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Artikel Ulasan/*Review Article*

Effectiveness of Debriefing towards Healthcare Professionals' Nontechnical Skills: A Critical Review

Keberkesanan Ulasan terhadap Penguasaan Kemahiran Bukan Teknikal dalam Kalangan Profesion Kesihatan: Satu Tinjauan Kritikal

MUHAMAD NUR FARIDUDDIN, WEE LEI HUM, LILIA HALIM & MOHD JOHAR JAAFAR

ABSTRACT

The importance of nontechnical skills among healthcare professionals is gaining widespread recognition as critical elements complementing technical skills that are used to improve patients' safety. These skills are typically acquired through simulation training which has emerged as an effective way to complement clinical training. Effective simulation requires structure and effective debriefing methods to enhance its learning outcome. In previous literature, evidence of the effectiveness of healthcare simulation was available but studies evaluating debriefing method(s) remain sparse. In this paper, the effectiveness of debriefing methods in eight studies on the acquisition of nontechnical skills among healthcare professionals is reviewed. Articles published from 1st January 2016 across three different databases were referred to. The results of the review show a statistically significant improvement in the performance of nontechnical and technical skills across different professionals through various methods of debriefing. Nontechnical skills such as teamwork, effective communication, decision-making, and situational awareness have improved significantly. In addition, integration of realism in simulation learning has begun to emerge as an effective technique of providing a real world experience. However, there was lack of detailed information on the length and type of debriefing conducted in the studies. These methods clearly require further research since the key to successful simulation learning is through debriefing which is the heart of simulation.

Keywords: Debriefing; nontechnical skills; healthcare professionals; critical review; simulation learning

ABSTRAK

Kepentingan kemahiran bukan teknikal bagi golongan profesional di dalam bidang penjagaan kesihatan telah berkembang dengan pesat dan mula mendapat pengiktirafan sebagai salah satu elemen kritikal yang menyumbang terhadap peningkatan keselamatan pesakit. Kemahiran ini yang seringkali dikuasai menerusi pembelajaran berasaskan simulasi, kini telah berkembang sebagai salah satu kaedah tambahan yang berkesan serta pelengkap kepada latihan klinikal. Simulasi yang berkesan memerlukan ulasan berstruktur bagi memastikan objektif pembelajaran dapat dicapai. Di dalam tinjauan literatur yang lepas, keberkesanan ulasan di dalam pembelajaran simulasi bagi bidang penjagaan kesihatan telah dibuktikan dengan jelas, namun begitu masih terdapat kelompangan dari sudut kaedah ulasan yang dilaksanakan. Artikel ini mengulas tentang keberkesanan kaedah ulasan terhadap penguasaan kemahiran bukan teknikal dalam kalangan profesional bagi bidang penjagaan kesihatan menerusi lapan artikel yang diterbitkan bermula dari 1 Januari 2016 dengan menggunakan tiga pangkalan data yang berbeza. Terdapat peningkatan yang signifikan dari segi prestasi kemahiran teknikal dan bukan teknikal bagi kesemua golongan profesional menerusi kaedah ulasan yang dilaksanakan. Elemen seperti kerjasama berkumpulan, komunikasi berkesan, kemahiran membuat keputusan serta kesedaran persekitaran turut meningkat secara signifikan. Sebagai tambahan, elemen realiti yang mula diintegrasikan di dalam pembelajaran simulasi telah mula berkembang sebagai salah satu teknik berkesan dalam memberikan pengalaman sebenar di dalam dunia pekerjaan. Namun begitu, maklumat yang kurang jelas dari sudut tempoh dan kaedah ulasan yang dilaksanakan merupakan isu penting yang perlu ditekankan di dalam kajian lanjutan memandangkan keberkesanan pembelajaran simulasi adalah menerusi pelaksanaan ulasan yang berkesan.

Kata Kunci: Ulasan; kemahiran bukan teknikal; tinjauan kritikal; penjagaan kesihatan; pembelajaran simulasi

INTRODUCTION

Human knowledge, technology, and organizations play a major role in patient safety. Over the years, while organizational changes and advances in technology have improved patient safety, indicators such as health professionals' medical expertise, technical abilities, and nontechnical skills (NTS) have also played major roles in improving patient safety (Sevdalis et al. 2012). Generally, healthcare professionals are trained in silos associated with medical knowledge and technical skills, often neglecting the importance of nontechnical skills as these are rarely taught in the curriculum. Nevertheless, these nontechnical skills are expected to be attained since they are indeed needed for clinical work (Rasmussen et al. 2012). Nontechnical skills, or also known as cognitive, social, and personal resource skills which complement technical skills, are skills which directly contribute towards safe and efficient task performance (Flin et al. 2008). Training of nontechnical skills was first introduced as a crisis resource management (CRM) course in healthcare industries which addresses the importance of human factor issues and introduces ways to improve patient safety via team building skills and individual cognitive ability (Gaba et al. 1998). As of date, this training has successfully improved individuals' or team members' performance in terms of communication, teamwork, and technical skills, especially in the operating room (Neily et al. 2010).

Although there is evidence to support the need to train healthcare professionals on nontechnical skills in order to improve patient safety, the implementation of training and assessment of nontechnical skills has been slow. The poor implementation might be due to lack of shared understanding of the underlying concepts (Flin & Patey 2011). Apart from clinical training, training using high-fidelity simulation has emerged as an effective way of complementing nontechnical skill training of healthcare professionals (Issenberg et al. 2005). The use of simulation over the decades, beginning with low fidelity mannequins, has evolved to high fidelity simulations to date. Debriefing, which is also known as the heart of simulation learning is considered by experts to be an integral and critical part of simulation learning experiences (Shinnick et al. 2011 & Arafeh et al. 2010). The debriefing approach following the simulation learning in healthcare is aimed to improve learning, future performance and ultimately patient safety. This outcome is achieved by providing an opportunity to clarify a learner's knowledge and rationale for each action during a simulation experience (McGaghie et al. 2010).

Evidence suggests that various debriefing approaches have been developed with little evidence of their effectiveness. Some studies suggest that debriefing should occur immediately after simulation (Cantrell 2008; Decker 2007; Flanagan 2008). On the other hand, a structured debriefing with prompt questions specifically developed to guide faculty members to facilitate discussion on certain criteria such as nontechnical skills are highly suggested in simulation learning to ensure the acquisition of nontechnical skills (Peter et al. 2015). Besides, there are conflicting views regarding the ideal length of debriefing, with some proposing that it should be typically three times longer than the length of a scenario (Arafah et al. 2010) and others limiting it to several minutes (Cantrell 2008).

As such, the aims of the review are to 1) examine current practices of using debriefing following simulation learning for healthcare professionals; and 2) evaluate the up to date evidence on the effectiveness of debriefing to enhance the acquisition of nontechnical skills (NTS).

DEFINITION OF SIMULATION ACTIVITY

The authors used the definition based upon that proposed by Lopreiato (2016), Healthcare Simulation Dictionary (Table 1), which defined the standard terms used in Healthcare Simulation.

TABLE 1. A definition of simulation activity adapted from Healthcare Simulation Dictionary

Term	Definition
Technical Skills	The knowledge, skill and ability to accomplish a specific medical task, eg: inserting a chest tube or performing a physical examination
Nontechnical skills	The skill of communication, teamwork, situational awareness, decision making, resource management, safe practice, adverse event mitigation, and professionalism: also known as behavioral skills or teamwork skills
High-fidelity simulation	Simulation experiences that are extremely realistic and provide a high level of interactivity and realism for the learner
Low-fidelity mannequin	Case studies, role playing or task trainers used to support students or professionals in learning a clinical situation or practice utilizing full or partial body representation of a patient for practice
Simulation learning	An educational technique that replaces or amplifies real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner
Debriefing	To conduct a session after a simulation event where educators/instructors/facilitators and learners re-examine the simulation experience for the purpose of moving toward assimilation and accommodation of learning to future situations

METHODS

CRITERIA FOR CONSIDERING STUDIES

Primary research articles that had assessed the use of debriefing following simulation learning for healthcare professionals were eligible for inclusion. These included studies using single group pre/post, non-randomized design, randomized control trial, mixed method approach and video analysis. The outcome/measures of interest are specifically related to the performance of nontechnical skills such as communication, teamwork, decision-making and situational awareness. Any simulation study not involving healthcare professionals and those conducted in different settings such as military or aviation industries were excluded.

SEARCH STRATEGY

The electronic databases of PubMed Medline, Science Direct, and Google Scholar were searched for suitable articles published from 1st January 2016 onwards. The keywords used for the literature search included 'Debriefing.mp.' AND 'healthcare.mp' AND 'nontechnical skills.mp' [mp = title, abstract, subject heading].

DATA EXTRACTION

Two independent reviewers assessed the selected articles to ensure their eligibility based on the selection criteria. A coding sheet focusing on the relevant parameters was developed, which described the methodology used in the research, participants of each research, types of simulation and debriefing used, outcomes and results.

RESULTS

The keyword search yielded 741 articles from three different databases. After removing 15 duplicated articles, 726 articles remained. Their titles and abstracts were screened according to the criteria for considering studies as mentioned above, and 692 articles were excluded. Of the remaining 34 articles, 20 articles were excluded in which 19 of them were review articles and a plain abstract. The remaining 14 articles were retrieved for detailed examination. Six articles were excluded following thorough assessment whereby three papers were not specifically measuring nontechnical skill outcomes, while the remaining articles focused on the assessment tools used to measure nontechnical skills. Finally, eight articles were included in this review. There were six quantitative studies, whereas the remaining were qualitative and mixed method as summarized in the respective tables. The details of the selection process are presented in the PRISMA flow chart (Figure 1).

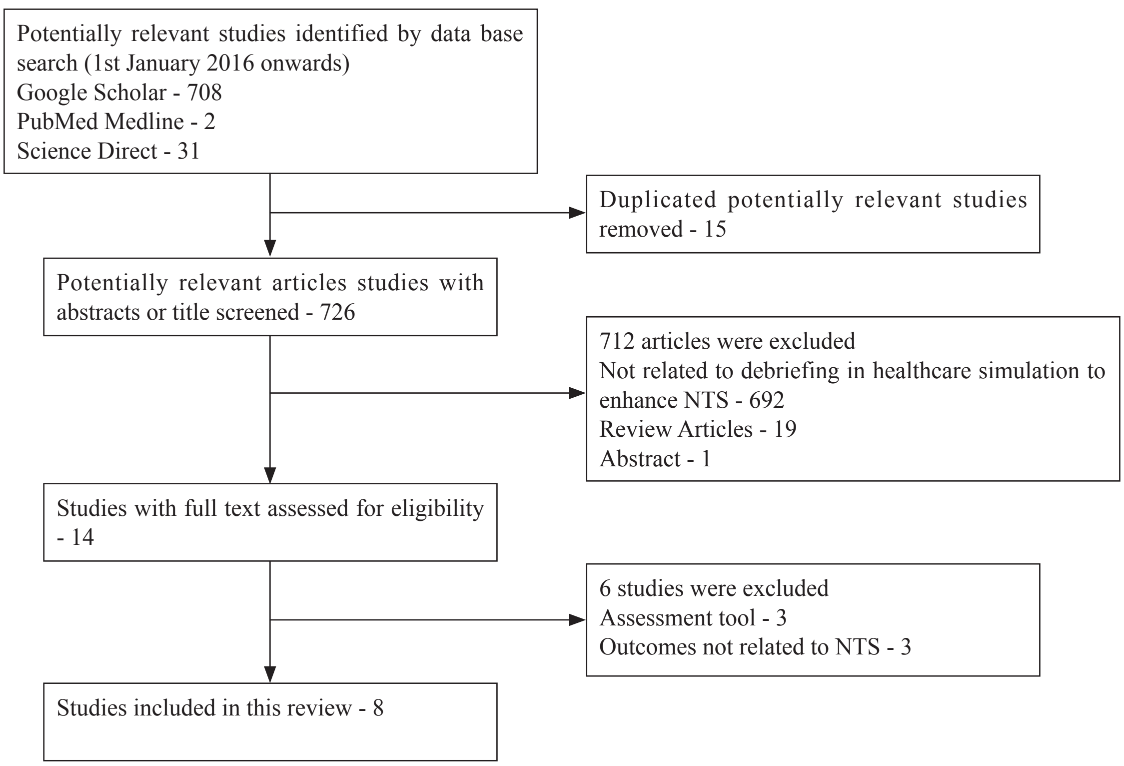

FIGURE 1. Study selection flow diagram

STUDY DESIGN

Four randomized controlled trials (RCTs) (Skelton et al. 2016; Ghazali et al. 2016; Nicolas et al. 2016; Sayaka et al. 2016), one non-randomized controlled trial (Nicolas et al. 2016), one basic simulation and debriefing (Markus et al. 2016), one mixed method approach (Jorm et al. 2016) and a video recording analysis (Dimitrios et al. 2016) were included in the review.

PARTICIPANT

All of the reviewed studies used convenience sampling of healthcare professionals and health professional students as follows:

a. Inter-professionals (medical and nursing students) (Markus et al. 2016) and emergency physician, resident, nurse, and ambulance driver (Ghazali et al. 2016)
b. Students (Postgraduate Year 1) (Sayaka et al. 2016) and 2nd Year Medical Students (Jorm et al. 2016)
c. Anaesthesia (Skelton et al. 2016)
d. Surgical residents (Nicolas et al. 2016; Nicolas et al. 2016)
e. General surgeon & Gynaecologist (Dimitrios et al. 2016)

LOCATION

The included studies were conducted in the following countries:

a. Canada (Skelton et al. 2016; Nicolas et al. 2016; Nicolas et al. 2016)
b. Germany (Markus et al. 2016)
c. France (Ghazali et al. 2016)
d. Hawaii (Sayaka et al. 2016)
e. Australia (Jorm et al. 2016)
f. United States of America (Dimitrios et al. 2016)

DEBRIEFING CHARACTERISTICS

All of the studies involved simulation learning followed by debriefing except the study by Nicolas et al. (2016) which utilized actual surgical procedures to analyse deficiencies of performance of nontechnical skills. In two studies, the simulation learning was conducted as part of the training curriculum for the experimental group. Skelton et al. (2016) applied two simulated low-cost high psychological fidelity simulations focusing on ANTS themes which were conducted in a group of four in a total of three hours for the entire session. As for Nicolas et al. (2016), a total of four high fidelity crisis scenario simulations were randomly assigned as part of the training curriculum with the entire course conducted for five days over the period of two months. Participants in both studies received debriefing immediately after the simulation. No further information was given in the articles regarding the type or length of debriefing conducted.

Other studies (Jorm et al. 2016 & Markus et al. 2016) utilized shorter debriefing (15-30 mins) in terms of duration for a simulation that was conducted for 45-50 mins each without any specific type of debriefing method mentioned. Dimitrios et al. (2016) and Ghazali et al. (2016) conducted debriefing in two sessions with shorter periods for individuals (10 mins) followed by 15 mins for group debriefing (Dimitrios et al. 2016) and 15 mins for normal debriefing, followed by debriefing with good judgment (30-45 mins) for the entire team (Ghazali et al. 2016). Only Sayaka et al. (2016) practiced the appropriate length of debriefing which was 15-20 mins for a five-minute simulation session. As for Nicolas et al. (2016), a 20-40 mins debriefing was conducted based on the performance reflected on the recorded surgery conducted in the operating room.

OUTCOME ASSESSMENT

The primary debriefing outcomes were nontechnical skills such as teamwork, decision-making, communication skills and situational awareness that can be grouped into cognitive and social skills followed by the secondary outcome of technical skills. Three of the included studies used the Nontechnical Skills for Surgeon (NOTSS) scale (Nicolas et al. 2016 & Dimitrios et al. 2016), a most validated existing tool to rate nontechnical skills in the operating room focusing on the team performance of the surgeon (Yule et al. 2008). One study used the Anaesthesia Nontechnical Skills (ANTS) scale (Skelton et al. 2016), a validated behavioural marker used to assess nontechnical performance in an anaesthesia context. This scoring system is hierarchical and consists of four main skill categories: situational awareness, team work, decision-making, and task management. Each category of the ANTS is further subdivided into a number of elements, and for each element, a number of behavioural descriptors of good and poor performance are described. Each category is scored out of 4, with 4 being the highest score and 1 the lowest possible score.

Three other validated instruments were used, namely the Clinical Teamwork Scale (CTS) (Ghazali et al. 2016) to assess the element of nontechnical skills in teamwork, the Objective Structured Assessment of Nontechnical Skills (OSANTS) (Nicolas et al. 2016) and the Oxford Nontechnical Skills (Dimitrios et al. 2016). The remaining three studies (Jorm et al. 2016; Sayaka et al. 2016; Markus et al. 2016) used observation field notes to rate the elements of nontechnical skills such as collaboration, negotiation, and teamwork in a large mass scale of disaster, Team Performance Assessment (TPA) and Self Performance Assessment (SPA) for teamwork and feedback in the form of questionnaire to rate the success of inter-professional communication and teamwork in a simulated context, respectively. A detailed summary of the characteristics of the reviewed studies including all the results is given in Tables 2 and 3.

RESULTS OF THE REVIEW

With the range of debriefing methods used and wide variation in the assessment of the outcomes on nontechnical skills, the findings and outcomes are presented according to the method and duration of debriefing used.

GROUP VERSUS INDIVIDUAL DEBRIEFING

In all the studies included in this review, six (Skelton et al. 2016; Markus et al. 2016; Ghazali et al. 2016; Nicolas et al. 2016; Sayaka et al. 2016; Jorm et al. 2016) illustrated the effectiveness of group debriefing on the acquisition of nontechnical skills across healthcare professionals. In Skelton et al. (2016) and Nicolas et al. (2016), the debriefing was conducted in an intervention group which received simulation learning incorporated with nontechnical skills as part of the teaching curriculum. The three-hour session that includes two simulated scenarios followed by debriefing was conducted in a group of three to four anaesthesia participants focusing on the ANTS themes. The result demonstrated that the intervention group showed a significant increase in each of the ANTS element, while teamwork has the greatest scores compared to other elements (Skelton et al. 2016). As for Nicolas et al. (2016), the designated nontechnical skills curriculum introduced to the intervention group which consists of five-day courses over a two-month period has successfully improved the scores of NOTSS and OSANTS significantly through the assessment of high fidelity simulated crisis scenarios. However, there were no specific details given on the length of simulation as well as duration of debriefing conducted in both studies.

Two studies assessed the effects of simulation learning among inter-professionals. Markus et al. (2016) conducted a study on nursing and 5th-year medical students using a simulated scenario of a patient's fall recorded in three phases, each for 45 minutes followed by 15 minutes of debriefing. There were no specific types of debriefing model used but the elements of the Debriefing Assessment of Simulation in Healthcare (DASH) served as guidelines for the debriefer. This joint training successfully increased the scores of inter-professional communication and teamwork which helps students utilise these skills into their routine work. In a clinical trial by Ghazali et al. (2016), multidisciplinary professionals (emergency physician, resident, nurse, and ambulance driver) underwent a simulated scenario of an infant shock which lasted for 25 to 30 minutes followed by 15 minutes of general debriefing and 30 to 45 minutes of debriefing with good judgment. The scenario resulted in an increase in teamwork scores and leadership among professionals.

An RCT study by Sayaka et al. (2016) evaluated the effects between using a facilitator and self-debriefing on the team and self-assessment performance of 57 1st year postgraduate residents on four simulated case scenarios based on the NOC curriculum. Each case was limited to five minutes, followed by immediate debriefing that lasted for 15 to 20 minutes. The results demonstrated that team performance requires a facilitator to guide the debriefing process. A large mass casualty simulation study by Jorm et al. (2016) utilized earthquake simulations in a total of eight clustered disasters on 117 2nd year medical students. The simulation was conducted for 50 minutes in four different stages followed by 50 minutes of debriefing session. The large scale mass was an effective teaching model to teach nontechnical skills such as collaboration between inter-professionals, negotiation, and effective communication, and is suitable for medical disaster prone areas.

An individual debriefing was conducted in two studies (Dimitrios et al. 2016 & Nicolas et al. 2016) that had utilized videotaped surgical procedures in the operating room instead of simulation learning to assess deficiencies in surgeon performance. A surgical educator study by Nicolas et al. (2016) analysed 11 individual surgical residents for surgical performance specifically on the elements of nontechnical skills. An intervention was administered in the form of debriefing and a feedback session ranging from 20 to 40 minutes was conducted individually. A significant increase of residents' nontechnical skills performance was observed after the debriefing sessions. The study by Dimitrios et al. (2016) reported that nontechnical skills such as situational awareness, ergonomic position, handling of distraction and delays showed an improvement after the coaching sessions which were conducted for 4.5 hours in total, including 2 hours of simulation sessions. These simulations consisted of three technical simulations of 30 minutes each and a 15 minutes nontechnical simulation followed by 10 minutes of debriefing session conducted individually on 32 surgeons.

DEBRIEFING DURATION

Time allocation is an important element in debriefing. Six studies (75%) discussed or reported the duration of debriefing and the details are shown in Tables 1 and 2, respectively. Four studies examined this issue using a quantitative approach with the remaining two using a qualitative and mix method approach. Studies by Markus et al. (2016), Nicolas et al. (2016) Jorm et al. (2016), and Dimitrios et al. (2016) used a shorter debriefing session than the amount of time spent on conducting the simulation case scenario. Even though each session conducted showed a significant improvement on its nontechnical skills outcome, knowledge building dialogue was limited and this will leave students with the feeling of having unfinished work. Apart from that, there was no suggestion made on the amount of time required for each

TABLE 2. Design summary of the quantitative studies that assessed the use of simulation debriefing in healthcare

Author(s), Year/Country	Methodology	Participants Groups (Sample Size)	Details of Simulation Scenario	Outcomes	Results
Skelton et al. (2016), Canada & Rwanda	Randomized Controlled Trial	Anesthesia Providers ($N = 20$) Control Group – no ANTS training ($n = 10$) Experimental Group ANTS training ($n = 10$).	ANTS training involving 3-4 participants in a group conducted for 3 hours. 2 simulated scenarios followed by debriefing session. No details on length of debriefing or scenarios.	Nontechnical Skills (NTS) such as Task Management, Teamwork, Situation Awareness & Decision Making was evaluated by using ANTS scales.	• Statistically significant in improvement of NTS between Control & Experimental Group ($p = 0.002$) • Statistically significant increase in simulation group (pre/post) ~ ($p = 0.005$) • Teamwork shows the most improvement. • Low cost simulation can be effective for teaching ANTS.
Markus et al. (2016), Germany	Basic Simulation Debriefing	Nursing Students ($n = 2$) 5th Year Medical Students ($n = 8$)	A case scenario divided into 3 phases each with 45 minutes of simulation followed by 15 minutes of debriefing sessions.	Feedback from questionnaire Cooperation between interprofessionals Communication, Teamwork and Simulation as a teaching method	• Descriptive analysis of (Mean) and (SD) value of team training of 2 professional group courses were given as an average score. • Joint training session provide the chances to integrate the non technical skills into routine daily work.
Ghazali et al. (2016), France	Randomized Controlled Trial	12 teams of multidisciplinary ($N = 48$), each team consist of emergency physician, resident, nurse & ambulance driver ($n = 4$) Control Group = 6 teams Experimental Group = 6 teams	Repeated scenario incorporated with 3 fidelity ranging from 25-30 minutes followed by 15 minutes of debriefing & 25-30 minutes of debriefing with Good Judgment	• Clinical performance ~ Team Average Performance Assessment Scale (*TAPAS*) • Nontechnical Skills ~ The Clinical Teamwork Scale (CTS) & Crisis Resource Management (CRM) & Behavioral Assessment Tool (BAT) • Stress Assessment ~ Stress – O – Meter (SOM) & State-Trait Anxiety Inventory (STAI) • Post Traumatic Stress Disorder ~ Impact of Event Scale Revised (IES-R) & Post Traumatic Check List Scale (PCLS)	Clinical Trial – estimated completion on September 2016.
Nicolas et al. (2016), Canada	Non Randomized Single Blinded Trial	Surgical Residents ($N = 11$)	No simulation was conducted. Actual surgery was conducted in the Operating Room (OR) and was observed by surgeon educator. An individual debriefing ranging from 20-40 minutes was conducted as part of the intervention	• Nontechnical Skills for Surgeon (NOTSS) • Perceived Quality of Debriefing (participants)	• Score of NOTSS improve significantly from 3.2 (SD = 0.37) to 3.5 (SD = 0.43) after the intervention [t (10) = -.2.25, $p = 0.029$] • Effect size, $d = 0.74$ • Improvement of resident NTS performance was observed after a single session of debriefing.
Nicolas et al. (2016), Canada	Randomized Controlled Trial	Surgical Residents ($N = 22$) Conventional Group ($n = 11$) Intervention Group ($n = 11$) ~ additional structured NTS curriculum/5 days courses (105 minutes each)	4 crisis scenarios randomly assigned at Base Line (BL) & Post Training (PT) followed by immediate feedback on each scenario but none was focusing on NTS elements.	• Score of NOTSS at BL & PT • Score of OSANTS	• Intervention Group improve significantly on NOTSS & OSANTS (from BL to PT) – ($p = 0.012$) • Mean changes was significantly higher in the intervention group for both NOTSS t (20) = 3.06, $p = .006$ & OSANTS t (20) = 3.01, $p = .007$.

Continued

TABLE 1. *Continue*

Author(s), Year/Country	Methodology	Participants Groups (Sample Size)	Details of Simulation Scenario	Outcomes	Results
Sayaka et al. (2016), Hawaii	Randomized Controlled Trial	Postgraduate Year – 1 Residents ($N = 57$) Control Group = Facilitator Debriefing ($n = 27$)/(9 teams) Intervention Group = Self Debriefing ($n = 30$)/(10 teams)	4 simulated case scenarios not exceeding 5 minutes in duration followed by immediate debriefing ranging from 15-20 minutes.	• Team Performance Assessment (TPA) • Self Performance Assessment (SPA)	• Overall TPA & SPA scores improve from pre courses ($p = 0.014$ SPA) & ($p = 0.013$ TPA) • S-DB scores are significantly higher than F-DB (TPA) • No significant differences between S-DB and F-DB (SPA) • Team performance required facilitator for debriefing

TABLE 3. Design summary of the qualitative and mixed method studies that assessed the use of simulation debriefing in healthcare

Author(s), Year/Country	Methodology	Participants Groups (Sample Size)	Details of Simulation Scenario	Outcomes	Results
Jorm et al. (2016), Australia	Mixed Method Approach	2nd Year Medical Students ($N = 117$) Group accordingly ($n = 5$)	50 minutes of large scale mass simulated earthquake progressively into 4 stages followed by 30 minutes of debriefing sessions.	Observation via field note on the aspects of NTS such as teamwork, situational awareness, clinical risk assessmen and priority of all clinical cases.	• Effectiveness of large scale mass teaching model for NTS • Elements such as collaboration, negotiation and teamwork in a simulated context (suitable for medical disaster prone areas)
Dimitrios et al. (2016), North Carolina	Video Recordings Analysis	Surgeons ($N = 32$) General Surgeons ($n = 18$) Gynecologist ($n = 14$)	2 hours of coaching curriculum consist of 30 minutes simulation for 3 different technical skills and 15 minutes simulation for 1 nontechnical skills followed by individual debriefing for 10 minutes and group debriefing for 15 minutes.	Nontechnical Skills • Oxford NTS • NOTSS • Observational teamwork assessment for surgeon Technical skills • Global objective assessment of laparoscopic skills • Global evaluative assessment of robotic skills • Competency assessment tool	Nontechnical Skills • Inappropriate handling of distraction/delays • Poor ergonomic positioning & situational awareness • Inadequate mitigation of delays Technical skills • Dissection technique • Visualization improvement

debriefing conducted. Studies by Ghazali et al. (2016), and Sayaka et al. (2016) were the only research that provided details of their debriefing sessions. Both demonstrated the appropriate duration of debriefing, ranging from 20 minutes of debriefing for a 5-minute case scenario to 40 minutes of debriefing for a 15-minute case scenario.

Overall, the above studies reported debriefing durations ranging from 15 minutes to 40 minutes. Debriefing duration does not show any significant relationship with scenario length and the ratio for debriefing to case scenario duration was around 1:5. John & Bailey (2010) proposed that the time for debriefing should not be less than 30 minutes and the purpose should be aligned with the learning objectives, level of students and complexity of skills required in the scenario. The duration of debriefing should be at least more than the scenario (Flanagan 2008). With the wide range of debriefing duration and its ratio with scenario duration, there is no strong current evidence to support the optimum duration for debriefing based on this review.

DISCUSSION

In this review, the effectiveness of debriefing was presented by illustrating different types of debriefing approaches that were used to assess nontechnical skills in different healthcare settings. Most of the simulation scenarios reflected the actual working environment specifically designed to target the acquisition of nontechnical knowledge and skills which are assessed through validated instruments that are well adapted to different healthcare settings. All of the instruments used consist of very similar categories of nontechnical skills with a few exceptions. In this discussion, instead of reflecting on the effectiveness of debriefing method and instruments used to assess the skills, the different perspectives of simulation learning, current trends and practices which would eventually and indirectly affect the outcome of simulation learning are reviewed (rather than focusing on the behavioural marker in assessing the intended skills through validated instruments).

REALISM IN SIMULATION

To achieve the intended objective in simulation learning, faculty members tend to develop simulation learning in a short framework to ensure that the targeted skills and knowledge can be successfully acquired. Unfortunately, such short framework seems unlikely to precisely fit the learning path of nontechnical skills which clearly requires more interaction in a larger group of professionals. Simulation is not a technology or tool, but a teaching technique aimed at providing a learning platform that is similar to real world experience. With the current advances in simulation technology, the presence of high fidelity simulators is questionable to educators, whether the advancement of technology alone is guaranteed sufficient enough to ensure that successful learning can be achieved by the learner and can be further applied in real world situations.

For instance, a study by Ghazali et al. (2016) utilized a short and simple case scenario such as providing shock treatment to an infant which requires successful inter-professional teamwork. While it is a less complex scenario, the element of realism was integrated into this study in which the entire simulation was conducted repeatedly over a period of time throughout the years to mimic the actual real life working experience of these professionals. First, healthcare professionals with various specialties work together in a team (ambulance driver, resident, nurse, and emergency physician) to provide care towards the patient. Secondly, in simulation learning, a trainer evaluates the successful achievement of an individual or team members through well-known validated instruments, be it technical or nontechnical skills. These validated behavioural markers require observation either directly or through a recorded video blindly segregated to certified raters to provide scores that reflect the achievement of specific skills. However, the scores achieved does not necessary reflect the successful acquisition of specific skills since there are other extraneous factors which indirectly affect the performance, but had failed to be observed through simulation learning. The effects of realism are the key answers to extraneous factors above, where repeated expose to the same case scenario for a period of time will allow the participants to expose themselves to the real life situation which is a reality in their working environment. Instead of measuring the intended skills as an indicator for successful learning, the extraneous factor should be considered as an important key towards designing an effective framework for the intended skills.

The same scenario can be observed in a study by Markus et al. (2016) which evaluated the handling of a patient's fall in a hospital. The realism of this situation allowed the collaboration between inter-professional healthcare providers to express their specialty accordingly. A simulation was designed to primarily focus on technical skills. Most debriefing sessions following simulation tend to channel professional discussion on elements that can be easily observed; the technical skills rather than the nontechnical skills. Technical skills are a priority towards patient safety; however, nontechnical skills such as effective communication, leadership quality, task management and teamwork performances among healthcare professionals are also crucial and would complement the technical skills accordingly. The element of realism in simulation learning helps bridge theory and practice together towards successful application in real world situations.

A large scale mass simulation has begun to emerge as one of the successful applications of realism in simulation as illustrated by Jorm et al. (2016). The study was conducted in Australia, utilizing an emergency situation involving an earthquake that was reported across New Zealand with different healthcare professionals working together as a team throughout this simulation which portrayed actual scenes that can be anticipated in a real earthquake situation. With the high amount of victims, chaos, limited supplies of resources on the scenes, and limitations to conduct necessary tests, the simulation provided the best platform for participants to acquire skills such as negotiation, leadership quality, setting up priorities in providing necessary treatments, and effective communication between victims and healthcare members. Without the element of realism, it is impossible to achieve a successful transition of knowledge and skills and apply them successfully into real life working experience.

All of the studies above utilized debriefing following each simulation experience. It is proven that debriefing is the heart of simulation, and the effectiveness of debriefing following simulation has been well documented. Nevertheless, of all the studies included in this review, it was clearly illustrated that debriefing was not the only element which effectively improve the acquisition of knowledge and performance of nontechnical skills among healthcare professionals.

Although most studies included in the review were conducted to highlight the importance of debriefing, the majority did not provide sufficient details about the debriefing conducted. Thus, this made it difficult to establish with certainty the strength of specific findings. Of all the studies included, the details given on the debriefing method used varied in terms of length and type of debriefing. For example, there was no evidence to support the optimum time frame for the debriefing phase of simulation experience, and whether debriefing requires less or more than the hands-on simulation component. As suggested by Jeffries & Rogers (2007), the duration for debriefing should be three times longer than the simulation conducted. Of the eight studies included, only one study (Sayaka et al. 2016) conducted a short simulation of five minutes followed by a 15 to 20 minutes debriefing session as suggested by the experts as the appropriate length. Other studies (e.g., Markus et al. 2016; Ghazali et al. 2016; Nicolas et al. 2016; Jorm et al. 2016, Dimitrios et al. 2016) conducted shorter debriefing sessions ranging from 5 to 10 minutes for simulations which lasted for more than 30 minutes. Apart from this, none of the studies mentioned the types of debriefing used; either structured, semi or unstructured or specific models targeted to debrief on certain skills, except Ghazali et al. (2016) who utilized Debriefing with Good Judgment. Therefore, it is not possible to form strong conclusions regarding the best practices or models that can be used to debrief participants on nontechnical skills, whereby the evidence to support a specific debriefing method was limited.

As such, simulation educators currently have little guidance on which of the various methods described in this review should be used. It is likely that any of the methods reviewed here can be effective if used appropriately by well trained and engaged simulation facilitators. Practically speaking, it is important to highlight that the specific debriefing method may be less important than the simple act of debriefing itself. In addition, it is very likely that there is no 'best' way to conduct a debriefing but rather various methods from which simulation educators can choose depending on the context of the simulation exercise they are conducting, as well as their own skill set and preferences. In fact, debriefers may want to try different approaches to identify which methods they find most comfortable and effective.

However, when considering which debriefing methods and model to use, the researcher would like to offer the following advice. Facilitator-guided post-event debriefing is the most commonly used and suited method for simulation debriefing (Tannenbaum & Cerasoli 2013). It improves individual and team performance in a number of contexts, while skill retention may be longer with post-event feedback (Xeroulis et al. 2007). On top of it, employing a predefined structure or model of debriefing enables the facilitator to act as a conversational guide during the debriefing. Using some types of models allow the conversation to unfold in an orderly manner, promote the efficient use of time, keep the discussion on track, and focus the conversation on important learning objectives. Without a specific model or conversation structure, the debriefing conversation is at risk of degrading into an unfocused series of comments or observations.

CONCLUSION

Although the studies in this review reported positive outcomes on the elements of nontechnical skills, the small number of studies and different approaches to the research in debriefing and simulation means that it is not possible to draw generalizable inferences and identify the best available evidence on the effectiveness of debriefing on the acquisition of nontechnical skills as it relates from low to high fidelity/simple to complex simulation-based learning for healthcare professionals. First, simulation learning integrated into the teaching curriculum is an effective teaching tool for nontechnical skills whereby successful learning can be achieved when debriefing is included as part of the simulation experience. Second, debriefing alone is sufficient enough to act as a coaching technique to provide guidance and feedback and such studies had provided evidence that the nontechnical performance of personnel had statistically and significantly increased in the studies. However, it is important to choose the appropriate type of debriefing technique to ensure that the intended objective can be achieved through successful simulation learning. These important findings provide a framework to teach nontechnical skills by highlighting the importance of debriefing apart from simulation experience alone.

IMPLICATION FOR PRACTICE

Based on the findings from a small number of studies included in this review, two recommendations can be made for practice. First, debriefing, regardless of type and length, contributes towards effective learning and it is crucial to simulation learning experiences. However, it is highly recommended that specific debriefing models are used for specific types of learning experiences as the model is developed by experts with an underlying educational theory to guide students on specific skills and knowledge. Second, realism is an important element in creating a simulation experience. Though a simulation is designed to mimic an actual setting, without the element of realism as part of the simulation, the students find it difficult to bridge knowledge and skills together and apply them to the real world. Though there are validated behavioural markers that can be used to assess the skills acquired by students through simulation, without the sense of realism in the simulation, the experiences gained are nothing more than just a regular exercise which could easily decline over time.

REFERENCES

Arafeh, J., Hansen, S. & Nicolas, A. 2010. Debriefing in simulated-based learning: Facilitating a reflective discussion. *Journal of Perinatal & Neonatal Nursing* 24: 302-309.

Cantrell, M. A. 2008. The importance of debriefing in clinical simulations. *Clinical Simulation in Nursing* 4(2): e19-e23.

Decker, S. 2007. *Integrating guided reflection into simulated learning experiences*. In: P. R. Jeffries (Ed.), Simulation in Nursing. New York: National League for Nursing, 73-85.

Dimitrios, S., Brittany, A. M., Robert, V. H., Manuel, E. P., Patrick, R., Madison, O. S. & Danelle, H. 2016. Developing a coaching mechanism for practicing surgeons. *Journal of Surgery* 160(3): 536-545.

Flanagan, B. 2008. *Debriefing: Theory and techniques*. In: R. Riley (Ed.). Manual of Simulation in Healthcare. New York: Oxford Press, 155-170.

Flin, R & Patey, R. 2011. Nontechnical skills for anesthetists: Developing and applying ANTS. *Best Practice & Research Clinical Anesthesiology* 25(2): 215-227.

Flin, R., O'Connor, P., Crichton, M. 2008. Safety at the sharp end: A guide to nontechnical skills. *Ashgate Aldershot*: 215-269.

Gaba, D. M., Howard, S. K., Flanagam, B., Smith, B.E., Fish, K. J. & Botney, R. 1998. Assessment of clinical performance during simulated crisis using both technical and behavioral ratings. *Anethesiology* 89: 8-18.

Ghazali, D. A., Stephanie, R., Cyril, B., Youcef, G., Amelie, B. V., Franck, P. & Denis, O. 2016. Randomized controlled trial of multidisciplinary team stress and performance in immersive simulation for management of infant in shock: study protocol. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 24: 36.

Issenberg, B. S., Megaghie, W. C., Petrusa, E. R., Gordon, D. L & Scalese, R. J. 2005. Features and uses of high fidelity medical simulations that lead to effective learning: A BEME systematic review. *Journal of Medical Teacher* 27(1): 10-28.

Jeffries, P. R. & Rogers, K. J. 2007. *Theoretical framework for simulation design*. In P. R. Jeffries (Ed.), Simulation in Nursing: From conceptualization to evaluation. New York: National League for Nursing, 21-33.

Johnson, R. J. & Bailey, C. 2010. Facilitated debriefing. In W. M. Nehring & F. R. Lashley (Eds.), High-fidelity patient simulation in nursing education. Boston MA: Jones and Bartlett, 369-385.

Jorm, C., Chris, R., Renee, L., Josephine, R., Clare, S., Jeremy, R., Stacey, G. & Adam, O. 2016. A large scale mass casualty simulation to develop the nontechnical skills medical students require for collaborative teamwork. *BMC Medical Education* 16: 83.

Lopreiato, J. O. 2016. *Healthcare Simulation Dictionary*. In: M. D. Rockville (Ed.), Agency for Healthcare Research and Quality. AHRQ Publication No. 16(17)-0043.

Markus, F., Thomas, M., Bettina, H. & Jan, P. J. 2016. Simulating a patient's fall as a means to improve routine communication: Joint training for nursing and fifth year medical students. *GMS Journal for Medical Education* 33(2): Doc19.

McGaghie, W. C., Issenberg, S. B., Petrusa, E. R., Scalese, R. J. 2010. A critical review of simulation based medical education research: 2003-2009. *Journal of Medical Education* 44: 50-63.

Neily, J., Mills, P. D., Young-Xu, Y., Carney, B. T., West, P. & Berger, D. H. 2010. Association between implementation of a medical team training program and surgical mortality. *Journal of the American Medical Association* 304(15): 1693-1700.

Nicolas, J. D., Andras, B. F., Peter, S., Esther, M. B. & Teodor, P. G. 2016. Implementation of an effective strategy for teaching nontechnical skills in the operating room. A single blinded nonrandomized trial. *Annals of Surgery* 263(5): 937-941.

Nicolas, J. D., Esther, M. B., Najma, A. & Teodor, P. G. 2016. Structured training to improve nontechnical performance of junior surgical residents in the operating room. A randomized controlled trial. *Annals of Surgery* 263(1): 43-49.

Peter, J., Libby, T. & Gabriel, R. 2015. "The Diamond": a structure for simulation debrief. *The Clinical Teacher* 12: 171-175.

Rasmussen, M. B., Dieckmann, P., Isenberg, S., Ostegard, D., Seroide, E., Ringsted, C. V. 2012. Long term intended and unintended experiences after advanced life support training. *Resuscitation* 84(3): 373-377.

Sayaka, O., Benjamin, B., Joseph, T., Dale, V., Yasuhiro, M. & Deborah, B. P. 2016. Self debriefing vs. instructor debriefing in a pre-internship simulation curriculum: Night on Call. *Hawai'i Journal of Medicine & Public Health* 75(5): 127-132.

Sevdalis, N., Hull, L. & Birnbach, D. J. 2012. Improving patient safety in the operating theatre and perioperative care: Obstacles, interventions and priorities for accelerating progress. *British Journal of Anesthesia* 109(1): i3-i16.

Shinnick, M., Woo, M., Horwich, T. & Steadman, R. 2011. Debriefing: The most important component in simulation? *Clinical Simulation in Nursing* 7(3): 105-111.

Teresa, S., Isaac, N., Christian, M., Sara, W., Lauren, Z. & Patricia, L. 2016. Low cost simulation to teach anesthetists's nontechnical skills in Rwanda. *Anesthesia & Analgesia* 123(2): 474-480.

Tannenbaum, S. I. & Cerasoli, C. P. 2013. Do team and individual debriefs enhance performance? *A meta analysis*. *The Journal of the Human Factors and Ergonomics Society* 55(1): 231-245.

Xeroulis, G. J., Park, J., Moulton, C. A., Reznick, R. K., Leblanc, V. & Dubrowski, A. 2007. Teaching suturing and knot-tying skills to medical students: A randomized controlled study comparing computer-based video instruction and (concurrent and summary) expert feedback. *Journal of Surgery* 141(4): 442-449.

Muhamad Nur Fariduddin Abdul Aziz
Faculty of Education
Universiti Teknologi MARA (UiTM)
42300 Bandar Puncak Alam
Selangor Darul Ehsan, Malaysia

Wee Lei Hum
School of Healthcare Sciences
Faculty of Health Sciences
Universiti Kebangsaan Malaysia
Jalan Raja Muda Abdul Aziz
50300 Kuala Lumpur, Malaysia

Lilia Halim
Department of Methodology & Educational Practice
Faculty of Education
Universiti Kebangsaan Malaysia
43600 Bangi
Selangor Darul Ehsan, Malaysia

Mohd Johar Jaafar
Department of Emergency Medicine
Pusat Perubatan Universiti Kebangsaan Malaysia
Jalan Yaacob Latif, Bandar Tun Razak
56000 Cheras
Wilayah Persekutuan Kuala Lumpur, Malaysia

Corresponding author: Wee Lei Hum
E-mail address: weeleihum@ukm.edu.my

Tel: 03-9289 7297
Fax: 03-2694 7621

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