoo and will be presented at a later date during a physiotherapy departmental meeting and in appropriate conferences.

Background Information

This questionnaire has been adapted and modified from the Acute Respiratory/On Call Physiotherapy Self-evaluation of Competence Questionnaire. The Acute Respiratory/On Call Physiotherapy Self-evaluation of Competence Questionnaire was developed and previously validated to identify perceived competence and confidence of physiotherapists undertaking respiratory care on call duties (Thomas, et al., 2008). This self assessed competency form will help you identify your specific strengths and weaknesses in relation to respiratory physiotherapy care as well as areas of learning.

Use of this questionnaire

This questionnaire is anonymous but it is coded to allow for comparison during the analysis of this project. You will require approximately 15 minutes to complete this questionnaire. All responses or data collection will be kept strictly confidential and **there will be no attempt made to identify you**, other than your level of experience or current scope of practice. You are free to refuse to answer any questions and to withdraw anytime. The research consists of 2 parts. You will need to complete this questionnaire **twice**. Please complete the *pre-simulation questionnaire* **at least 2 days** before your simulation case study and place the questionnaire in Melissa Khoo's letter tray in the staff room. After completing the first questionnaire, you will need to attend your simulation programme (timing and directional details enclosed in this same envelope) in the NUH SIM suite located at level 2. Kindly complete and submit the *post-simulation questionnaire* to Melissa Khoo's letter tray **at most 2 days** after your simulation case study.

The data collected from these 2 sets of questionnaires (saved in 2 CDs) will be securely stored in the NUH physiotherapy department and Auckland University of Technology Faculty of Health and Environment Sciences for 6 years and will only be accessible to the researchers only

for research or clarification purposes. After this time, the hard copy data will be shredded and the CD which holds the soft copy of the data will be discarded.

Ethical consent

Ethical consent has been obtained from Auckland University of Technology Ethics Committee (AUTEC) and NUS-Institutional Review Board (IRB).

AUTEC Reference Number: 10/248

NUS-IRB Reference Number: D/10/657

If you have any concerns about the conduct of this study, you can contact the AUTEC ethics coordinator, Madeleine Banda: Phone +64 (09) 921 9999 ext: 8860 Email: ethics@aut.ac.nz or the NHG Domain Specific Review Board Secretariat at +65 64713266.

We thank you in advance for your time and assistance in this project. We will be happy to answer any queries that you may have during this project.

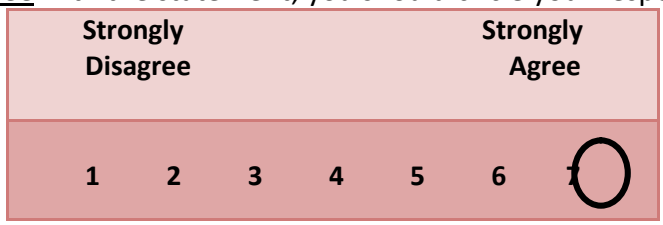
Khoo Lin Shan, Melissa. Dip(Physiotherapy). MHPr. Candidate.
Julie Reeve. PhD., MSc., Grad Dip Phys. Senior Lecturer, Auckland University of Technology.
julie.reeve@aut.ac.nz

Pre Simulation Questionnaire

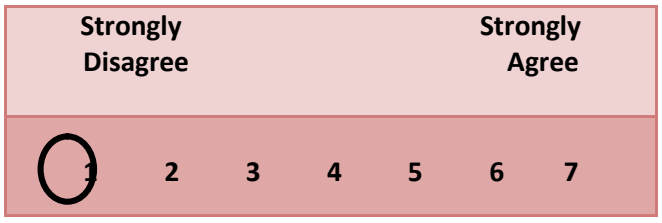
PARTICIPANT CODE	
DATE	

Instructions for the use of this questionnaire:

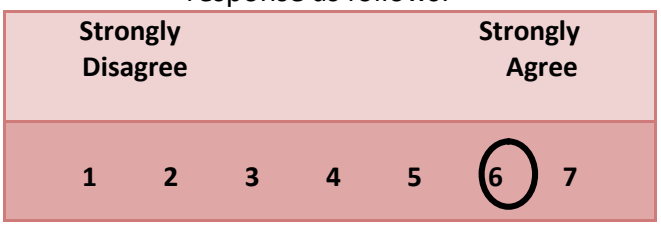
If you strongly agree with the statement, you should circle your response as follows:



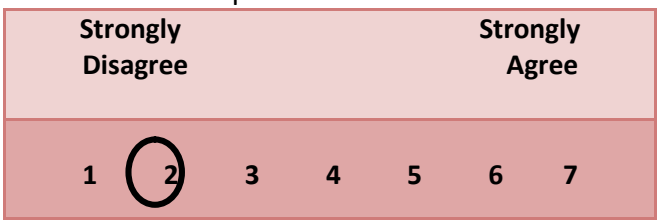
Or, if you strongly disagree with the statement, then you should circle your response as follows:



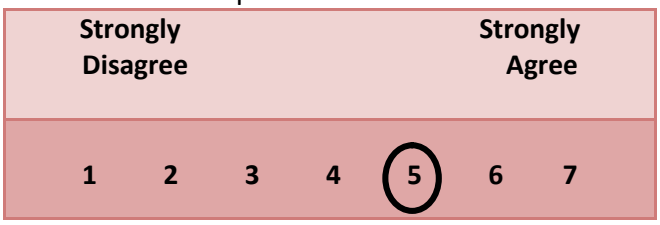
If you agree (but not extremely) with the statement, then you should circle your response as follows:



Or, if you disagree (but not extremely) with the statement, then you should circle your response as follows:

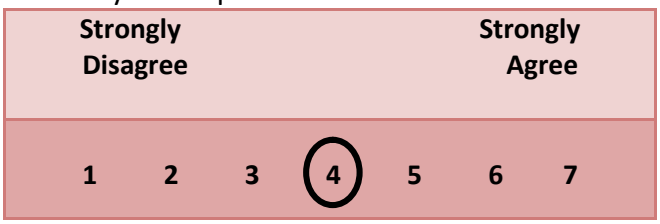


If you agree (but are not really neutral) with the statement, then you should circle your response as follows:



Or, if you disagree (but are not really neutral) with the statement, then you should circle your response as follows:

If you are neutral with the given statement in the questionnaire, then you should circle your response as follows:



Respiratory Patient Assessment

Item	Strongly Disagree						Strongly Agree
I can interpret patient notes, charts and records	1	2	3	4	5	6	7
I can take an appropriate subjective history from the patient	1	2	3	4	5	6	7
I can use a stethoscope and interpret auscultation findings	1	2	3	4	5	6	7
I can palpate respiratory movements and identify significant variations	1	2	3	4	5	6	7
I can observe the patient's breathing and general status and identify significant findings	1	2	3	4	5	6	7
I can identify and explain the purpose of commonly used drugs	1	2	3	4	5	6	7
I can interpret readings from monitoring equipment (SpO2, heart rate, blood pressure)	1	2	3	4	5	6	7
I can interpret readings from ventilators (PEEP, FiO2, ventilation modes)	1	2	3	4	5	6	7
I can interpret ABG results correctly	1	2	3	4	5	6	7
I can interpret chest X rays that is relevant to physiotherapy	1	2	3	4	5	6	7
The information that I collect is accurate and appropriate	1	2	3	4	5	6	7
I can analyse and identify the patient's main respiratory problem correctly	1	2	3	4	5	6	7
I can select appropriate outcome measures	1	2	3	4	5	6	7
I can identify a patient who is deteriorating acutely	1	2	3	4	5	6	7
I am able to determine if the patient is suitable for physiotherapy treatment	1	2	3	4	5	6	7
I know where to find the additional information that I will need to treat the patient (e.g.: use of Carevue or updated ABG values)	1	2	3	4	5	6	7

Respiratory Patient Treatment

Item	Strongly Disagree						Strongly Agree
I can produce an appropriate treatment plan based on the patient's respiratory problem	1	2	3	4	5	6	7
I can treat patient problems associated with lung volume losses	1	2	3	4	5	6	7
I can treat patient problems associated with sputum retention	1	2	3	4	5	6	7
I can treat patient problems associated with increased work of breathing	1	2	3	4	5	6	7
I can manage patients who develop respiratory failure	1	2	3	4	5	6	7
I am aware of my limitations and when to call for additional assistance or refer the patient on to others	1	2	3	4	5	6	7
I can implement my treatment plan safely	1	2	3	4	5	6	7
I can implement my treatment plan effectively	1	2	3	4	5	6	7
I know where to find additional equipment that I will need to treat the patient (e.g.: ambu bag, suction catheters or equipment, vacuum tip, PEEP valve, masks)	1	2	3	4	5	6	7
I can take appropriate action for the patient who acutely deteriorates or becomes critically ill during my treatment	1	2	3	4	5	6	7
I know how to reassess my patient accurately	1	2	3	4	5	6	7
I can make suggestions for future treatment plans after my intervention	1	2	3	4	5	6	7
I understand and can apply correct infection control measures (e.g.: sterile suctioning techniques for oral, tracheostomy or ETT suctioning, wearing appropriate masks or gowns)	1	2	3	4	5	6	7

Item (Please tick accordingly)	I can understand the criteria for selection	I can explain the contraindications and precautions when using this treatment	I can manage the equipment needed to execute treatment or rectify any potential faults	I can apply the treatment correctly	I can monitor the treatment	I can modify the treatment according to the patient's needs	I can evaluate the outcomes of treatment	I understand and can manage the potential complications
Active Cycle Breathing Technique								
Manual techniques (Percussion/Vibrations/Shaking)								
Postural drainage positioning								
Positioning and breathing control for breathlessness								
Manual cough assist								
Oro-pharyngeal Suctioning								
Naso-pharyngeal Suctioning								
Closed circuit ETT Suctioning								
Open circuit ETT Suctioning								

Item (Please tick accordingly)	I can understand the criteria for selection	I can explain the contraindications and precautions when using this treatment	I can manage the equipment needed to execute treatment or rectify any potential faults	I can apply the treatment correctly	I can monitor the treatment	I can modify the treatment according to the patient's needs	I can evaluate the outcomes of treatment	I understand and can manage the potential complications of the treatment
Tracheostomy Suctioning								
Manual Hyperinflation								
Non-invasive ventilation (BiPap/CPAP)				**Not applicable**	**Not applicable**			
Inserting an oral airway					**Not applicable**		**Not applicable**	
Managing a tracheostomy (removal and changing tubes)		**Not applicable**			**Not applicable**		**Not applicable**	

I feel that I am <u>able to perform a safe and effective</u> treatment for:	Strongly Disagree						Strongly Agree
<u>Adults</u> after abdominal surgery (transplants, anterior resections)	1	2	3	4	5	6	7
<u>Adults</u> after cardiothoracic surgery (CABG, aortic valve repair)	1	2	3	4	5	6	7
<u>Adults</u> after neurosurgery(e.g.: craniotomy)	1	2	3	4	5	6	7
<u>Adults</u> with chronic respiratory diseases (e.g.: COPD)	1	2	3	4	5	6	7
<u>Adults</u> with acute medical conditions (e.g.: myocardial infarct, diabetic ketoacidosis)	1	2	3	4	5	6	7
<u>Adults</u> with multiple trauma	1	2	3	4	5	6	7
<u>Adults</u> with spinal cord injuries	1	2	3	4	5	6	7
<u>Adults</u> with cardiovascular instability (heart rate, blood pressure)	1	2	3	4	5	6	7
<u>Adults</u> with a tracheostomy	1	2	3	4	5	6	7
<u>Adults</u> with neurological deficits	1	2	3	4	5	6	7

I feel that I am <u>able to perform a safe and effective</u> treatment in	Strongly Agree						Strongly Disagree
Neurosurgical general ward (Ward 41)	1	2	3	4	5	6	7
Surgical general ward (Ward 43)	1	2	3	4	5	6	7
Respiratory general ward (Ward 44)	1	2	3	4	5	6	7
Respiratory isolation wards (Ward 61/62)	1	2	3	4	5	6	7
Cardiothoracic High Dependency Unit (Ward 20)	1	2	3	4	5	6	7
Surgical High Dependency Unit (Ward 27)	1	2	3	4	5	6	7
Medical High Dependency Unit (Ward 26)	1	2	3	4	5	6	7
Neurosurgical High Dependency Unit (Ward 25)	1	2	3	4	5	6	7
Cardiothoracic Intensive Care Unit (Ward 20)	1	2	3	4	5	6	7
Surgical Intensive Care Unit (Ward 21)	1	2	3	4	5	6	7
Medical Intensive Care Unit (Ward 26)	1	2	3	4	5	6	7
Please explain your choice of answers:							

Confidence

Statement	**Strongly Agree**						**Strongly Disagree**
I do not feel worried about treating a patient in the <u>general wards by myself</u>	1	2	3	4	5	6	7
I do not feel worried about treating a patient in the <u>high dependency units by myself</u>	1	2	3	4	5	6	7
I do not feel worried about treating a patient in the <u>ICU by myself</u>	1	2	3	4	5	6	7
I feel <u>sufficiently prepared</u> to handle a patient in a cardiopulmonary scenario	1	2	3	4	5	6	7
I feel that I have something to offer my patients	1	2	3	4	5	6	7
Please explain your choice of answers:							

About You:

Highest level of physiotherapy qualifications	Diploma	Degree	Postgraduate diploma	Masters	PhD
Number of years of working experience **since qualification**					
Previous clinical areas **since qualification and months in that rotation** (e.g.: 6 months in ortho outpatients)					
Current area of clinical practice **in NUH**(CTVS, Med-Surg, etc)					
How much of your current daily caseload comprise of respiratory cases?	All	About 3/4	About 1/2	About 1/4	I only see respiratory patients during on call or weekend duties

Appendix 8: Post Simulation Self Assessed Competency and Confidence Questionnaire

Post Simulation Questionnaire

PARTICIPANT CODE	
DATE	

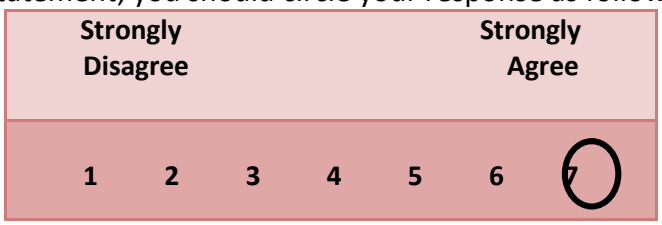
Please provide your feedback about the simulation programme

Item (please tick)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I enjoyed the simulation session					
The simulation session was a useful learning experience					
Please explain why you feel that the session was(not) a useful learning experience:					
The simulation session will influence my clinical practice					
Please explain how you think this session will(not) influence your clinical practice					
The simulation programme was realistic and I would behave the same way in real life					
The level of difficulty of the case was appropriate					
The content of the case was relevant					
The duration of the simulation session was sufficient					
The HFS session improved my confidence to treat respiratory patients					
The HFS session improved my skills in treating respiratory patients					
The orientation to the simulation suite and manikin was in sufficient detail					
The instructor provided adequate feedback and discussion about the case after the HFS session					
The feedback provided was useful to me					
The discussion and debriefing environment **after** the case scenario was comfortable and non judgemental					
Further opportunities to practise during the programme will improve my ability to manage the **same situation** in **real life**					

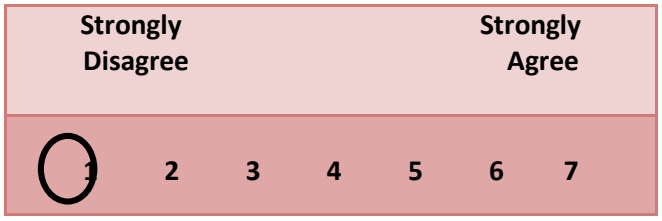
I would recommend this programme to **new** physiotherapists in the department					
I would recommend this programme to **experienced** physiotherapists in the department					
This HFS programme should be made a compulsory component in NUH cardiopulmonary team's preceptorship programme					
Physiotherapists should attend this HFS programme before seeing a real patient					
Please suggest some ways to improve this programme					

Instructions for the use of this questionnaire:

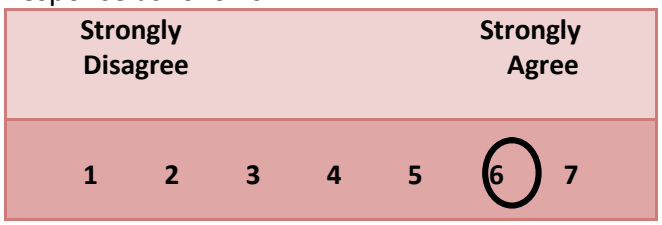
If you strongly agree with the statement, you should circle your response as follows:



Or, if you strongly disagree with the statement, then you should circle your response as follows:



If you agree (but not extremely) with the statement, then you should circle your response as follows:



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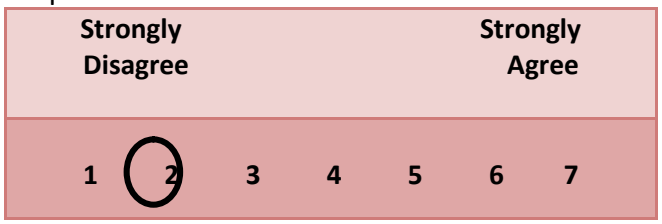

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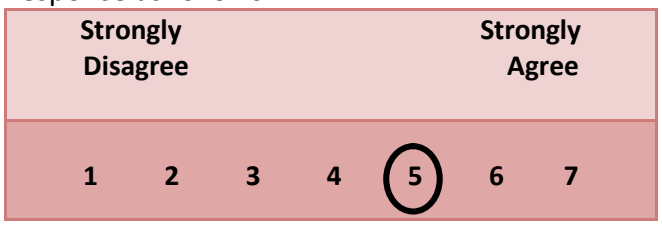
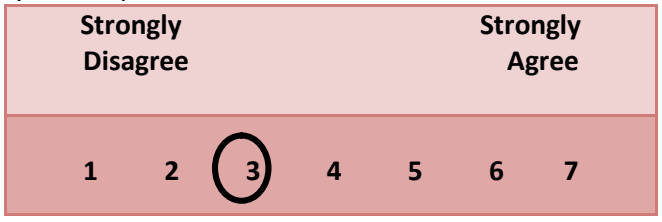


Or, if you disagree (but are not really neutral) with the statement, then you should circle your response as follows:



If you are neutral with the given statement in the questionnaire, then you should circle your response as follows:

Strongly Disagree						Strongly Agree
1	2	3	(4)	5	6	7

Respiratory Patient Assessment

Item	Strongly Disagree						Strongly Agree
I can interpret patient notes, charts and records	1	2	3	4	5	6	7
I can take an appropriate subjective history from the patient	1	2	3	4	5	6	7
I can use a stethoscope and interpret auscultation findings	1	2	3	4	5	6	7
I can palpate respiratory movements and identify significant variations	1	2	3	4	5	6	7
I can observe the patient's breathing and general status and identify significant findings	1	2	3	4	5	6	7
I can identify and explain the purpose of commonly used drugs	1	2	3	4	5	6	7
I can interpret readings from monitoring equipment (SpO2, heart rate, blood pressure)	1	2	3	4	5	6	7
I can interpret readings from ventilators (PEEP, FiO2, ventilation modes)	1	2	3	4	5	6	7
I can interpret ABG results correctly	1	2	3	4	5	6	7
I can interpret chest X rays that is relevant to physiotherapy	1	2	3	4	5	6	7
The information that I collect is accurate and appropriate	1	2	3	4	5	6	7
I can analyse and identify the patient's main respiratory problem correctly	1	2	3	4	5	6	7
I can select appropriate outcome measures	1	2	3	4	5	6	7
I can identify a patient who is deteriorating acutely	1	2	3	4	5	6	7
I am able to determine if the patient is suitable for physiotherapy treatment	1	2	3	4	5	6	7
I know where to find the additional information that I will need to treat the patient (e.g.: use of Carevue or updated ABG values)	1	2	3	4	5	6	7

Respiratory Patient Treatment

Item	Strongly Disagree						Strongly Agree
I can produce an appropriate treatment plan based on the patient's respiratory problem	1	2	3	4	5	6	7
I can treat patient problems associated with lung volume losses	1	2	3	4	5	6	7
I can treat patient problems associated with sputum retention	1	2	3	4	5	6	7
I can treat patient problems associated with increased work of breathing	1	2	3	4	5	6	7
I can manage patients who develop respiratory failure	1	2	3	4	5	6	7
I am aware of my limitations and when to call for additional assistance or refer the patient on to others	1	2	3	4	5	6	7
I can implement my treatment plan safely	1	2	3	4	5	6	7
I can implement my treatment plan effectively	1	2	3	4	5	6	7
I know where to find additional equipment that I will need to treat the patient (e.g.: ambu bag, suction catheters or equipment, vacuum tip, PEEP valve, masks)	1	2	3	4	5	6	7
I can take appropriate action for the patient who acutely deteriorates or becomes critically ill during my treatment	1	2	3	4	5	6	7
I know how to reassess my patient accurately	1	2	3	4	5	6	7
I can make suggestions for future treatment plans after my intervention	1	2	3	4	5	6	7
I understand and can apply correct infection control measures (e.g.: sterile suctioning techniques for oral, tracheostomy or ETT suctioning, wearing appropriate masks or gowns)	1	2	3	4	5	6	7

Item (Please tick accordingly)	I can understand the criteria for selection	I can explain the contraindications and precaution-s when using this treatment	I can manage the equipment needed to execute treatment or rectify any potential faults	I can apply the treatment correctly	I can monitor the treatment	I can modify the treatment according to the patient's needs	I can evaluate the outcomes of treatment	I understand and can manage potential complications of treatment
Manual techniques (Percussion/Vibrations/Shaking)								
Postural drainage positioning								
Oro-pharyngeal Suctioning								
Closed circuit ETT Suctioning								
Open circuit ETT Suctioning								
Manual Hyperinflation								

I feel that I am <u>able to perform a safe and effective</u> treatment for:	Strongly Disagree						Strongly Agree
<u>Adults</u> after abdominal surgery (transplants, anterior resections)	1	2	3	4	5	6	7
<u>Adults</u> after cardiothoracic surgery (CABG, aortic valve repair)	1	2	3	4	5	6	7
<u>Adults</u> after neurosurgery(e.g.: craniotomy)	1	2	3	4	5	6	7
<u>Adults</u> with chronic respiratory diseases (e.g.: COPD)	1	2	3	4	5	6	7
<u>Adults</u> with acute medical conditions (e.g.: myocardial infarct, diabetic ketoacidosis)	1	2	3	4	5	6	7
<u>Adults</u> with multiple trauma	1	2	3	4	5	6	7
<u>Adults</u> with spinal cord injuries	1	2	3	4	5	6	7
<u>Adults</u> with cardiovascular instability (heart rate, blood pressure)	1	2	3	4	5	6	7
<u>Adults</u> with a tracheostomy	1	2	3	4	5	6	7
<u>Adults</u> with neurological deficits	1	2	3	4	5	6	7

I feel that I am <u>able to perform a safe and effective</u> treatment in	Strongly Disagree						Strongly Agree
Neurosurgical general ward (Ward 41)	1	2	3	4	5	6	7
Surgical general ward (Ward 43)	1	2	3	4	5	6	7
Respiratory general ward (Ward 44)	1	2	3	4	5	6	7
Respiratory isolation wards (Ward 61/62)	1	2	3	4	5	6	7
Cardiothoracic High Dependency Unit (Ward 20)	1	2	3	4	5	6	7
Surgical High Dependency Unit (Ward 27)	1	2	3	4	5	6	7
Medical High Dependency Unit (Ward 26)	1	2	3	4	5	6	7
Neurosurgical High Dependency Unit (Ward 25)	1	2	3	4	5	6	7
Cardiothoracic Intensive Care Unit (Ward 20)	1	2	3	4	5	6	7
Surgical Intensive Care Unit (Ward 21)	1	2	3	4	5	6	7
Medical Intensive Care Unit (Ward 26)	1	2	3	4	5	6	7
Please explain your choice of answers:							

Confidence

Statement	Strongly Disagree						Strongly Agree
I do not feel worried about treating a patient in the general wards by myself	1	2	3	4	5	6	7
I do not feel worried about treating a patient in the high dependency units by myself	1	2	3	4	5	6	7
I do not feel worried about treating a patient in the ICU by myself	1	2	3	4	5	6	7
I feel sufficiently prepared to handle a patient in a cardiopulmonary scenario	1	2	3	4	5	6	7
I feel that I have something to offer my patients	1	2	3	4	5	6	7
Please explain your choice of answers:							

Appendix 9:How to calculate median for the components of respiratory assessment, respiratory treatment, range of abilities and confidence

Respiratory Patient Treatment (Example)

Item	Strongly Disagree						Strongly Agree
I can produce an appropriate treatment plan based on the patient's respiratory problem	1	2	3	4	**(5)**	6	7
I can treat patient problems associated with lung volume losses	1	2	3	**(4)**	5	6	7
I can treat patient problems associated with sputum retention	1	2	3	4	5	**(6)**	7
I can treat patient problems associated with increased work of breathing	1	2	3	4	**(5)**	6	7
I can manage patients who develop respiratory failure	1	2	3	4	**(5)**	6	7
I am aware of my limitations and when to call for additional assistance or refer the patient on to others	1	2	3	4	5	**(6)**	7
I can implement my treatment plan safely	1	2	3	4	**(5)**	6	7
I can implement my treatment plan effectively	1	2	3	**(4)**	5	6	7
I know where to find additional equipment that I will need to treat the patient (e.g.: ambu bag, suction catheters or equipment, vacuum tip, PEEP valve, masks)	1	2	3	4	5	**(6)**	7
I can take appropriate action for the patient who acutely deteriorates or becomes critically ill during my treatment	1	2	3	4	**(5)**	6	7
I know how to reassess my patient accurately	1	2	3	4	**(5)**	6	7
I can make suggestions for future treatment plans after my intervention	1	2	3	4	5	**(6)**	7
I understand and can apply correct infection control measures (e.g.: sterile suctioning techniques for oral, tracheostomy or ETT suctioning, wearing appropriate masks or gowns)	1	2	3	4	**(5)**	6	7

Participant's Median for Respiratory Treatment: 5

Item (Please tick accordingly)	I can understand the criteria for selection	I can explain the contraindications and precaution-s when using this treatment	I can manage the equipment needed to execute treatment or rectify any potential faults	I can apply the treatment correctly	I can monitor the treatment	I can modify the treatment according to the patient's needs	I can evaluate the outcomes of treatment	I understand and can manage potential complication-ns of treatment
Manual techniques (Percussion/Vibrations/Shaking)	✓	✓	✓	✓	✓	✓	✓	✓
Postural drainage positioning	✓	✓			✓		✓	
Oro-pharyngeal Suctioning	✓	✓		✓				
Closed circuit ETT Suctioning	✓	✓						
Open circuit ETT Suctioning		✓						
Manual Hyperinflation	✓							

Respiratory treatment item	Participant's score
Manual Techniques	8
Postural drainage positioning	4
Oro-pharyngeal suctioning	3
Closed ETT suctioning	2
Open circuit ETT suctioning	1
Manual Hyperinflation	1
Total score for this component	8+4+3+2+1+1 = 19

Appendix 10: Participant Information Sheet

Participant Information Sheet

Principal Investigator (NUHS) / Researcher (AUT) & Contact Details:

Ms Khoo Lin Shan Melissa

Physiotherapist

National University Hospital

5 Lower Kent Ridge Road Singapore 119074

Telephone: 6772 5555

Project Supervisor (AUT)/ Co-investigator (NUHS) & Contact Details:

Julie Reeve

Senior Lecturer

90 Akoranga Drive
Northcote
North Shore City 0627
New Zealand

Project/ Protocol Title

The development of a high fidelity simulation training programme to improve physiotherapists' self assessed skills and confidence during treatment of critically ill patients

An Invitation

You are invited to participate in this research project that will contribute towards the completion of the principal investigator's (Khoo Lin Shan, Melissa) Masters of Health Practice degree. This project is about the use of high fidelity simulation in physiotherapy education and how this form of simulation can be used to as an educational tool to increase a physiotherapist's self rated level of skills and confidence when treating critically ill patients.

It is important to us that you first take time to read through and understand the information provided in this sheet. Nevertheless, before you take part in this research study, the study will be explained to you and you will be given the chance to ask questions. After you are properly satisfied that you understand this study, and that you wish to take part in the study, you must

sign the informed consent form attached. You will be given this information sheet as well as a copy of the project consent form to take home with you.

What is the purpose of this project?

The primary aim of this project is to develop and implement a simulation programme to help physiotherapists employed by National University Hospital (NUH) to gain confidence and improve their self assessed competence when treating critically ill patients. The second aim of this project is to evaluate the effectiveness of the simulation programme developed. These improvements might be achieved through the development and refinement of the participant's skills during the simulation programme. Participation in this study is estimated to require 1 ½ hours of time. Based on the results from this study, this programme might be further developed in NUH to better prepare physiotherapists for their professional duties. The results from this project might also be presented at the National Healthcare Group Congress as well as the Singapore Physiotherapy Association Congress in 2011.

How was I identified and why am I being invited to participate in this project?

Participation in this project is open to all physiotherapists working in National University Hospital, who are able to understand English and give informed consent. At the same time, this research project specifically wishes to recruit 10 participants who undertake on call duties and are either new physiotherapy graduates (within 6 months of graduation from their physiotherapy degree or diploma) or physiotherapists whose weekly caseload do not exceed 10 respiratory patients. As you have met the inclusion criteria of this project, you have been invited to participate in this research.

What will happen in this project?

You will need to volunteer a total of 1 ½ hours of your time in order to participate in this project. If you agree to participate in this study, you will receive an envelope. This envelope will contain 2 coded but anonymous sets of questionnaires: the pre simulation questionnaire as well as the post simulation questionnaire and survey. These questionnaires are coded to allow for comparison during data analysis and will not be able to identify you in any way. In addition, the envelope will also contain an information sheet that will provide you with directions to the NUH simulation suite and the specific timing for you to attend your simulation programme. This simulation programme is estimated to last for an hour.

Permission from your workgroup leader for time off clinical duties for you to attend this simulation programme will be sought by the principal investigator/researcher. Even though your workgroup leader is aware of your participation in this study, your performance during the simulated case scenario and the topics of the discussion during debrief will be kept strictly confidential and will not be made known to anyone else except for the researcher.

Before you attend the simulation programme:

You will need to complete and return the pre simulation questionnaire via the principal investigator's/researcher's letter tray at least 2 days before your allocated date of the programme. This first questionnaire will provide information about your level of confidence

and self assessed competence in cardiorespiratory physiotherapy skills prior to the simulation programme and some information about your work experience.

On the day of your simulation programme:

On the day of the simulation programme, the principal investigator/researcher will meet you at the NUH simulation suite at your allocated timing. After the principal investigator has orientated you to the simulation suite, you will then be provided with the simulated case history and information that is necessary to manage the simulated case scenario. After which, the principal investigator/researcher will ask you some questions to understand your analysis of the simulated case and record your answers on a procedural checklist. The case scenario would then begin and you will then be required to manage this case as if in real life by performing assessment and treatment on the manikin. The principal investigator/researcher will modify the progress of the simulation case scenario based on your actions and will also observe and record your actions on this procedural checklist.

After the simulated case scenario, you will be debriefed by the principal investigator/researcher. You will be asked several questions to encourage reflection on your actions and clinical reasoning. At the same time, the principal investigator/researcher will also provide you with the procedural checklist and provide objective feedback based on the checklist. Please note that this is NOT an evaluative session and the feedback will be provided in a respectful and open manner by a fellow colleague. The main aim of the simulation programme is to help you gain confidence and learn from the simulation programme. Therefore, your participation in the discussions during debrief contribute largely to the effectiveness of the programme in achieving its aims.

If you wish to, you can repeat the same case scenario with the principal investigator/researcher to practise. If necessary, the principal investigator/researcher would also demonstrate and guide you into performing the correct steps for the physiotherapy procedures. At the end of your session, the researcher will make a copy of your procedural checklist for data analysis before returning the original procedural checklist to you. This procedural checklist will be coded but will not be able to identify you in any way. However, in view of the small sample size of this study, there is a possibility that the researcher will still be able to identify you. In the event of such a situation, your performance during the case study, the topics of debrief and your responses from the questionnaires and survey will be kept strictly confidential and will not be discussed with you at any time other than during the simulation programme.

After the simulation programme:

You will need to complete and return the post simulation questionnaire and survey within 2 days after your session via the principal investigator's/researcher's letter tray.

What are the discomforts and risks?

There are minimal physical risks involved during this study. However, you might experience some psychological discomforts during the simulation programme or when providing your responses in the questionnaires.

How will these discomforts and risks be alleviated?

If you experience any discomfort at any point of time during the simulated case study, you can request to stop the scenario. It is not necessary that you complete the entire case study. At the same time, the principal investigator/researcher will also terminate the simulation session if she feels that it is not appropriate for you to continue with the simulated case scenario in order to reduce any unnecessary psychological stress that you may experience.

It is important for you to understand that this simulation programme is a learning and non judgemental experience for all participants. Its primary aim is to help develop your confidence and self assessed competence in treating critically ill patients. Your confidentiality will be highly respected at all times and your performance and the debrief discussion topics will not be made known to any other person other than the researcher. You also do not have to answer any question that on the questionnaire and survey form that you are uncomfortable with. The principal investigator/researcher has also undergone training and placements with experienced lecturers in the Auckland University of Technology who run HFS programmes to develop appropriate and sensitive debriefing skills techniques to reduce any potential discomfort that you may experience during the simulation programme.

If you feel that you require additional counselling assistance as a consequence of your participation in this project, you may seek the assistance of the NUH rehabilitation department care buddies, who are trained in providing counselling and assistance to fellow rehabilitation professionals. If you feel that you require further counselling, you may seek the assistance of the NUH medical social worker.

What are the benefits?

Simulation programmes have been used in hospitals as well as in schools to provide objective assessments and training programmes for health care professionals to ensure standards of care or for areas for further learning and development. HFS programmes, like this one you may choose to participate in, have been shown to increase health care professionals' confidence and clinical performance in treating patients.

By participating in this project, you will be able to obtain feedback about your cardiorespiratory physiotherapy skills and identify your strengths or areas for further training. You will also have protected time away from clinical work to engage in reflective practice while learning and practising cardiorespiratory physiotherapy skills in a realistic context without potentially harming a real patient. Therefore, this potentially increases clinical skill competence, confidence in treating the critically ill physiotherapy patient and promotes continued professional development.

How will I be compensated if I get injured during the project?

In case of any physical injuries during the course of this project, you may contact the Principal Investigator, Melissa Khoo at +656772 5555.

National University Hospital without legal commitment will compensate you for the injuries arising from your participation in the study without you having to prove National University Hospital is at fault. There are however conditions and limitations to the extent of compensation provided. You may wish to discuss this with your Principal Investigator. By

signing this consent form, you will not waive any of your legal rights or release the parties involved in this study from liability for negligence.

Your participation and alternatives to participation

Your participation in this project is entirely voluntary. Your choice to participate or not participate in this project does not affect (for example: add more benefit or black mark) your employment status or work evaluation. If you choose to participate in this project, you may choose to withdraw at any time up until the completion of data analysis without any adverse consequences.

If you decide to stop taking part in this study, you should tell the Principal Investigator/researcher. The principal investigator/researcher of this study may stop your participation in the study (in particular during the simulated case study) if she feels that your further involvement might cause you unnecessary psychological stress. In the event of any new information becoming available that may be relevant to your willingness to continue in this study, you will be informed in a timely manner by the principal investigator/ researcher.

How will my privacy be protected?

Your responses to the questionnaires will be coded but remain anonymous to the researcher. As you are not required to reveal your identity and personal particulars in the data collected, your responses cannot be identified.

As there is a portion of the study (during the simulation programme) when you can be identified, there will be an written and signed agreement between you and the researcher in the consent form that that specifies that your performance during the case study and discussion topics during the programme will be kept strictly confidential. Furthermore, there will be no discussion with you about your performance, topic of the debrief session or responses other than during the simulation programme.

However, Auckland University of Technology (AUT) and the NHG Domain-Specific Review Board will be granted direct access to the study documents for auditing purposes, without making any of your information public. By signing the Informed Consent Form attached, you are authorizing such access to the study. The NHG Domain-Specific Review Board is independent of National University Hospital. As such, there will not be any issues including your employment status when DSRB has access to the study documents.

Data collected will be considered as property of National University Health System and AUT. The final storage location of the data collected during the course of this study will be in AUT. As the data collected in this study does not require you to reveal your personal particulars, the data sent to AUT will not be able to determine your identity. In the event of any publication regarding this study, your identity will remain confidential. At the same time, access to the raw data is only available to the research team.

What are the costs of participating in this research?

There are no monetary costs involved when participating in this research. It is estimated that participation in the entire project will take approximately 1½ hours of your time. You will not be reimbursed for your time and/or inconvenience caused by the study.

What opportunity do I have to consider this invitation?

You will have until the 7th of January 2011 to consider this invitation.

How do I agree to participate in this research?

If you agree to participate in this research, please contact the principal investigator/researcher directly in person or by calling her at +6567725555 and sign the attached consent form.

Will I receive feedback on the results of this research?

The results from this project will be presented during a NUH physiotherapy departmental meeting at a later date. You will be informed of the date, time and location of this presentation. In addition, you can indicate your request on the consent form to receive a copy of the research report from the principal investigator/researcher when the project has been completed.

What do I do if I have concerns about this research?

If you have any complaints about this research study, you may contact the Principal Investigator
Ms Khoo Lin Shan Melissa
Physiotherapist
National University Hospital
5 Lower Kent Ridge Road Singapore 119074
Telephone: 6772 5555

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Julie Reeve, *julie.reeve@aut.ac.nz*, +6409921999 ext 7085.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Madeline Banda, *madeline.banda@aut.ac.nz* , +64099219999 ext 8044.

If you want an independent opinion of your rights as a research subject you may contact the NHG Domain Specific Review Board Secretariat at +6564713266.

If you have any complaints about this research study, you may contact the Principal Investigator or the NHG Domain Specific Review Board Secretariat.

The study has been reviewed by the NHG Domain Specific Review Board (the central ethics committee) and Auckland University of Technology Ethics Committee for ethics approval. Approved by the Auckland University of Technology Ethics Committee on*7/4/2011*, AUTEC Reference number *10/248*

Appendix 11: Participant consent form

Consent Form

Protocol Title:

The development of a high fidelity simulation programme to improve physiotherapists' self assessed skills and confidence during treatment of critically ill patients

Principal Investigator (NUHS) / Researcher (AUT) & Contact Details:

Khoo Lin Shan Melissa

5 Lower Kent Ridge Road

Singapore 119074

Telephone: 6772 5555

Hand phone: +6598389746

Co-investigator(NUHS)/ Project Supervisor (AUT) & Contact Details:

Julie Reeve (Dr)

Senior Lecturer

90 Akoranga Drive
Northcote
North Shore City 0627
New Zealand

Tick	Statements
	I have fully read, discussed and understood the information provided about the purpose and procedures of this research project in the Participant Information Sheet dated 23/12/2010
	I have had an opportunity and time to ask questions that I have about the study and to have them answered to my satisfaction
	I understand that my participation in this project will not affect my employment status or work evaluation
	I understand that there will not be any advantages or disadvantages (monetary or work) as a result of my participation in this project
	I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way
	I understand that my workgroup leader will be notified of my participation in this study in order for me to be able to attend the simulation programme during working hours. However, I understand that my performance, the discussion topics during the simulation programme and my responses in the questionnaires will be kept strictly confidential and will not be made known to any other person other than the researcher.
	I understand that my responses provided in the 2 sets of questionnaires will be coded for comparison but will remain anonymous to the researcher and will not be able to identify me in anyway
	I am aware that the researcher will be able to identify me during the simulated case study. I also understand that my performance as well as the discussion topics during the programme will be kept strictly confidential
	I am aware that there will be no further discussion with me about my performance , topic of the debrief session or responses other than during the simulation programme
	I am aware that the coded but anonymous procedural checklist used during my simulated case study will be returned to me. I understand that a copy of this procedural checklist will be for data analysis and will not be able to identify me in any way. However, due to the small sample size in this study, I understand that there is a possibility that the researcher might still be able to identify me. If this occurs, I understand that the researcher will maintain the confidentiality of the data provided by the procedural checklist
	The potential risks and benefits of my participation in this project have been adequately explained to me.
	I voluntarily consent to take part in this research project

	I have been provided a copy of this consent form
	I wish to receive a copy of the report from the research (Please tick one): Yes○ No○

_____ _____
Name of Participant Signature Date

Contact work email address: _____

Investigator Statement

I, the undersigned, certify that I explained the study to the participant and to the best of my knowledge the participant signing this informed consent form clearly understands the nature, risks and benefits of her participation in the study.

_____ _____
Name of Investigator / Person administering consent Signature Date

Approved by the Auckland University of Technology Ethics Committee on AUTEC Reference number 10/248

Approved by National Healthcare Group Domain Specific Review Board (DSRB) NHG DSRB Reference number *D/10/657*

Appendix 12: Ethics approval letters

MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To:	Julie Reeve
From:	**Madeline Banda** Executive Secretary, AUTEC
Date:	7 April 2011
Subject:	Ethics Application Number 10/248 **The development of a high fidelity simulation training programme to improve physiotherapists' self assessed skills and confidence during treatment of critically ill patients.**

Dear Julie

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 8 November 2010 and that on 3 February 2011, I approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 9 May 2011.

Your ethics application is approved for a period of three years until 3 February 2014.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through http://www.aut.ac.nz/research/research-ethics/ethics. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 3 February 2014;
- A brief report on the status of the project using form EA3, which is available online through http://www.aut.ac.nz/research/research-ethics/ethics. This report is to be submitted either when the approval expires on 3 February 2014 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this. Also, if your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply within that jurisdiction.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at ethics@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of AUTEC and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Lin Shan Melissa Khoo Khoo_melissa@hotmail.com,

National Healthcare Group
Adding years of healthy life

6 Commonwealth Lane
Level 6 GMTI Building
Singapore 149547
Tel: 6496 6600 Fax: 6496 6870
www.nhg.com.sg
RCB No. 200002150H

DSRB Ref: D/10/657

23 December 2010

Ms Khoo Lin Shan, Melissa
Department of Physiotherapy
National University Hospital

Dear Ms Khoo

NHG DOMAIN-SPECIFIC REVIEW BOARD (DSRB) APPROVAL

Project Title: The development of a high fidelity simulation training programme to improve physiotherapists' self assessed skills and confidence during treatment of critically ill patients

We are pleased to inform you that the NHG Domain Specific Review Board has approved the above research project to be conducted in National University Hospital.

The documents reviewed are:

a) Complete Application Form: The development of a high fidelity simulation training programme to improve physiotherapists' self assessed skills and confidence during treatment of critically ill patients, **Version 1 dated 23/12/2010**
b) Participant Information Sheet and Consent Form: **Version 3 dated 23/12/2010**
c) Physiotherapy Self Assessed Competency Questionnaire: **Version 3 dated 23/12/2010**
d) Pre Simulation Questionnaire: **Version 3 dated 23/12/2010**
e) Post Simulation Questionnaire: **Version 1 dated 14/10/2010**
f) Poster (An invitation to all NUHS Physiotherapists): **Version 2 dated 16/10/2010**
g) Questions accompanying Case Study One: **Version 1 dated 15/10/2010**
h) Questions accompanying Case Study Two: **Version 1 dated 15/10/2010**
i) Procedural Checklist Case Study One: **Version 1 dated 15/10/2010**
j) Procedural Checklist Case Study Two: **Version 1 dated 15/10/2010**
k) Study Process: **Version 1 dated 11/10/2010**
l) Objectives of Case Study One: **Version 1 dated 15/10/2010**
m) Objectives of Case Study Two: **Version 1 dated 15/10/2010**
n) Email Letter of Invitation: **Version 1 dated 15/10/2010**
o) Simulation Process for Case Study One: **Version 1 dated 15/10/2010**
p) Simulation Process for Case Study Two: **Version 1 dated 15/10/2010**
q) Case Study One: **Version 1 dated 15/10/2010**
r) Case Study Two: **Version 1 dated 15/10/2010**

National Healthcare Group

DSRB Ref: D/10/657

The approval period is from **23 December 2010** to **22 December 2011**. The reference number for this study is **DSRB-D/10/657**. Please use this reference number for all future correspondence.

Continued approval is conditional upon your compliance with the following requirements:

1. Only the approved Participant Information Sheet and Consent Form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject should be given a copy of the signed consent form.

2. No deviation from, or changes of the protocol should be implemented without documented approval from the NHG DSRB, except where necessary to eliminate apparent immediate hazard(s) to the study subjects, or when the change(s) involves only logistical or administrative aspects of the trial (e.g. change of monitor or telephone number).

3. Any deviation from, or a change of, the protocol to eliminate an immediate hazard should be promptly reported to the NHG DSRB within seven calendar days.

4. Please submit the following to the NHG DSRB:

   a. All unanticipated problems involving risk to subjects or others should be reported. In order to assist the DSRB, all reports should be accompanied by the NHG DSRB Unanticipated Problems Involving Risk to Subjects or Others Reporting Form. Please find all forms and guidelines on reporting on the internet at www.research.nhg.com.sg.

   b. Report(s) on any new information that may adversely affect the safety of the subject or the conduct of the study.

   c. NHG DSRB Project Status Report Form – this is to be submitted 4 to 6 weeks prior to expiry of the approval period. The study cannot continue beyond **22 December 2011** until approval is renewed by the NHG DSRB.

   d. Study completion – this is to be submitted using the NHG DSRB Project Status Report Form within 4 to 6 weeks of study completion or termination.

5. The NHG Research QA Program was launched in May 2006. The program aims to promote responsible conduct of research in a research culture with high ethical standards, and to identify potential systemic weaknesses and make recommendations for continual improvement. This research project may be randomly selected for completion of self assessment worksheet or for a study review by the QA team. For more information please visit www.research.nhg.com.sg.

National Healthcare Group

DSRB Ref: D/10/657

Yours sincerely,

A/Prof Low Yin Peng
Chairman
Domain Specific Review Board D
National Healthcare Group

Cc: Institution Representative, NUH
Department Representative, NUH

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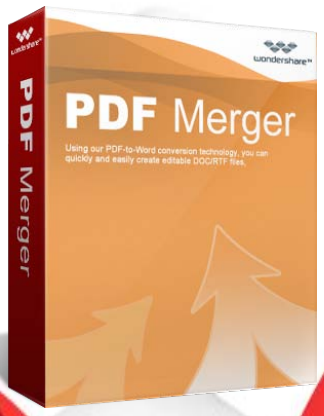

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Student's Name	Khoo Lin Shan Melissa	**Student ID No**	0955883
Degree	Masters of Health Practice (Rehabilitation)	**Year of submission (for examination)**	2011

Thesis ☐ **Dissertation** ☒ **Exegesis** ☐ **Points Value** 60

Title Using a high fidelity simulation programme to increase the self assessed competence and confidence of physiotherapists when treating critically ill patients – A preliminary investigation

DECLARATION

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Student's Signature Melissa **Date** 16/11/2011