Universidade de Aveiro Departamento de Educação e Psicologia
Ano 2020

SARA MARTINS PEREIRA PIRES

COMPETÊNCIAS NÃO-INSTRUMENTAIS NA PRESTAÇÃO DE CUIDADOS EM SAÚDE

NON-TECHNICAL SKILLS IN HEALTHCARE

Universidade de Aveiro Departamento de Educação e Psicologia
Ano 2020

SARA MARTINS PEREIRA PIRES

COMPETÊNCIAS NÃO-INSTRUMENTAIS NA PRESTAÇÃO DE CUIDADOS EM SAÚDE

NON-TECHNICAL SKILLS IN HEALTHCARE

Tese apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Doutor em Psicologia, realizada sob a orientação científica da Doutora Sara Otília Marques Monteiro, Professora Auxiliar Convidada do Departamento de Educação e Psicologia da Universidade de Aveiro e coorientação da Doutora Anabela Maria Sousa Pereira, Professora Associada com Agregação do Departamento de Educação e Psicologia da Universidade de Aveiro.

Dedico este trabalho à minha família...

o júri

presidente

Doutor Rui Luís Andrade Aguiar
professor catedrático da Universidade de Aveiro

Doutor Feliciano Henriques Veiga
professor catedrático da Universidade de Aveiro

Doutora Aida Maria de Oliveira Cruz Mendes
professora coordenadora do Instituto Politécnico de Coimbra

Doutora Cláudia Margarida Correia Balula Chaves
professora adjunta da Escola Superior de Saúde do Instituto Politécnico de Viseu

Doutor Ricardo João Fernandes Teixeira
Investigador especialista da Clínica Médico-Psiquiátrica da Ordem

Doutora Sara Otília Marques Monteiro
Professora auxiliar convidada da Universidade de Aveiro

agradecimentos

Começo por agradecer à Professora Sara Monteiro por ter aceitado orientar este trabalho. Pelo conhecimento transmitido, pela disponibilidade e palavras de apoio, em todos os momentos, sobretudo naqueles mais difíceis.

À Professora Anabela Pereira pela experiência partilhada, pela disponibilidade e palavras de incentivo.

À Dra. Daniela Chaló por me ter desafiado a descobrir e realizar um projeto inovador. Pela confiança ao longo deste percurso. Pelas horas de trabalho partilhadas.

À Professora Elsa Melo, pela disponibilidade, apoio e dedicação ao projeto. Pelas horas de trabalho partilhadas.

À Professora Alexandra Nunes, pela colaboração e tempo dedicado. Sem a sua ajuda não teria sido possível.

À Professora Assunção Almeida e à Professora Marília Rua. Ao Professor Alexandre Rodrigues e ao Professor João Simões. Pelo valor acrescentado, enquanto especialistas em enfermagem.

Aos estudantes que se voluntariaram a partilhar o seu tempo e a participar nesta investigação, tornando-a possível. Nomeadamente, Ana Afonso, Ana Antunes, Ana Faria, Ana Gonçalves, Ana Miguel, Ana Morim, André Abreu, Carla Abreu, Carla Viana, Carina Ribeiro, Catarina Silva, Ema Salvador, Enoque Guedes, Filipe Oliveira, Geraldine Vargas, Judite Rodrigues, Maria Coelho, Ricardo Andrade, Sara Costa e Vanessa Silva.

À colega Ana Bártolo. Pela disponibilidade e ajuda.

À minha amiga Joana Stocker, por toda a paciência. Pela presença constante. Pelo trabalho. Pelo reforço positivo.

À minha família. Pai. Mãe. E aos meus amores maiores. Diogo. Gonçalo. Afonso. Por tudo...

(E por fim... à minha estrelinha... que me acompanhará sempre, e que no fundo é inspiração e exemplo do quanto “não vale” o técnico, nos momentos em que a crise se instala).

palavras-chave

competências não-instrumentais; educação; enfermagem; estudantes de enfermagem; gestão de recursos em situações de crise; saúde; simulação de alta-fidelidade.

resumo

A literatura demonstra que a maioria dos erros em saúde se deve à falta de competências não-instrumentais. Estas, são competências interpessoais e cognitivas que, treinadas em ambiente de simulação de alta-fidelidade, contribuem para potenciar um desempenho seguro e eficaz na resolução de situações clínicas diversas e adversas.

Apesar de a literatura reforçar a importância do seu treino na prevenção de erros e consequentemente na melhoria da prestação de cuidados ao doente, não existe ainda uma integração curricular efetiva e estruturada, que permita desenvolver, de forma sistemática, estas competências no ensino em saúde.

Procurando dar resposta às normativas e preocupações da Organização Mundial de Saúde, nomeadamente às questões ligadas à segurança do doente, será premente a promoção e implementação de programas de formação em competências não-instrumentais.

Neste sentido, o objetivo da presente investigação, do tipo quase-experimental, é o de promover o conhecimento e treino de estratégias de atuação na prática clínica em enfermagem através do desenvolvimento e implementação de uma ação de formação em competências não-instrumentais em contexto de simulação de alta-fidelidade a estudantes de enfermagem. Com o intuito de avaliarmos a sua eficácia foram construídos alguns instrumentos, dos quais destacamos o Questionário de Competências Não-Instrumentais.

Desta forma, de acordo com os resultados obtidos, a presente investigação constitui um contributo para a evidência científica, reforçando a importância do treino de competências não-instrumentais no aumento do conhecimento, do desempenho e da confiança na prestação de cuidados, do grupo experimental após a implementação da formação, em comparação com o grupo de controlo, tendo como principal implicação para a prática clínica a promoção da segurança do doente.

Com base na presente investigação, futuros trabalhos poderão focar-se na implementação desta formação não só a estudantes como a profissionais de saúde, nomeadamente a equipas de trabalho constituídas. Por outro lado, seria importante a integração desta temática em módulos curriculares estruturados e especializados em competências não-instrumentais no ensino de estudantes de enfermagem, e de outras áreas da saúde, na medida em que o desempenho clínico de alta qualidade envolve não só competências instrumentais, mas sobretudo competências não-instrumentais.

,

keywords

non-technical skills; education; nursing; nursing students; crisis resource management; healthcare; high-fidelity simulation.

abstract

The literature shows that healthcare errors are due to a lack of non-technical skills. Non-technical skills are interpersonal and cognitive skills, whose training in high-fidelity simulation environment, contributes to a safe and effective performance in the solution of diverse and adverse clinical situations.

Although the literature reinforces the importance of non-technical skills training in the prevention of errors and consequently in the improvement of patient care delivery, there is not yet an effective and structured curricular integration that allows to develop, in a systematic way, these competences in healthcare education.

In order to respond to World Health Organization concerns, particularly those related to patient safety issues, the promotion and implementation of non-technical skills training programs is paramount.

In this sense, the objective of this quasi-experimental investigation is to promote knowledge and training of acting strategies in clinical nursing practice, through the development and implementation of a non-technical skills training course in high-fidelity simulation context with nursing students. In order to evaluate the effectiveness of the developed course, some instruments were constructed, namely the Non-Technical Skills Assessment Scale in Nursing.

Thus, according to the results obtained, the present investigation contributes to scientific evidence, reinforcing the importance of non-technical skills training in increasing knowledge, performance and confidence in patient care delivery in the experimental group after the implementation of the course, in comparison with the control group. The main implication for clinical practice is the promotion of patient safety.

Based on the present investigation, future work may focus on the implementation of this course not only to nursing students but also to professionals in healthcare teams. On the other hand, it would be important to integrate these competences into structured and specialized curricular modules in nursing education, and in other healthcare areas, as high-quality clinical performance involves not only technical, but mainly non-technical skills.

Table of Contents

List of tables

List of figures

List of abbreviations

CRM – Crisis resource management
ESSUA – School of Health of Aveiro University
HFS – High-fidelity simulation
NTS – Non-technical skills
NTSN – Non-Technical Skills Assessment Scale in Nursing
NTSNC – Non-Technical Skills Nursing Course
SBT – Simulation-based training
SIMULA – Center for Clinical Simulation of Aveiro University

PART I STATE OF ART

Chapter 1. Introdutory notes

Patient safety is essential and the most important aspect to ensure a quality healthcare service.

In the last two decades, several studies have emphasized that hospitalized patients may be harmed as a result of errors and incidents during their care, and it is estimated that 70% to 80% of healthcare errors can be attributed to non-technical skills (NTS) failure (Andersen, Jensen, Lippert, & Ostergaard, 2010). In Portugal the prevalence of errors and injuries occurs in 10 out of 100 hospitalizations and it is estimated that about half could have been avoided (Fragata, 2010). For example, medication error is a failure in the treatment process that leads to, or has the potential to lead to, harm to patient (Irwin & Weidman, 2015). Although errors happen in each step of the medication management process, a significantly percentage of errors occur during medication administration. As they are the primary healthcare professionals administering medications to patients in the hospital, nurses play a major role in the administration of medicines (Andrew, 2014). In other hand, failure of communication, particularly those that result from inadequate handoffs between clinicians has been shown to be a common factor underlying adverse events (Liaw, Zhou, Lau, Siau, & Chan, 2014). A study by Peebles et al. (2012) reported the failure of clinicians to relay critical information to nurses which contributes to delays in administration of treatment. Other findings have suggested that difficulties in task management during nursing activities contribute to critical incidents. For example, in a surgery setting, inefficient equipment preparation can produce interruptions during intra-operative procedures that can lead to a variety of critical events (Morineaua, Chapelainb, & Quinioc, 2016).

It is important to reinforce that traditionally, healthcare professionals are trained in settings where they learn clinical knowledge and develop technical skills (Flynn, Sandaker, & Ballangrud, 2017; Jepsen, Ostergaard, & Dieckmann, 2014; Lyk-Jensen et al. 2016). Though, promoting patient safety requires more than improved guidelines and technical skills, as challenges in the treatment of patients are not due to a lack of clinical expertise (Alken et al., 2018; Andersen et al., 2010; Dieckmann, 2010; Doumouras & Engels, 2016; Irwin & Weidmann, 2015; Jung,

Borkhoff, Juni, & Grantcharov, 2018; Kothari, Khushali, & Barach, 2017; Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Ostergaard, 2014; MacLean, Kelly, Geddes, & Della, 2017; Nguyen, Elliott, Watson, & Dominguez, 2015).

Therefore, one of the most important strategies for error reduction involves prevention (Lindamood, Rachwal, Kappus, Weinstock, & Doherty, 2011), and healthcare professionals must have knowledge of threats to patient safety and experience in caring for patients when extraordinary adverse events arise (Lucas & Edwards, 2017). Thus, NTS are cognitive and interpersonal skills that require training as it proved to be a necessary equation for error reduction (Flin & Maran, 2015; Gundrosen, Solligard, & Aadahal, 2014; Lyk-Jensen et al., 2014).

The Institute of Medicine in the report on medical error and patient safety, To Err is Human: Building a Safer Health System (Kohn, Corrigan, & Donald, 2000), determined that healthcare organizations should establish team training programs for healthcare professionals in critical care settings (emergency departments, intensive care units, and surgery) using proven methods such as crisis resource management (CRM), that is a set of direct acting principles and training prototype that was adapted to healthcare, providing a simulation-based training (SBT) model for teaching NTS to healthcare professionals. Nonetheless, because of the growing awareness of the need for the development of strategies to improve patient safety, it is expected that high-fidelity simulation-based training on CRM should become a routine in all applicable healthcare settings (Gaba et al., 2001). In regard of this, there has been a growing interest in teaching NTS to healthcare students, as there is evidence that it can result in improved outcomes (Alken et al., 2018; Bamford, Langdon, Rodd, Eastaugh-Waring, & Coulston, 2018; Bierer et al., 2018; Boet et al., 2014; Boet, Reeves, & Bould, 2015; Dieckmann, Graae Zeltner, & Helso, 2016; Flin & Maran, 2015; Flynn et al., 2017; Goldenberg, Fok, Ordon, Pace, & Lee, 2017; Gordon, Fell, Box, Farrell, & Stewart, 2017; Gundrosen et al., 2014; Khan et al., 2017; Lendahls & Oscarsson, 2017; Lyk-Jensen et al., 2014; Martinou et al., 2015; Myers et al., 2016; Pires et al., 2016).

1.1. Non-technical skills

NTS training can enhance healthcare professionals understanding of roles and improve communication as these skills remain an important component to rapid response to an adverse event (Porter, Cant, & Cooper, 2018).

In order to better understand what NTS are and their relevance for healthcare, this thesis will start defining technical and NTS concepts and explaining its differences. Thereby, technical skills describe what is needed to do and know for a given safety critical task, as NTS describe how to do that task and helps understanding each professional approach to tasks, the risk and errors that can occur, and how each role can be enhanced to mitigate against risk and errors (Gordon et al., 2017). In other way, technical skills are the procedural and clinical skills that healthcare professionals apply when diagnosing, monitoring and treating patients as NTS refer to the general cognitive and interpersonal skills that allow them to, among other things, monitor the situation, make decisions, take a leadership role, communicate and coordinate their actions within a team, in order to achieve high levels of safety and efficiency (Kodate, Ross, Anderson, & Flin, 2012).

In this sense, NTS are cognitive (decision-making, situation-awareness) and interpersonal (communication, mutual support, leadership) skills that underpin technical proficiency (Nguyen et al., 2015) and contribute to safe, effective and efficient healthcare professionals' knowledge in task performance (Flin, O'Connor, & Crichton, 2008).

The main categories of NTS are: a) decision-making, which can be defined as the capacity for problem definition and diagnosis, considering options, selecting and communicating options, risk assessment, and implementing and reviewing decisions, and is improved by early identification of possible difficulties. Decision-making conditions can vary in relation to time pressure, task demands, feasibility of options and what level of constraint, support and resource exists for the decision-maker; b) situation awareness, as a continuous monitoring of the task, noticing what is going on and detecting any changes in the environment that refers to the team observation and awareness of ongoing processes. Some research studies have indicated how interruptions and distractions can disrupt situation awareness and can present risks for prospective memory that is, remembering to do things in future (readminister a medicine in 10 minutes for example); c) communication, which refers

to the quality and quantity of information exchanged among members of the team and is defined as the transfer or exchange of information from a sender to a receiver. More specifically, communication is a structured process whereby information is clearly and accurately conveyed to another person using a method that is known and recognized by all involved and it includes the ability to ask questions, seek clarification, and acknowledge the message was received and understood; d) mutual support, that is related to effective communication, task coordination, supporting other team members, negotiating and resolving conflicts as being the ability to anticipate and support team members' needs through accurate knowledge about their responsibilities and workload, using competences and resources in the team in the basis of a shared understanding of the situation. Mutual support skill is critical to team performance and involves team members assisting one another; providing and receiving feedback; and, exerting assertive and advocacy behaviors when patient safety is threatened, in a constructive approach to team collaboration. For example, in healthcare environment, one team members' work overload may result in fatal consequences, and mutual support can provide a safety net to help prevent errors, increase effectiveness, and minimize strain caused by work overload; and e) leadership, which refers to the provision of directions, assertiveness and support among members of the team and is the ability to maximize the activities of team members by ensuring that team actions are understood, changes in information are shared, and team members have the necessary resources to work. Though, leadership is the capacity of using authority and assertiveness, providing and maintaining standards, supporting others, planning and coordinating workload management, and coping with pressure.

1.2. Crisis resource management

As mentioned, CRM is a set of direct actions taken to prepare for, responde to, and mitigate an adverse event (Hetu, Gupta, Vu, & Tan, 2018), that emerged in 1979 in aviation industry to educate pilots and their crews about the limitations of human performance, understanding cognitive errors, behavioral analysis,

communication, conflict resolution, and decision making. In this sense, CRM provides a model for teaching NTS to healthcare professionals (Lindamood et al., 2011) that aims to create an environment of improved efficiency and safety, especially during crises (Lucas & Edwards, 2017). However, CRM begins before crisis (a disruptive event that is difficult to predict and can lead to adverse events) as all the principles that help in dealing with an acute crisis also help avoiding the crisis in the first place. Therefore, CRM is about capturing errors as soon as possible and minimizing the negative consequences of errors which have already occurred. By this perspective, CRM aims to coordinate, utilize and apply all available resources (include all people involved with all their skills, abilities and attitudes, as well as their limitations, in addition to equipment) to optimize patient safety and clinical outcomes (Rall & Dieckmann, 2005). In this regard, its necessary to learn about crisis strengths and weaknesses and improve its weaknesses and reinforce its strengths. Thereby there are tipically three objectives on CRM training, the first one is to raise awareness of NTS and its importance in healthcare; the second one, is to practice skills using exercises and high-fidelity simulation (HFS) scenarios, usually followed by feedback to enable understanding on how NTS contributed to the exercise outcomes; and, the third one, pretends the reinforcement of such skills in the workplace (Kodate et al., 2012).

Further more, the use of CRM principles has been taught to reduce erros and adverse patient outcomes and to improve professionals' performance in healthcare settings (Lucas & Edwards, 2017).

To complete, its important to present CRM acting principles: 1) know the environment (personnel and equipment); 2) anticipate and plan (prepare to avoid potential risks); 3) call for help early (know individual and team limitations and identify when these limits are approaching); 4) exercice leadership and followership (clear role assignment); 5) distribute the workload (minimize each individual's task overload); 6) mobilize all available resources (use all resources: personnel and equipment); 7) communicate effectively (clear and direct communication: confirm that orders have been received and completed); 8) use all available information (history, vital signs, physical examination); 9) prevent and manage fixation errors (obtain a second opinion, keep the worst-case scenario in mind); 10) cross (double)

check (correlate information from various sources; double check critical information); 11) use cognitive aids; 12) reevaluate repeatedly; 13) use good teamwork (a shared mental model and mutual respect by team members must be present); 14) allocate attention wisely (situational awareness allows the team to concentrate on the most important information and tasks); 15) set priorities dynamically (reassess the situation and if necessary redefine priorities) (Brown & Overly, 2016).

1.3. High-fidelity simulation

Following the patient safety directive, HFS has been demonstrated to be an effective and powerful teaching tool (Bélanger et al., 2017), as it encourages learning with the ability to rewind, rehearse, and practice without risk of harm to real patients (Lai et al., 2016). This technique uses an artificial environment, by recreating a real situation for the purpose of practicing, learning, evaluating, testing or gaining understanding of systems or human actions. Thus, HFS provides participants with a high degree of interactivity and realism. In teaching, HFS increases and promotes significant learning experiences and may reach its maximum potential if participants perceive it as legitimate, authentic and realistic.

HFS includes a realistic child or adult mannequins and monitors placed in a realistic clinical environment that interface with a computer program to project and display vital signs, voice and, sometimes, movements and mimic diverse parameters of human physiology (cardiovascular, pulmonary, metabolic, and neurological systems). With this innovative equipment, HFS can use more realistic scenarios and immediate after-action debriefing discussions which allow fully realizing and learning from the consequences of actions in ways that would not be possible in situations involving real patients (Rosenstein & O´Daniel, 2006). Properly conducted, HFS creates an ideal educational environment because learning activities can be made to be predictable, consistent, standardized, safe, and reproducible, and the opportunity to expose students to a wide variety of unique

patient types, scenarios and technical procedures is thought to better prepare them to deal with challenging events in their future practices (Bierer et al., 2018).

Beyond developing techical and NTS required for competency, the nature of HFS offers several key advantages over traditional training methods and refine their clinical skills without risk of harm to real patients, as learners can refresh or gain confidence in rare, emergency situations or risky procedures (Goldenberg et al., 2017) and several nursing schools have gradually adopted this new teaching method as an integral part of their curriculum (Baptista, Martins, Pereira, & Mazzo, 2014). In this sense, HFS is an attempt to replicate the essential aspects of a given clinical situation so that it is more readily understood and managed in clinical practice.

With this teaching strategy, students show high levels of self-esteem and self-confidence when performing procedures, an increased internalization of information and a greater satisfaction in the learning process (Baptista et al., 2014).

1.4. Objectives and Structure

According to what was previously presented, the number of errors in healthcare is extremely high. Errors do occur in healthcare as in other industries but when these errors involve the risk to human life, the concern is paramount, and NTS are described as a pre-requisite for patient safety (Yule et al., 2008). However, opportunities have been limited in integrating NTS into healthcare settings, such as nursing education (Flynn et al., 2017; Gordon, Darbyshire, & Baker, 2012; Lyk-Jensen et al., 2014; Martinou et al., 2015; Pires et al., 2016), and on how such skills can be taught and evaluated (Murray, Mckenzie, & Kelleher, 2016) as the majority of healthcare education curriculums emphasize technical skills and forget that NTS remain an important component for example in rapid responsive teams on emergency settings (Porter et al., 2018). In other way, the number of studies exploring the measurement and training of these skills in undergraduate nursing education are limited. Thus, improving NTS is a priority strategic within healthcare by improving guidelines, applying knowledge of NTS and incorporating them in HFS

training (Sevdalis, 2013), based on the premise that students will be able to integrate and replicate them effectively in the solution of real life clinical challenges.

Therefore this investigation aims to respond to safety goals and act as a prevention and improvement strategy for healthcare behaviors because although errors cannot be eliminated, efforts can be made to minimize, identify, and mitigate them by ensuring that nursing students have the appropriate skills to cope with the risks and demands of their future work (Flin & Maran, 2015) as NTS training has proved to improve professionals' performance (Irwin & Weidman, 2015) that address to prepare for, respond to, and mitigate adverse events in healthcare.

In this context, the main objective of this investigation was to reinforce the importance of NTS in healthcare in general and in nursing education in particular, and to promote knowledge and practice in NTS within CRM principles, by providing a structured methodology that can contribute to error reduction, as it may significantly improve students' performance and confidence, and can be an added value as it can help them to adjust to the complex clinical context (Bamford et al., 2018; Pires et al., 2016).

Thus, this thesis is organized in three parts in order to respond to its specific objectives:

i. State of art:

1. Introdutory notes – through literature review it was made a contextualization of the importance of NTS in healthcare as a strategy for error reduction, and the concepts of NTS, CRM, and HFS were defined and explained, in order to contribute to a better understanding of the relevance of all studies developed within the scope of this thesis, and its contribution to clinical practice. Then the thesis objectives and structure were presented.

2. Non-technical skills in undergraduate nursing education: consideration for a training course development – in this study it was carried out a systematic review of the literature in order to analyse the existence of evidence on, if and whether NTS training could improve nursing students' confidence and clinical

performance. And this will be the starting point for the development and organization of this investigation.

3. Non-technical skills assessment for prelicensure nursing students: an integrative review – in this study it was implemented an integrative review on NTS assessment instruments with validation evidence relevant for use in HFS for nursing students, once to effectively provide NTS training it is essential to have an instrument to measure these skills, to benchmark good NTS and to guide formative feedback.

ii. Empirical studies:

4. Non-technical skills assessment scale in nursing: construction, development and validation – based on the previous study results on the importance of NTS assessment and that no instrument has been published or developed and validated for the assessment of NTS of only nurses in general, relevant for use in high-fidelity simulation-based training, it was presented all the process of creation and validation of the NTSN within a 177 nursing students sample where its psychometric qualities were analysed. This instrument was developed to evaluate students' perception on NTS performance in nursing activities. In this sense, NTS measurement could be included in healthcare education or until used to ascertain needs and improvements in healthcare professional contexts.

5. Course structure – in this chapter will be presented the course structure development and a brief resume of its sessions, theoretical and practical one.

6. Non-technical skills in nursing education: effectiveness of a high-fidelity simulation-based training course – this quasi-experimental study aimed to develop, implement and evaluate the effectiveness of the HFS course focusing on NTS within a 32 nursing student's sample, and analyse its impact on their knowledge, clinical performance and confidence, in comparison with a control

group. To evaluate the course effectiveness four instruments were constructed: a sociodemographic questionnaire; the NTSN; a self-confidence questionnaire; and a satisfaction questionnaire.

iii. Conclusions:

7. Integrative conclusion – in order to integrate all studies, an integrative conclusion of the results was summarized. On the other hand, the main methodological limitations were presented as well as implications for future research.

All studies were written in English and structured according to the guidelines of the journals where they were published.

1.5. References

Alken, A., Luursema, J., Weenk, M., Yauw, S., Fluit, C., & Van Goor, H. (2018). Integrating technical and non-technical skills coaching in an acute trauma surgery team training: Is it too much? *The American Journal of Surgery, 216*(2), 369-374. doi: 10.1016/j.amjsurg.2017.08.011

Andersen, P.O., Jensen, M.K., Lippert, A., & Ostergaard, D. (2010). Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation, 81*(6), 695-702. doi: 10.1016/j.resuscitation.2010.01.024

Andrew, D. (2014). *Priorities between technical and non-technical skills training among nurses in hospital sector in Ireland* (Master's thesis, Dublin Business School and Liverpool John Moore's' University). Retrieved from https://esource.dbs.ie/bitstream/handle/10788/2094/mba_andrew_d_2014.pdf?sequence=1&isAllowed=y

Bamford, R., Langdon, L., Rodd, C.A., Eastaugh-Waring, S., & Coulston, J.E. (2018). Core trainee boot-camp: A method for improving technical and non-

technical skills of novice surgical trainees. A before and after study. *International Journal of Surgery*, *57*, 60-65. doi: 10.1016/j.ijsu.2018.03.083

Baptista, R., Martins, J., Pereira, M., & Mazzo, A. (2014). High-fidelity simulation in the nursing degree: Gains perceived by students. *Revista de Enfermagem Referência, 4*(1), 131-140. doi: 10.12707/RIII13169

Bélanger, M., Tanoubi, I., Georgescu, M., Perron, R., Robitaille, A., Charron, M., & Drolet, P. (2017). Successful management of a neck hematoma following simulation training. *Anaesthesia Critical Care & Pain Medicine, 36*(4), 237-238. doi: 10.1016/j.accpm.2017.04.003

Bierer, J., Memu, E., Leeper, R., Fortin, D., Fréchette, E., Inculet, R., & Mathaner, R. (2018). The developement of an in-situ thoracic surgery crisis simulation focused on non-technical skill training. *The Annals of Thoracic Surgery, 106*(1), 287-292. doi: 10.1016/j.athoracsur.2018.01.058

Boet, S., Bould, M., Fung, L., Qosa, H., Perrier, L., Tavares, W., … Tricco, A. (2014). Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. *Canadian Journal of Anaesthesia, 61*(6), 571–582. doi: 10.1007/s12630-014-0143-8

Boet, S., Reeves, S., & Bould, D. (2015). Call for an internationally recognized interprofissional simulation-based disease/injury independent, crisis resource management training certification. *Resuscitation, 92*, 7. doi: 10.1016/j.resuscitation.2015.03.027

Brown, L.L., & Overly, F.L. (2016). Simulation-based interprofessional team training. *Clinical Pediatric Emergency Medicine, 17*(3), 179-84. Retrieved from http://ac.els-cdn.com/S1522840116300283/1-s2.0-S1522840116300283-main.pdf

Dieckmann, P. (2010). *Simulation and Patient Safety: Connections on many levels*. Retrieved from http://www.medinfo.hacettepe.edu.tr/duyuru/SIME2010.pdf

Dieckmann, P., Graae Zeltner, L., & Helso, A. (2016). Hand-it-on: An innovative simulation on the relation of non-technical skills to healthcare. *Advances in Simulation, 1*, 1-11. doi: 10.1186/s41077-016-0031-0

Doumouras, A., & Engels, P. (2016). Early crisis nontechnical skill teaching in residency leads to long-term skill retention and improved performance during

crises: A prospective, nonrandomized controlled study. *Surgery, 161*(1), 174-181. doi: 10.1016/j.surg.2016.11.022

Flin, R., O'Connor, P., & Crichton, M. (2008). *Safety at the sharp end: A guide to non-technical skills*. Ashgate: Aldershot

Flin, R., & Maran, N. (2015). Basic concepts for crew resource management and non-technical skills. *Best Practice and Research Clinical Anaesthesiology, 29*(1), 27-39. doi: 10.1016/j.bpa.2015.02.002

Flynn, F., Sandaker, K., & Ballangrud, R. (2017). Aiming for excellence – A simulation-based study on adapting and testing an instrument for developing non-technical skills in Norwegian student nurse anaesthetists. *Nurse Education in Practice, 22*, 37-46. doi: 10.1016/j.nepr.2016.11.008

Fragata, J. (2010). Erro médico: A segurança dos doentes – indicador de qualidade em saúde. *Revista Portuguesa de Medicina Geral e Familiar, 26*(6), 564-70. doi: 10.32385/rpmgf.v26i6.10799

Gaba, D.M., Howard, S.K., Fish, K. J., Smith, B. E., & Swob, Y. A. (2001). Simulation-based training in anesthesia crisis resource management: A decade of experience. *Simulation & Gaming 32*(2), 175–193.

Goldenberg, M., Fok, K., Ordon, M., Pace, K., & Lee, J. (2017). Simulation-based laparoscopic surgery crisis resource management training – Predicting technical and non-technical skills. *Journal of Surgical Education, 75*(4), 1113-1119. doi: 10.1016/j.jsurg.2017.11.011

Gordon, M., Darbyshire, D., & Baker, P. (2012). Non-technical skills training to enhance patient safety: A systematic review. *Medical Education, 46*, 1042-1054. doi: 10.1111/j.1365-2923.2012.04343.x

Gordon, M., Fell, C., Box, H, Farrell, M., & Stewart, A. (2017). Learning health 'safety' within non-technical skills interprofessional simulation education: A quantitative study. *Medical Education Online, 22*(1). doi: 10.1080/10872981.2017.1272838

Gundrosen, S., Solligård, S., & Aadahl, P. (2014). Team competence among nurses in an intensive care unit: The feasibility of in situ simulation and assessing non-technical skills. *Intensive and Critical Care Nursing, 30*(6), 312-317. doi: 10.1016/j.iccn.2014.06.007

Hetu, S., Gupta, S., Vu, V., & Tan, G. (2018). A simulation framework for crisis management: Design and use. *Simulation Modelling Practice and Theory, 85*, 15-32. doi: 10.1016/j.simpat.2018.03.001

Irwin, A., & Weidmann, A. (2015). A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. *Research in Social and Administrative Pharmacy, 11*(5), 1-11. doi: 10.1016/j.sapharm.2014.11.006

Jepsen, R., Ostergaard, D., & Dieckmann, P. (2014). Development of instruments for assessment of individuals' and teams' non-technical skills in healthcare: A critical review. *Cognition, Technology & Work, 17*(1), 63-77. doi: 10.1007/s10111-014-0306-y

Jung, J., Borkhoff, C., Juni, P., & Grantcharov, T. (2018). Non-technical skills for surgeons (NOTSS): Critical appraisal of its measurement properties. *The American Journal of Surgery, 216*(5), 990-997. doi: 10.1016/j.amjsurg.2018.02.021

Khan, R., Scaffidi, M., Walsh, C., Lin, P., Al-Mazroui, A., Chana, B., … Grover, S. (2017). Simulation-based training of non-technical skills in colonoscopy: Protocol for a randomized controlled trial. *JMIR Research Protocols, 6*(8): e153. doi: 10.2196/resprot.7690

Kodate, N., Ross, A., Anderson, J., & Flin, R. (2012). Non-technical skills for enhancing patient safety: Achievements and future directions. *Japanese Journal of Quality and Safety Healthcare, 7*(4), 360-370

Kohn, L.T., Corrigan, J. M., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Institute of Medicine (US) Committee on Quality of Healthcare in America. Washington (DC): National Academies Press (US).

Kothari, L., Shah, G., & Barach, P. (2017). Simulation based medical education in graduate medical education training and assessment programs. *Progress in Pediatric Cardiology, 44*, 33-42. doi: 10.1016/j.ppedcard.2017.02.001

Lai, A., Haligua, A., Bould, D., Everett, T., Gale, M., Pigford, A.A., & Boet, S. (2016). Learning crisis resource management: Practicing versus an observational role in simulation training – a randomized controlled trial. *Anaesthesia Critical Care & Pain Medicine, 35*(4), 275-281. doi: 10.1016/j.accpm.2015.10.010

Lendahls, L., & Oscarsson, M. (2017). Midwifery students' experiences of simulation-and skills training. *Nurse Education Today, 50*, 12-16. doi: 10.1016/j.nedt.2016.12.005

Liaw, S., Zhou, W., Lau, T., Siau, C., & Chan, S. (2014). An interprofessional communication training using simulation to enhance safe care for deteriorating patient. *Nurse Education Today, 34*, 259-264. doi: 10.1016/j.nedt.2013.02.019

Lindamood, K., Rachwal, C., Kappus, L., Weinstock, P., & Doherty, E. (2011). Development of neonatal intensive care multidisciplinary crisis resource training program. *Newborn & Infant Nursing Reviews, 11*(1), 17–22. doi: 10.1053/j.nainr.2010.12.011

Lucas, A., & Edwards, M. (2017). Development of crisis resource management skills: A literature review. *Clinical Simulation in Nursing, 13*, 347-358. doi: 10.1016/j.ecns.2017.04.006

Lyk-Jensen, H., Jepsen, R., Spanager, L., Dieckmann, P., & Ostergaard, D. (2014). Assessing nurse anaesthetists' non-technical skills in the operating room. *Acta Anaesthesiologica Scandinavia, 58*(7), 794-801. doi: 10.1111/aas.12315

Lyk-Jensen, H.T., Dieckmann, P., Konge, L., Jepsen, R.M., Spanager, L., & Ostergaard, D. (2016). Using a structured assessment tool to evaluate nontechnical skills of nurse anesthetists. *American Association of Nurse Anesthetists Journal, 84*(2), 122-127

MacLean, S., Kelly, M., Geddes, F., & Della, P. (2017). Use of simulated patients to develop communication skills in nursing education: An integrative review. *Nurse Education Today, 48*, 90-98. doi: 10.1016/j.nedt.2016.09.018

Martinou, E., Chindambaran, R., Krishnasamy, G., Donnell, A., Vig, S., & Menon, G. (2015). Simulation in undergraduate medical education: Designing a programme to improve medical students' non-technical skills. *Abstracts / International Journal of Surgery, 23*, 15-134.

Morineaua, T., Chapelainb, P., & Quinioc, P. (2016). Task management skills and their deficiencies during care delivery in simulated medical emergency situation: A classification. *Intensive and Critical Care Nursing, 34*, 42-50. doi: 10.1016/j.iccn.2015.11.001

Murray, K., McKenzie, K., & Kelleher, M. 2016. The evaluation of a framework for measuring the non-technical ward round skills of final year nursing students: An observational study. *Nurse Education Today, 45*, 87-90. doi: 10.1016/j.nedt.2016.06.024

Myers, J., Powell, D., Psirides, A., Hathaway, K., Aldington, S., & Haney, M. (2016). Non-technical skills evaluation in the critical care air ambulance environment: Introduction of an adapted rating instrument – an observational study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 24*(24). doi: 10.1186/s13049-016-0216-5

Nguyen, N., Elliott, J., Watson, W., & Dominguez, E. (2015). Simulation improves non-technical skills performance of residents during the perioperative and intraoperative phases of surgery. *Journal of Surgical Education, 72*(5), 957-963. doi: 10.1016/j.jsurg.2015.03.005

Pires, S., Monteiro, S., Pereira, A., Chaló, D., Melo, E., & Rodrigues, A. (2016). Non-technical skills in undergraduate nursing education: Consideration for a training course development. *The European Proceedings of Social & Behavioural Sciences Eissn*, 2357-1330. doi: 10.15405/epsbs.2016.11.32.

Porter, J., Cant, R., & Cooper, S. 2018. Rating teams' non-technical skills in the emergency department: A qualitative study of nurses' experience. *International Emergency Nursing, 38*, 15-20. doi: 10.1016/j.ienj.2017.12.006

Rall, M., & Dieckmann, P. 2005. Crisis resource management to improve patient safety. *Euroanesthesia*, 107-112. Retrieved from https://www.guysandstthomas.nhs.uk/resources/education-training/sail/reading/crisis-mgt-pt-safety.pdf

Rosenstein, A., & O`Daniel, M. (2006). Impact and implications of disruptive behaviour in the perioperative arena. *Journal of the American College of Surgeons, 203*(1), 96-105. doi: 10.1016/j.jamcollsurg.2006.03.027

Sevdalis, N. (2013). *Non-technical skills and the future of teamwork in healthcare settings*. The Health Foundation Inspiring Improvement. Retrieved from http://patientsafety.health.org.uk/sites/default/files/resources/non_technical_skills_and_the_future_of_teamwork_in_healthcare_settings.pdf

Yule, S., Flin, R., Maran, N., Rowley, D., Youngson, G., & Paterson-Brown, S. (2008). Surgeons' non-technical skills in the operating room: Reliability testing of the NOTSS behavior rating system. *World Journal of Surgery, 32*(4), 548-556. doi: 10.1007/s00268-007-9320-z

Chapter 2. Non-technical skills in undergraduate nursing education: Consideration for a training course development.

Pires, S., Monteiro, S., Pereira, A., Chaló, D., Melo, E., Rodrigues, A. (2016). Non-technical skills in undergraduate nursing education: consideration for a training course development. *The European Proceedings of Social & Behavioural Sciences Eissn*, 2357-1330. doi: 10.15405/epsbs.2016.11.32.

2.1. Abstract

Until nowadays, formal training of nurses has focused predominantly on developing knowledge, clinical expertise and technical skills. These skills are necessary but not sufficient to promote and maintain high levels of patient care and safety. Therefore, although recent literature has highlighted the importance of introducing non-technical skills training and assessment within healthcare, nursing education has still to fully include these skills on the training process. International research has shown that many errors and adverse events are due to a lack of non-technical skills rather than clinical knowledge (Dieckmann, 2010; Irwin & Weidmann, 2015; Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Ostergaard, 2014). Patient safety issues and the incidence of errors are important to all healthcare professionals and public health organizations. Errors do occur in healthcare as in other industries but when these errors involve the risk to human life, the concern is paramount. Thus, one of the most important strategies for error reduction involves prevention (Lindamood, Rachwal, Kappus, Weinstock, & Doherty, 2011). In the light of this, it is essential for undergraduate nursing students to develop not only technical but also non-technical skills. Moreover, developing and implementing a non-technical skills training course may significantly improve students' performance and better prepare them for their future clinical practice. Consequently, consideration must be given in integrating NTS training into undergraduate nursing education curriculum.

2.2. Keywords

Non-Technical Skills; Nursing Education; Undergraduate Nursing Students; Patient Care and Safety; High-Fidelity Simulation; Healthcare.

2.3. Introduction

The term non-technical skills (NTS), sometimes referred to as crisis resource management (CRM), was primarily used in the aviation industry in a simulation-based safety training program known as crew resource management. This program was designed to educate pilots and their crews about the limitations of human performance, understanding cognitive errors, behavioral analysis, communication, conflict-resolution, and decision-making. The successful training prototype from aviation provided a simulation-based model for teaching NTS to healthcare professionals (Lindamood et al., 2011). NTS are the cognitive (decision-making, situation-awareness) and interpersonal (communication, teamwork, leadership) skills that underpin technical proficiency (Nguyen, Elliott, Watson, & Dominguez, 2015). These skills require training, and proved to be a necessary equation for error reduction (Flin & Maran, 2015; Gundrosen, Solligård, & Aadahl, 2014; Lyk-Jensen et al., 2014). Therefore, nurses must improve their understanding of NTS as these are described as vital for patient safety (Yule et al., 2008).

High-fidelity simulation-based (HFSB) training uses realistic scenarios and immediate after-action debriefing discussions which allow fully realizing and learning from the consequences of actions in ways that would not be possible in situations involving real patients (Rosenstein & O´Daniel, 2006). Properly conducted, HFSB creates an ideal educational environment because learning activities can be made to be predictable, consistent, standardized, safe, and reproducible. This encourages learning through experimentation and trial-and-error with the ability to rewind, rehearse, and practice without negative patient outcomes (Okuda et al., 2009), as it provides a safe place for students to practice before entering the clinical setting (Goodstone et al., 2013).

The training of not only technical but also NTS in high-fidelity simulation, is based on the premise that students will be able to integrate and replicate them together and effectively in the solution of real-life clinical challenges (Lyk-Jensen et al., 2014), as it affects knowledge, attitudes, and behaviors about team skills (Robertson et al., 2009) and have been applied extensively throughout healthcare in many specialties and procedures (Dunn et al., 2007) such as anesthesia (Gaba, Howard, Fish, Smith, & Sowb, 2001), emergency medicine (Shapiro et al., 2004), neonatal resuscitation (Thomas et al., 2007), perinatal emergencies (Freeth et al.,

2009; Nielsen et al., 2007), critical care air support (Lamb, 2007), and surgery (Chaer et al., 2006).

2.4. Problem Statement

In the last two decades, several studies have emphasized that hospitalized patients may be harmed as a result of errors and incidents during their care. It is estimated that 70% to 80% of healthcare errors can be attributed to a NTS failure (Andersen, Jensen, Lippert, & Ostergaard, 2010). Incidents are possible even when healthcare professionals are skilled and committed to their work (Sara-aho, 2015). Thus, patient safety requirements in nursing have changed the educational needs and curriculum, and NTS promotion and training is a part of quality and risk management (Sara-aho, 2015).

2.5. Research Questions

Taking into consideration what was previously mentioned, our study aimed to review the existence of evidence on, if and whether, NTS training could improve undergraduate nursing students' confidence, self-efficacy and clinical performance, as well as if its training should be integrated on undergraduate nursing curriculum.

2.6. Purpose of the Study

The study focuses on the importance of NTS training regarding errors prevention and the improvement of undergraduate nursing students' confidence, self-efficacy and clinical performance before starting their future practice. This training course development may be an added value in education for undergraduate nursing students, as shown in different studies with healthcare students and professionals. In this sense, Milligan (2007) purports that essential changes in nurse

education from the outset of their training programmes, with the inclusion of NTS, is a pre-requisite to patient safety. Therefore, our study aims to act as a prevention and improvement strategy for healthcare behaviors, because although errors cannot be eliminated, efforts can be made to minimize, identify and mitigate them by ensuring that undergraduate nursing students have appropriate skills to cope with the risks and demands of their future work (Flin & Maran, 2015).

2.7. Research Methods

A literature research was conducted to locate and review articles focusing on NTS training for undergraduate nursing education, as well as its importance for error reduction in healthcare, and impact on clinical performance and patient outcomes. Between January and December 2015, we searched online resources on PubMed Medline, Sciencedirect, ProQuest and Google Scholar databases, on such keywords as: non-technical skills; nursing education; undergraduate nursing students; patient care and safety; high-fidelity simulation; and, healthcare. The articles were selected if they referred and/or described studies on NTS training for nurses, undergraduate nursing students and/or other healthcare students and/or professionals (inclusion criteria). They were initially screened based on title and abstract. When abstracts appeared to meet the inclusion criteria, then full articles were read. The articles meeting the inclusion criteria were included in the review.

2.8. Findings

The Institute of Medicine in the report on medical error and patient safety, To Err is Human: Building a Safer Health System (Kohn, Corrigan, & Donaldson, 2000), determined that healthcare organizations should establish team training programs for professionals in critical care settings (emergency departments, intensive care units, and surgery) using proven methods such as CRM. Nonetheless, because of the growing awareness of the need for the development of strategies to improve

patient safety it is expectated that high-fidelity simulation-based training on CRM should become routine in all applicable healthcare settings (Gaba et al., 2001).

Our review found several articles referring to the importance of NTS training for healthcare and patient safety (Andersen, Jensen, Lippert, & Ostergaard, 2010; Andrews, 2014; Baker, Capella, Hawkes, Gallo, & Clinic, 2011; Boet et al., 2014; Boet, Reeves, & Bould, 2015; Briggs et al., 2015; Brunckhorst et al., 2015; Burton & Ormrod, 2011; Capella et al., 2010; Clark, 2009; Cooper, Endacott, & Cant, 2010; Cooper et al., 2010; Cooper & Cant, 2014; Dieckmann, 2010; Dunn et al., 2007; Fletcher et al., 2003; Flin, O'Connor, & Crichton, 2008; Flin & Patey, 2011; Flin & Maran, 2015; Freeth et al., 2009; Gaba et al., 2001; Garbee et al., 2013; Gillman et al., 2015; Gundrosen, Solligård, & Aadahl, 2014; Gururaja, Yang, Paige, & Chauvin, 2008; Hicks, Coke, & Li, 2009; Hull et al., 2012; Irwin & Weidmann, 2015; Jepsen, Ostergaard, & Dieckmann, 2014; Kiesewetter & Fischer, 2015; Kodate, Ross, Anderson, & Flin, 2012; Kohn, Corrigan, & Donaldson, 2000; Kutzin, 2010; Légaré el al., 2012; Lindamood et al., 2011; Lyk-Jensen et al., 2014; Martinou et al., 2015; Milligan, 2007; Mitchell & Flin, 2008; Nguyen, Elliott, Watson, & Dominguez, 2015; Paige et al., 2014; Pearson & McLafferty, 2011; Ponton-Carss, Kortbeek, & Ma, 2016; Riley et al., 2011; Roberts et al., 2014; Robertson et al., 2009; Robertson et al., 2014; Sara-aho, 2015, Sevdalis, 2013; Shapiro et al., 2004; Thomas et al., 2007; Wisborg & Manser, 2014; Yule et al., 2008; Yule & Paterson-Brown, 2012; Ziesmann et al., 2013) and/or describing studies relating to NTS training in different healthcare settings and/or for different healthcare students and/or professionals (Brunckhorst et al., 2015; Capella et al., 2010; Dunn et al., 2007; Freeth et al., 2009; Garbee et al., 2013; Gillman et al., 2015; Hull et al., 2012; Lindamood et al., 2011; Lyk-Jensen et al., 2014; Martinou et al., 2015; Nguyen, Elliott, Watson, & Dominguez, 2015; Paige et al., 2014; Riley et al., 2011; Roberts et al., 2014; Robertson et al., 2009; Thomas et al., 2007; Ziesmann et al., 2013).

All the studies found refered to NTS improvement after its training courses (Brunckhorst et al., 2015; Capella et al., 2010; Garbee et al., 2013; Hull et al., 2012; Lindamood et al., 2011; Lyk-Jensen et al., 2014; Martinou et al., 2015; Nguyen, Elliott, Watson, & Dominguez, 2015; Paige et al., 2014; Riley et al., 2011; Robertson et al., 2009; Thomas et al., 2007; Ziesmann et al., 2013). In resuscitation teams,

Thomas et al. (2007) aimed to integrate a team training and human error curriculum to the Neonatal Resuscitation Program and measure its effect on teamwork, hypothesizing and then concluding that teams that received the new course exhibited more teamwork behaviors during simulated resuscitations than others. On the other hand, Capella et al. (2010) demonstrated that strucutured simulation-based trauma resuscitation team (surgery residents, faculty, and nurses) training improves team performance, resulting in improved efficiency of patient care, proposing that formal teamwork training should be included in surgery residency training. Then, trauma team training programs have been shown to provide important education on NTS (Ziesmann et al., 2013) and the implementation of these programs has resulted in improved team performance in subsequent simulated and real-time scenarios (Capella et al., 2010; Roberts et al., 2014). Ziesmann et al. (2013) evinced that a national multidisciplinary trauma CRM curriculum is feasible, has high satisfaction among participants (surgical residents, nurses, respiratory therapists, trauma surgeons, emergency physicians, and intensivists), and can improve attitudes toward the importance of simulation and CRM principles with the ultimate goal of improving patient safety and care. Finally, the Simulated Trauma And Resuscitation Team Training (STARTT) course showed that participants (physicians, nurses and respiratory therapists) maintained high levels of satisfaction and significant improvements in CRM skills as a team as they advanced through the course (Gillman et al., 2015).

Moreover, Robertson et al. (2009) in their study with perinatal healthcare professionals (attending physicians, nurses, resident, and nurse midwives) demonstrated a positive change in their attitudes; perception of individual and team performance, and overall team performance in a simulated environment, concluding that the ability of individuals to accurately assess their performance improved as a result of training, and that the crisis team training model is applicable to obstetric emergencies.

On the other hand, Riley et al. (2011) refered to their interdisciplinary team training program using in-situ simulation as the first evidence providing a clear association between simulation training and improved patient outcomes and perinatal safety in a hospital setting, proving that didactics alone were not effective.

Also, the study on the development of the Neonatal Intensive Care Multidisciplinary Crisis Resource Training Program, was well received by those experiencing it (physicians, nurse practitioners, nurses, and respiratory therapists) (Lindamood et al., 2011).

Thus, there is general acceptance that the introduction of NTS concepts into healthcare via training, development and research has had an impact on clinical outcomes. On surgery, Hull et al. (2012) concluded that NTS can and do have an effect on surgeons' technical performance. On the other hand, in a study with undegraduate medical students, those participating on the programme to improve NTS, demonstrated better NTS. Therefore, authors considered that offering an intense programme may significantly improve medical students' NTS and consideration must be given in integrating a simulation curriculum into the medical education curriculum, as simulation on surgery using human tissue samples could help students become more proficient in handling surgical instruments before stepping into a real surgical situation (Martinou et al., 2015). On another study, with the purpose to examine the effect of simulation-based training on NTS performance of general surgical residents during simulated laparoscopic cholecystectomy, as surgical proficiency is 75% in NTS and 25% in technical skills, it could be reasonably argued that improved NTS of surgeons could improve surgical outcomes (Nguyen, Elliott, Watson, & Dominguez, 2015). Paige et al. (2014), after investigating the immediate impact of conducting interprofessional students (nursing, nurse anesthetist, and medical students) in operating room team training using high-fidelity simulation on students' team attitudes and behaviors, indicated that the team training improved students' team attitudes and behaviors.

Then, Garbee et al. (2013) when evaluating the efficacy of using CRM principles and high-fidelity human patient simulation for interprofessional team training of students from undergraduate nursing, nurse anesthesia, medical, and respiratory therapy, suggested it as an effective pedagogy for teaching communication and teamwork skills to interprofessional students' teams; and Lyk-Jensen et al. (2014) also reinforce that collaboration on a patient does not solely depend on clinical and technical skills, but of the interaction between professionals

and human factors such as nurses' self-insight, attitudes to work and their way of being, as playing a substantial role that affects the clinical work.

Finally, Brunckhorst et al. (2015) had demonstrated that integrating technical and NTS within one training pathway is not only feasible, but also educationally valuable, and that this may be useful for the development of future curriculum for other procedures. In this study, 32 novice participants with no prior practical ureteroscopy experience were included within the data analysis, and was proved that strong correlation between technical and NTS performance exists, which was demonstrated to be irrespective of received training. This supports the importance of training both of these skills together within one curriculum.

After our review, we were able to understand that NTS training, such as communication, teamwork, leadership, decision-making and situation-awareness, has proved to improve professionals' performance (Irwin & Weidman, 2015). Although there are still limited studies related to NTS training in undergraduate nursing education, nursing has begun to recognize these skills as playing an important role to increase patients' care and safety and successful clinical outcomes, and the use of high-fidelity simulation as a learning approach to NTS awareness (Pearson & McLafferty, 2011). Thus, inclusion of NTS training in formal education programs must be taken into consideration (Gururaja, Yang, Paige, & Chauvin, 2008).

2.9. Conclusions

Research evidence portrays successful outcomes in clinical performance and patient care and safety after high-fidelity simulation-based NTS training in many different clinical settings (Boet et al., 2014). This suggest that NTS are essential skills to acquire across specialties, healthcare professions, and clinical conditions (Boet, Reeves, & Bould, 2015).

In nursing education, NTS training is the interface between nurses' internal environment and the real professional world, in which they will enter. Therefore, improving these skills is becoming a strategic priority within healthcare institutions

at international level (Sevdalis, 2013). Thus, is essential for students to acquire and train not only technical but also NTS. So, consideration must be given in integrating its training in undergraduate nursing curriculum.

Our study highlighted the importance and the intent for the development of a NTS training course for undergraduate nursing students in response to patient safety goals and improvement of clinical performance. Therefore, the development of a NTS training course may significantly improve undergraduate nursing students' performance, confidence, and self-efficacy, and be an added value as it can help them to adjust to the complex clinical context, and increase patient care and safety.

2.10. References

Andersen, P.O., Jensen, M.K., Lippert, A., & Ostergaard, D. (2010). Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation, 81*(6), 695-702. doi: 10.1016/j.resuscitation.2010.01.024.

Andrew, D. (2014). *Priorities between technical and non-technical skills training among nurses in hospital sector in Ireland*. A thesis presented to Dublin Business School and Liverpool John Moore's' University in fulfilment of the requirements for the award degree of Masters of Business Administration in Human Resource Management under the supervision of Mrs. Claire Devlin.

Baker, D., Capella, J., Hawkes, C., Gallo, J., & Clinic, C. (2011). *Development of the trauma team performance observation tool*. Paper presented at the 26th Annual Meeting of the Society for Industrial and Organizational Psychology. Chicago, IL.

Boet S., Bould, M., Fung, L., Qosa, H., Perrier, L., Tavares, W., Reeves, S., & Tricco, A. (2014). Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. *Canadian Journal of Anaesthesia, 61*(6), 571–582. doi: 10.1007/s12630-014-0143-8.

Boet, S., Reeves, S., & Bould, D. (2015). Call for an internationally recognized interprofissional simulation-based disease/injury independent, crisis resource

management training certification. *Resuscitation, 92*, 7. doi: 10.1016/j.resuscitation.2015.03.027.

Briggs, A., Raja, A., Joyce, M., Yule, S., Jiang, W., Lipsitz, S., & Havens, J. (2015). The role of non-technical skills in simulated trauma resuscitation. *Journal of Surgical Education, 72*(4), 732-739. doi: 10.1016/j.jsurg.2015.01.020.

Brunckhorst, O., Shahid, S., Aydin, A., Khan, S., McIlhenny, C., Brewin, J., Sahai, A., Bello, F., Kneebone, R., Shamim Khan, M., Dasgupta, P., & Ahmed, K. (2015). The relationship between technical and non-technical skills within a simulation-based ureteroscopy training environment. *Journal of Surgical Education, 72*(5), 1039-1044. doi: 10.1016/j.jsurg.2015.04.002.

Burton, R. & Ormrod, G. (2011). *Nursing Times: Transition to Professional Practice*. London: Oxford University Press.

Campos, L., Saturno, P., & Carneiro, A. (2010). *A qualidade dos cuidados e dos serviços. Plano Nacional de Saúde 2011-2016*. Retrieved from http://pns.dgs.pt/files/2010/07/Q2.pdf.

Capella, J., Smith, S., Philp, A., Putnam, T., Gilbert, C., Fry, W., Harvey, E., Wright, A., Henderson, K., Baker, D., Ranson, S., & Remine, S. (2010). Teamwork training improves the clinical care of trauma patients. *Journal of Surgical Education, 67*(6), 439-443. doi: 10.1016/j.jsurg.2010.06.006.

Chaer, R.A., Derubertis, B. G., Lin, S. C., Bush, H. L., Karwowski, J. K., Birk, D., Morrissey, N. J., Faries, P. L., McKinsey, J. F., & Kent, K. C. (2006). Simulation improves resident performance in catheter-based intervention: Results of a randomized, controlled study. *Annals of Surgery, 244*(3), 343–352.

Clark, P. (2009). Teamwork: Building healthier workplaces and providing safer patient care. *Critical Care Nursing Quarterly, 32*(3), 221-231. doi: 10.1097/CNQ.0b013e3181ab923f.

Cooper, S., Cant, R., Porter, J., Sellick, K., Somers, G., Kinsman, L., & Nestel, D. (2010). Rating medical emergency teamwork performance: Development of the team emergency assessment measure (TEAM). *Resuscitation, 81*(4), 446-452. doi: 10.1016/j.resuscitation.2009.11.027.

Cooper, S., Endacott, R., & Cant, R. (2010). Measuring non-technical skills in medical emergency care: A review of assessment measures. *Open Access Emergency Medicine, 2*, 7-16. doi: 10.2147/OAEM.S6693.

Cooper, S. & Cant, R. (2014). Measuring non-technical skills of medical emergency teams: An update on the validity and reliability of the team emergency assessment measure (TEAM). *Resuscitation, 85*(1), 31-33. doi: 10.1016/j.resuscitation.2013.08.276.

Dieckmann, P. (2010). Simulation in medical education: A regional meeting for medical educators. Retrieved from http://www.medinfo.hacettepe.edu.tr/duyuru/SIME2010.pdf.

Dunn E.J., Mills, P.D., Neily, J., Crittenden, M.D., Carmack, A.L., & Balgian, J.P. (2007). Medical team training: Applying crew resource management in the Veterans Health Administration. *The Joint Commission Journal Quality and Patient Safety, 33*(6), 317–325.

Fletcher, G., Flin, R., McGeorge, P., Glavin, R., Maran, N., & Patey, R. (2003). Anaesthetists' non- technical skills (ANTS): Evaluation of a behavioural marker system. *British Journal of Anaesthesia, 90*(5), 580-588. doi: 10.1093/bja/aeg112.

Flin, R., O'Connor, P., & Crichton, M. (2008). *Safety at the sharp end: A guide to non-technical skills*. Ashgate: Aldershot.

Flin, R. & Patey, R. (2011). Non-technical skills for anaesthetists: Developing and applying ANTS. *Best Practice & Research Clinical Anaesthesiology, 29*(1), 215-227. doi: 10.1016/j.bpa.2011.02.005.

Flin, R. & Maran, N. (2015). Basic concepts for crew resource management and non-technical skills. *Best Practice and Research Clinical Anaesthesiology, 29*(1), 27-39. doi: 10.1016/j.bpa.2015.02.002.

Freeth, D., Ayida, G., Berridge, E. J., Mackintosh, N., Norris, B., Sadler, C., & Strachan, A. (2009). Multidisciplinary obstetric simulated emergency scenarios (MOSES): Promoting patient safety in obstetrics with teamwork-focused interprofessional simulations. *The Journal of Continuing Education in the Health Professions, 29*, 98–104.

Gaba, D.M., Howard, S.K., Fish, K. J., Smith, B. E., & Swob, Y. A. (2001). Simulation-based training in anesthesia crisis resource management: A decade of experience. *Simulation & Gaming 32*(2), 175–193.

Garbee, D., Paige, J., Barrier, K., Kozmenko, V., Kozmenko L., Zamjahn, J., Bonanno, L., & Cefalu, J. (2013). Interprofessional teamwork among students in simulated codes: A quasi-experimental study. *Nursing Education Perspectives, 34*(5), 339-344.

Gillman, L., Brindley, P., Paton-Gray, J., Engels, P., Park, J., Vergis, A., & Widder, S. (2015). *Simulated trauma and resuscitation team training course: Evolution of a multidisciplinary trauma crisis resource management simulation course*. Paper presented as a podium presentation at the Trauma Association of Canada (TAC) Meeting in Calgary, Alberta, April 2015.

Goodstone, L., Goodstone, M., Cino, K., Glaser, C., Kupferman, K., & Dember-Neal, T. (2013). Effect of simulation on the development of critical thinking in associate degree nursing students. *Nursing Education Perspectives, 34*(3), 159-162.

Gundrosen, S., Solligård, S., & Aadahl, P. (2014). Team competence among nurses in an intensive care unit: The feasibility of in situ simulation and assessing non-technical skills. *Intensive and Critical Care Nursing, 30*(6), 312-317. doi: 10.1016/j.iccn.2014.06.007.

Gururaja, R., Yang, T., Paige, J. & Chauvin, S. (2008). *Examining the effectiveness of debriefing at the point of care in simulation-based operating room team training*. Rockville, MD: Advances in patient safety: new directions and alternative approaches, vol 3. Agency for healthcare research and quality.

Hicks, F., Coke, L., & Li, S. (2009). *The effect of high-fidelity simulation on nursing students' knowledge and performance: A pilot study*. National Council of State Boards of Nursing, Inc. (NCSBN) l 2009.

Hull, L., Arora, S., Aggarwal, R., Darzi, A., Vincent, C., & Sevdalis, N. (2012). The impact of non-technical skills on technical performance in surgery: A systematic review. *Journal of the American College of Surgeons 214*(2), 214-230.

Irwin, A. & Weidmann, A. (2015). A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. *Research in Social and Administrative Pharmacy, 11*(5), 1-11. doi: 10.1016/j.sapharm.2014.11.006.

Jepsen, R., Ostergaard, D., & Dieckmann, P. (2014). Development of instruments for assessment of individuals' and teams' non-technical skills in healthcare: A critical review. *Cognition, Technology & Work, 17*(1), 63-77. doi: 10.1007/s10111-014-0306-y.

Kiesewetter, J. & Fischer, M. (2015). The teamwork assessment scale: A novel instrument to assess quality of undergraduate medical students' teamwork using the example of simulation-based ward-rounds. *GMS Zeitschrift für Medizinische Ausbildung, 32*(2), 7-18. doi: 10.3205/zma000961.

Kodate, N., Ross, A., Anderson, J., & Flin, R. (2012). Non-technical skills for enhancing patient safety: Achievements and future directions. *Japanese Journal of Quality and Safety Healthcare, 7*(4), 360-370.

Kohn, L.T., Corrigan, J. M., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Institute of Medicine (US) Committee on Quality of Healthcare in America. Washington (DC): National Academies Press (US).

Kutzin, J. (2010). Communication and teamwork focused simulation-based education for nursing students. *Doctor of Nursing Practice*. Capstone Projects. Paper 4. Retrieved from http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1003&context=nursing_dnp_capstone.

Lamb, D. (2007). Could simulated emergency procedures practiced in a static environment improve the clinical performance of a Critical Care Air Support Team (CCAST)? A literature review. *Intensive and Critical Care Nursing, 23*, 33–42.

Légaré, F., Politi, M., Drolet, R., Desroches, S., Stacey, D., & Bekker, H. (2012). Training health professionals in shared decision-making: An international environmental scan. *Patient Education and Counseling, 88*(2), 159-169. doi: 10.1016/j.pec.2012.01.002.

Lindamood, K., Rachwal, C., Kappus, L., Weinstock, P., & Doherty, E. (2011). Development of neonatal intensive care multidisciplinary crisis resource training program. *Newborn & Infant Nursing Reviews, 11*(1), 17–22. doi: 10.1053/j.nainr.2010.12.011.

Lyk-Jensen, H., Jepsen, R., Spanager, L., Dieckmann, P., & Ostergaard, D. (2014). Assessing nurse anaesthetists' non-technical skills in the operating room. *Acta Anaesthesiologica Scandinavia, 58*(7), 794-801. doi: 10.1111/aas.12315.

Martinou, E., Chindambaran, R., Krishnasamy, G., Donnell, A., Vig, S., & Menon, G. (2015). Simulation in undergraduate medical education: Designing a programme to improve medical students' non-technical skills. *Abstracts / International Journal of Surgery, 23*, 15-134.

Milligan, F.J. (2007). Establishing a culture for patient safety – the role of education. *Nurse Education Today, 27*(2), 95-102.

Mitchell, L. & Flin, R. (2008). Non-technical skills of the operating theatre scrub nurse: Literature review. *Journal of Advanced Nursing, 63*(1), 15-24. doi: 10.1111/j.1365-2648.2008.04695.x.

Nguyen, N., Elliott, J., Watson, W., & Dominguez, E. (2015). Simulation improves non-technical skills performance of residents during the perioperative and intraoperative phases of surgery. *Journal of Surgical Education, 72*(5), 957-963. doi: 10.1016/j.jsurg.2015.03.005.

Nielsen, P.E., Goldman, M. B., Mann, S., Shapiro, D. E., Marcus, R. G., Pratt, S. D., Greenberg, P., McNamee, P., Salisbury, M., Bimbach, D. J., Gluck, P. A., Pearlman, M. D., King, H., Tornberg, D. N., & Sachs, B. P. (2007). Effects of teamwork training on adverse outcomes and process of care in labor and delivery: A randomized controlled trial. *Obstetrics & Gynecology, 109*(1), 48–55.

Okuda, Y., Bryson, E., De Maria Jr., S, Jacobson, L., Quintones, J., Shen, B., & Levine, A. (2009). The utility of simulation in medical education: What is the evidence? *Mount Sinai Journal of Medicine, 76*(4), 330-343. doi: 10.1002/msj.20127.

Paige, J. T., Garbee, D. D., Kozmenko, V., Yu, Q., Kozmenko, L., Yangm T., Bonanno, L., & Swartz, W. (2014). Getting a head start: high-fidelity,

simulation-based operating room team training of interprofessional students. *Journal of the American College of Surgeons, 218*(1), 140-149. doi: 10.1016/j.jamcollsurg.2013.09.006.

Pearson, E. & McLafferty, I. (2011). The use of simulation as a learning approach to non-technical skills awareness in final year student nurses. *Nurse Education in Practice, 11*(6), 399-405. doi: 10.1016/j.nepr.2011.03.023.

Riley, W., Davis, S., Miller, K., Hansen, H., Sainfort, F., & Sweet, R. (2011). Didactic and simulation non-technical skills team training to improve perinatal patient outcomes in a community hospital. *The Joint Commission Journal on Quality and Patient Safety, 37*(8), 357-364.

Roberts, N. K., Williams, R. G., Schwind, C. J., Sutyak, J. A., McDowell, C., Griffen, D., Wall, J., Sanfey, H., Chestnut, A., Meier, A. H., Wohltmann, C., Clark, T. R., & Wetter, N. (2014). The impact of brief team communication, leadership and team behavior training on ad hoc team performance in trauma care settings. *The American Journal of Surgery, 207*(2), 170-178. doi: 10.1016/j.amjsurg.2013.06.016.

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*, 77–83. doi: 10.1097/SIH.0b013e31819171cd.

Robertson, E., Hadi, M., Morgan, L., Pickering, S., Collins, G., New, S., Griffin, D., McCulloch, P., & Catchpole, K. (2014). Oxford NOTECHS II: A modified theatre team non-technical skills scoring system. *Plos One 9*(3). doi: 10.1371/journal.one.0090320.

Rosenstein, A. & O`Daniel, M. (2006). Impact and implications of disruptive behaviour in the perioperative arena. *Journal of the American College of Surgeons, 203*(1), 96-105. doi: 10.1016/j.jamcollsurg.2006.03.027.

Sara-aho, A. (2015). *Enhancing patient safety in the healthcare: Patient safety skills. About nursing education and clinical settings: A collection of abstracts*. Saimaa University of Applied Sciences. Retrieved from https://publications.theseus.fi/bitstream/handle/10024/103935/livarinen.pdf?sequence=1.

Sevdalis, N. (2013). Non-technical skills and the future of teamwork in healthcare settings. *The Health Foundation Inspiring Improvement*. Retrieved from http://patientsafety.health.org.uk/sites/default/files/resources/non_technical_skills_and_the_future_of_teamwork_in_healthcare_settings.pdf.

Shapiro, M.J., Morey, J., Small, S., Langford, V., Kaylor, C., Jagminas, L., Suner, S., Salisbury, M., Simon, R., & Jay, G. (2004). Simulation based teamwork training for emergency department staff: Does it improve clinical team performance when added to an existing didactic teamwork curriculum? *Quality and Safety Health Care, 13*(6), 417–421. doi: 10.1136/qshc.2003.005447.

Siu, J., Maran, N., & Paterson-Brown, S. (2014). Observation of behavioural markers of non-technical skills in the operating room and their relationship to intra-operative incidentes. *The Surgeon, 14*(3), 119-128. doi: 10.1016/j.surge.2014.06.005.

Thomas, E. J., Taggart, B., Crandell, S., Lasky, R. E., Williams, A. L., Love, L. J., Sexton, J. B., Tyson, J. E., & Helmreich, R. L. (2007). Teaching teamwork during the Neonatal Resuscitation Program: A randomized trial. *Journal of Perinatology-Nature, 27*(7), 409–414.

Wisborg, T. & Manser, T. (2014). Assessment of non-technical skills in the operating room – one assessment tool per specialty? *Acta Anaesthesiologica Scandinavica, 58*(7), 773-774. doi: 10.1111/aas.12352.

Yule, S., Flin, R., Maran, N., Rowley, D., Youngson, G., & Paterson-Brown, S. (2008). Surgeons' non-technical skills in the operating room: Reliability testing of the NOTSS behavior rating system. *World Journal of Surgery, 32*(4), 548-556. doi: 10.1007/s00268-007-9320-z.

Yule, S. & Paterson-Brown, S. (2012). Surgeons' non-technical skills. *Surgical Clinics of North America, 92*(1), 37–50. doi: 10.1016/j.suc.2011.11.004.

Ziesmann, M. T., Widder, S., Park, J., Kortbeek, J. B., Brindley, P., Hameed, M., Paton-Gray, J. D., Engels, P. T., Hicks, C., Fata, P., Ball, C. G., & Gillman, L. M. (2013). S.T.A.R.T.T.: Development of a national, multidisciplinary trauma crisis resource management curriculum—results from the pilot course. *Journal of Trauma and Acute Care Surgery, 75*(5), 753-758. doi: 10.1097/TA.0b013e3182a925df.

Chapter 3. Non-technical skills assessment for prelicensure nursing students: An integrative review.

Pires, S., Monteiro, S., Pereira, A., Chaló, D., Melo, E., Rodrigues, A. (2017). Non-technical skills assessment for prelicensure nursing students: An integrative review. *Nurse Education Today*, *58*, 19-24. doi: 10.1016/j.nedt.2017.07.015.

3.1. Abstract

Background: in nursing, non-technical skills are recognized as playing an important role to increase patient safety and successful clinical outcomes (Pearson and McLafferty, 2011). Non-technical skills are cognitive and social resource skills that complement technical skills and contribute to safe and efficient task performance (Flin et al., 2008). In order to effectively provide non-technical skills training, it is essential to have an instrument to measure these skills.

Methodology: An online search was conducted. Articles were selected if they referred to and/or described instruments assessing non-technical skills for nurses and/or prelicensure nursing students in educational, clinical and/or simulated settings with validation evidence (inclusion criteria).

Results: Of the 53 articles located, 26 met the inclusion criteria. Those referred to and/or described 16 instruments with validation evidence developed to assess non-technical skills in multidisciplinary teams including nurses.

Conclusion: Although articles have shown 16 valid and reliable instruments, to our knowledge, no instrument has been published or developed and validated for the assessment of non-technical skills of only nurses in general, relevant for use in high-fidelity simulation-based training for prelicensure nursing students. Therefore, there is a need for the development of such an instrument.

3.2. Keywords

Non-technical skills; Assessment ; Nursing; Prelicensure nursing students; Education; High-fidelity simulation-based training programs; Healthcare.

3.3. Introduction

In the last two decades, several studies have emphasized that hospitalized patients may be harmed as a result of errors and incidents during their care. The

prevalence of clinical errors and injuries is high, leading to large numbers of malpractice claims (Campos et al., 2010). Traditionally, health professionals are trained in settings where they learn clinical knowledge and develop technical skills, whereas non-technical skills are seldom promoted (Jepsen et al., 2014). Therefore, challenges in the treatment of patients are often not due to a lack of clinical expertise, but to a failure on non-technical skills (Dieckmann, 2010; Irwin and Weidmann, 2015). Non-technical skills include communication, leadership and followership, decision-making, situation-awareness and task-management (Flin et al., 2008). Although, non-technical skills' training has proved to improve professionals' performance, the numbers of studies considering non-technical skills' training in prelicensure nursing education seem to be limited (Irwin and Weidmann, 2015; Pearson and McLafferty, 2011).

Non-technical skills are the cognitive (decision-making, situation-awareness) and interpersonal (communication, teamwork, leadership) skills that underpin technical proficiency, and are considered particularly important for preventing errors (Gundrosen et al., 2014; Nguyen et al., 2015). Poor non-technical skills can increase the chance of error, which in turn can increase the chance of an adverse event. Good non-technical skills can reduce the likelihood of error and consequently of accidents (Flin and Maran, 2015). The development of competences is not solely based on achieving skills, but also on being able to integrate these skills effectively in the solution of clinical problems. For example, a Canadian study documented that the introduction of team briefings resulted in improved clinical practice. Another study showed that the use of checklists reduced the number of communication errors and improved communication by team members (Lyk-Jensen et al., 2014).

Non-technical skills need to be learned and trained. In this sense, the Department of Defense's Patient Safety Program in collaboration with the Agency for Healthcare Research and Quality developed a teamwork system. TeamStepps, designed to improve communication and teamwork skills among healthcare professionals. In 2005 the TeamSTEPPS pilot curriculum was developed. Evidence has shown that TeamSTEPPS training does produce these outcomes in healthcare organizations, for example, Capella et al. (2010), found that trauma resuscitation team performance improved across all teamwork skills after TeamSTEPPS training.

Thomas and Gala (2013) describe a systemwide implementation of TeamSTEPPS that involved training healthcare professionals across several hospitals, long-term care centers, and outpatient areas. This work suggests an important link between team training and organizational outcomes. To this purpose, high-fidelity simulation-based training is considered a powerful teaching tool, as it appears to improve both perceived and actual non-technical skills with retention over time, more than didactic teaching. Students need to actively practice in order to be effective and do the transfer to patient care (Garbee et al., 2013; Lai et al., 2016). There is early evidence on that non-technical skills trained in high-fidelity simulation environment are transferred to clinical settings, and may translate to improved patient care (Boet et al., 2014). Thus, the use of high-fidelity simulation as a learning approach to non-technical skills awareness can potentially contribute to patient safety and optimal care delivery, as it provides an opportunity for students to practice complex-skills in a low-risk environment (Goodstone et al., 2013; Pearson and McLafferty, 2011). In prelicensure nursing education, non-technical skills' training is the interface between nurses' internal environment and the real professional world, in which they will enter. Therefore, it is essential for prelicensure nursing students to develop not only clinical but also non-technical skills. In order to effectively provide non-technical skills training, it is essential to have an instrument to measure these skills. Such an instrument is necessary to benchmark good non-technical skills and to guide formative feedback to prelicensure nursing students' future practice. The aim of this paper is to report on an integrative review of the literature on non-technical skills assessment instruments with validation evidence relevant for use in high-fidelity simulation-based training for prelicensure nursing students.

3.4. Methods

A literature search was conducted in order to locate and review instruments that assess non-technical skills in nurses relevant for use in high-fidelity simulation-based training for prelicensure nursing students. Between January 2015 and June 2015, online resources on PubMed Medline, Sciencedirect, ProQuest and Google

Scholar data-bases for articles about non-technical skills and non-technical skills assessment in nurses were searched. Search strategies included such keywords as: non-technical skills; assessment; nursing; prelicensure nursing students; education; high-fidelity simulation-based training programs; and healthcare. Articles were selected if they referred to and/ or described instruments assessing non-technical skills for nurses and/ or prelicensure nursing students in educational, clinical and/or simulated settings with validation evidence (inclusion criteria). Articles were initially screened based on title and abstract. When abstracts appeared to meet the inclusion criteria, then full articles were read. The articles meeting the inclusion criteria were included in the review.

3.5. Results

Our search located 53 articles. By applying the inclusion criteria, 26 articles were selected for the review. These 26 articles referred to and/ or described 16 non-technical skills instruments assessing non-technical skills for nurses in educational, clinical and simulated settings with validation evidence. These instruments were developed to be used in multidisciplinary teams including nursing professionals. Table 1 shows an overview of the 16 non-technical skills instruments included in the review and that will be described below.

Instruments were found which focus on a variety of hospital settings and teams such as the operating room, the resuscitation teams, obstetric teams; trauma teams; nurse anaesthetic teams; healthcare teams in acute settings, and the emergency environment, as shown in Table 1.

Table 1. Non-technical skills assessment instruments

Instrument	Assessment Skills	Target Group	Response Scale	Reliability	Validity
Revised Non-Technical-Skills (NOTECHS) (Sevdalis et al., 2008): Revision of the NOTECHS scale from the aviation industry.	Communication/interaction; Situation awareness/vigilance; Cooperation/team skills; Leadership/managerial skills; Decision making	Surgical teams: Surgeons, Anaesthetists, Scrub Nurses and Operating Department Practitioners	6 point scale: Not done (1) to Done very well (6). Not Applicable option to each item	Internal consistency	Construct
Oxford Non-Technical-Skills (Oxford NOTECHS) (Mishra et al., 2009): developed from an aviation instrument for assessment of non-technical skills. Differences from the NOTECHS are the assessment skills and the response scale.	Leadership/management; Teamwork/cooperation; Problem solving/decision making; Situation awareness	Surgeons, Anaesthetists and Nurses	4 point scale: Bellow standard (1) Basic Standard (2) Standard (3) Excellent (4)	Inter-rater Test-retest	Predictive Concurrent Convergent
Oxford Non-Technical Skills II (Oxford NOTECHS II) (Robertson et al., 2014): to provide greater discrimination between the behaviour of theatre teams. Differences from the original Oxford NOTECHS are the use of an eight-point scale; assigning all teams a baseline score of 6, a behavioural marker of 'consistently maintaining an effective level of patient safety and teamwork', from which subsequent observations could result in deviation upwards or downwards in response to observable behavioural markers	Leadership/management; Teamwork/cooperation; Problem solving/decision making; Situation awareness	Three sub-teams: surgical (operating and assisting surgeons); anaesthetic (anaesthetists and anaesthetic nurses/practitioners) and nursing (scrub and non-anaesthetic circulating nurses and practitioners)	8 point scale to be rated in consistent ot inconsistent in 4 behaviours descriptors.	Inter-rater	Face Concurrent Construct

Table 1. (*continued*)

Instrument	Assessment Skills	Target Group	Response Scale	Reliability	Validity
Trauma Non-Technical-Skills (T-NOTECHS) (Steinemann et al., 2012).	Communication/interaction; Situation awareness/coping with stress; Cooperation/resource management; Leadership; Assessment/decision-making	Any speciality and staff attending a trauma call (trauma/critical care surgeons, trauma/medical intensivists, trauma/critical care nurses)	5 point scale: In general (5) indicates flawless teamwork, and (1) indicates the team did not demonstrate this teamwork behavior	Inter-rater Internal consistency	Construct
Trauma Team Performance Observation Tool (TPOT) (Baker et al., 2011).	Leadership; Situation monitoring; Mutual Support; Communication	Trauma resuscitation teams	5 point scale: Very poor (1) Poor (2) Average (3) Good (4) Excellent (5) Not Applicable option to each item	Inter-rater Internal consistency	Construct
Observational Teamwork Assessment for Surgery (OTAS) (Healey et al., 2004; Sevdalis et al., 2009; Hull et al., 2011).	Communication; Cooperation/back up behavior; Coordination; Leadership; Team monitoring/situation awareness	Surgical teams: Surgeons, Anaesthetists and Scrub Nurses	7 point scale: Exemplary behavior; very high effective in enhancing team function (6) to Problematic behavior; team function severely hindered (0)	Inter-rater	Content Concurrent Construct

Table 1. (*continued*)

Instrument	Assessment Skills	Target Group	Response Scale	Reliability	Validity
Scrub Practitioners List of Intraoperative Non-Technical Skills (SPLINTS) (Mitchell et al., 2012).	Communication/teamwork; Task management; Situation awareness	Operating theatre scrub nurses/practitioners	4 point scale: Poor (1) Marginal (2) Acceptable (3) Good (4). Not required option for each item	Inter-rater	Content
Observational Skill-based Clinical Assessment tool for resuscitation (OSCAR) (Walker et al., 2011).	Communication; Cooperation/back up behavior; Coordination; Leadership; Team monitoring/Situation awareness; Decision-making	Anaesthetic, Medical and Nursing staff in resuscitation teams	7 point scale: Team severely compromised (0) Team compromised (1) Slight detriment team (2) Team neither enhanced or hindered (3) Moderate enhancement to team (4) High level of enhancement to team (5) Highly effective in enhancing teamwork (6)	Inter-rater Internal consistency	Face Content Convergent
Team Emergency Assessment Measure (TEAM) (Cooper et al., 2010; Cooper & Cant, 2014).	Leadership; Teamwork; Task management	Emergency resuscitation teams (medical students and nursing students)	5 point scale: Never/Hardly ever (0) Seldom (1) About as often as not (2) Often (3) Always/Nearly always (4)	Inter-rater Internal consistency Test-retest	Content Construct Uni-dimensional Concurrent

Table 1. (*continued*)

Instrument	Assessment Skills	Target Group	Response Scale	Reliability	Validity
Mayo High Performance Teamwork Scale (MHPTS) (Malec et al., 2007).	Teamwork; Leadership; Communication	Inter-professional teams/Healthcare teams (physicians and nurses) in acute settings High performance multi-professional medical teams	3 point scale: Never or rarely (0) Inconsistently (1) Consistently (2)	Inter-rater Internal consistency	Construct
Ottawa Crisis Resource Management Global Rating Scale (Ottawa GRS) (Kim et al., 2006).	Problem solving; Situational awareness; Leadership; Resource utilization; Communication	All specialities of healthcare teams (physicians and nurses) in acute settings (medical students)	7 point rating scale with rating guidance (descriptors) given for ratings 1, 3, 5, 7	Inter-rater Internal consistency	Construct
Clinical Teamwork Scale (CTS) (Guise et al., 2008).	Communication; Situational Awareness; Decision Making; Role Responsibility; Patient Friendliness	Interprofessional Obstetric team	10 point scale: Unacceptable (0) Poor (1) (2) (3) Average (4) (5) (6) Good (7) (8) (9) Perfect (10). Not relevant option to each item	Inter-rater	Construct Accuracy
Non-Technical Skills in Nurse Anaesthetists (N-ANTS) (Lyk-Jensen et al., 2014).	Situation Awareness; Decision Making; Task Management; Team Working	Nurse Anaesthetists	5 point scale: Very good (5) Good (4) Acceptable (3) Poor (2) Very poor (1) Not Relevant option to each item		

Table 1. (*continued*)

Instrument	Assessment Skills	Target Group	Response Scale	Reliability	Validity
Leadership Behaviour Description Questionnaire (LBDQ) (Cooper & Wakelam, 1999).	Leadership	Multi-disciplinary resuscitation teams	5 point scale: Always (4) Very often (3) About as often as not (2) Seldom (1) Never (0)	Inter-rater	Uni-dimensional
Emergency Team Dynamics (Cooper & Wakelam, 1999).	Leadership; Teamwork	Multi-disciplinary emergency teams and emergency care practitioners	5 point scale: Always (4) Very often (3) About as often as not (2) Seldom (1) Never (0)	Inter-rater	Face Content Uni-dimensional
Communication Competency Questionnaire (Cooper et a., 2007)	Communication	Emergency Care Practitioners	7 point scale: Very strong agreement (6) Strong agreement (5) Mild agreement (4) Neutral feelings or don´t know (3) Mild disagreement (2) strong disagreement (1) Very strong disagreement (0)	Inter-rater	Face Content One-dimensional

Most instruments assess three or more non-technical skills, including leadership, task management, teamwork, problem-solving, decision-making, resource utilization, situation-awareness, and communication (Baker et al., 2011; Cooper et al., 2010a, 2010b; Cooper and Cant, 2014; Guise et al., 2008; Healey et al., 2004; Hull et al., 2011; Kim et al., 2006; Lyk-Jensen et al., 2014; Malec et al., 2007; Mishra et al., 2009; Mitchell et al., 2012; Robertson et al., 2014; Sevdalis et al., 2008; Sevdalis et al., 2009; Steinemann et al., 2012; Walker et al., 2011). Other instruments focus only on one or two isolated non-technical skills such as leadership (Cooper and Wakelam, 1999), leadership and teamwork (Cooper and Wakelam, 1999), and communication (Cooper et al., 2007).

The Revised Non-Technical Skills (NOTECHS) (Sevdalis et al., 2008) was based on the original NOTECHS scale for use in simulation-based training for junior surgeons. The revised NOTECHS has five dimensions to be assessed, communication and interaction, vigilance/situation awareness, team skills, leadership and management skills, and decision-making, on four subteams from intraoperative surgical teams. The scrub nurses, the surgeons and the operating department practitioners scale version has a total of 22 items; and the anaesthetists version has 23 items; on a 6-point scale. Validity and reliability testing included construct validity and internal consistency.

The Oxford Non-Technical Skills (Oxford NOTECHS) (Mishra et al., 2009) was developed and used to assess the non-technical skills performance of three subteams (surgeons, anaesthetists and nurses) of intraoperative surgical teams in four dimensions, leadership and management, teamwork and cooperation, problem-solving and decision-making, and situation-awareness. An assessor observes the entire team during a procedure and scores individuals in all items of each dimension using a 4-point scale with guidance behaviour descriptors for all 16 items. Summation of the scores could be used to examine the performance of subteams or the team overall. Predictive, concurrent and convergent validity, as well as inter-rater agreement and test-retest reliability were tested.

The Oxford Non-Technical Skills II (Oxford NOTECHS II) (Robertson et al., 2014) was developed to facilitate a greater discrimination between levels of performance within the normal range. The new measure has the same 16 items as Oxford NOTECHS and uses an 8-point instead of a 4-point scale to measure each dimension of the same four as Oxford NOTECHS. This 8-point scale is divided in 4

behaviour descriptors, to be rated in consistent or inconsistent each. In terms of validity and reliability, this instrument demonstrated face, concurrent and construct validity and inter-rater agreement.

The Trauma Non-Technical Skills (T-NOTECHS) (Steinemann et al., 2012) was developed to teach and assess teamwork skills of multidisciplinary trauma resuscitation teams. T-NOTECHS is divided in five domains, leadership, cooperation and resource management, communication and interaction, assessment and decision-making, and situation-awareness/coping with stress. The domains were illustrated with 27 exemplar behaviours. T-NOTECHS has a total of 47 items rated on a 5- point Likert scale. T-NOTECHS showed construct validity, internal consistency and inter-rater agreement.

The Trauma Team Performance Observation Tool (TPOT) (Baker et al., 2011) was developed for observing and measuring team performance during trauma resuscitations. TPOT measured four categories of non-technical skills, leadership, situation monitoring, mutual support, and communication. TPOT included 21 items, rated in a 5-point scale. A “Not Applicable” rating option was also included for cases when there was not an opportunity or need to elicit the team behaviours. In respect to validity and reliability, construct validity, internal consistency and inter-rater agreement were tested.

The Observational Teamwork Assessment for Surgery (OTAS) (Healey et al., 2004; Sevdalis et al., 2009; Hull et al., 2011) assesses the entire surgical team. OTAS distinguishes between different subteams within the operation room (surgeons, anesthesiologists, and nurses) and different stages of a procedure (pre-, intra-, and postoperative). Quality of teamwork is assessed through direct real-time observation for each subteam separately across the three operative stages. OTAS assesses five behaviours, communication, leadership, cooperation, coordination, and team monitoring on a 7-point scale with a brief anchor definition each. To guide the behaviour ratings, exemplar behaviours are used. Behaviour rating can be summed to provide team performance scores. OTAS assesses each one of the three stages of a procedure, for each one of the three subteams. Validity and reliability testing included content, concurrent and construct validity and inter-rater agreement.

The Scrub Practitioners List of Intraoperative Non-Technical Skills (SPLINTS) (Mitchell et al., 2012) was a teamwork assessment tool for scrub practitioners such as nurses and operating department practitioners’ behaviours during surgical operations.

SPLINTS taxonomy is organised into three skillset categories, each containing three elements against which subjects are marked using a 4-point rating scale with the additional option of "not required". The "situation-awareness" category assesses information gathering, information recognition and understanding, and anticipation; "communication and teamwork" contains acting assertively, exchanging information, and coordinating with others; "task-management" involves planning and preparation, providing and maintaining standards, and coping with pressure. In terms of validity and reliability the SPLINTS showed content validity and inter- rater agreement.

The Observational Skill-Based Clinical Assessment tool for Resuscitation (OSCAR) (Walker et al., 2011) was developed from existing well-validated instruments that have been developed for other contexts (OTAS, N-ANTS and NOTECHS) and assesses each resuscitation team member (anaesthetist, physician and nurse) separately, capturing six behaviours, communication, cooperation, decision-making, coordination, leadership, and monitoring, in detail within these subteams, in a total of 48 items, rated on a 7-point scale. Face and content validity were tested, as well as internal consistency and inter-rater agreement.

The Team Emergency Assessment Measure (TEAM) (Cooper et al., 2010a, 2010b; Cooper and Cant, 2014) was divided in three categories, leadership, teamwork and task-management to measure resuscitation teams' performance. Encompassed within these categories are nine elements, leadership control, communication, cooperation and coordination, team climate, adaptability, situation-awareness (perception), situation-awareness (projection), prioritization, and clinical standards. The final 11 items are inclusive of the elements and categories and include applicable prompts to aid rating. Performance ratings for these 11 items are based on a 5-point scale. The 12th item is a global or overall rating, 1 to 10, which is intended as an overall 'gut reaction' to the performance. The user can choose to summarise performance through the global rating, the sum of the categories, the sum of the total score, or a combination of all with the objective of providing a description and assessment of performance in simulated and real settings. This instrument was validated with content, construct, unidimensional and concurrent validity, and internal consistency, test- retest and inter-rater agreement.

The Mayo High Performance Teamwork Scale (MHPTS) (Malec et al., 2007) was a measure of crisis teamwork skills designed for simulation based reflection and training of high performance multi-professional healthcare teams in acute settings.

MHPTS includes 16 items rating teams' teamwork, leadership and communication on a 3-point scale. From 9 to 16th item, could be marked "Not Applicable" if no situations occurred in which these types of responses were required. Validity and reliability testing included construct validity and internal consistency and inter-rater agreement.

The Ottawa Crisis Resource Management Global Rating Scale (OTTAWA GRS) (Kim et al., 2006) was used to evaluate simulation-based performance of healthcare teams managing in acute settings. OTTAWA GRS is based upon 6 items that measure leadership, problem-solving, situation-awareness, resource utilization and communication, on a 7-point rating scale. The OTTAWA GRS uses global rating scales of each category as well as an overall rating of team performance. Validity and reliability testing included construct validity and internal consistency and inter-rater agreement.

The Clinical Teamwork Scale (CTS) (Guise et al., 2008) was developed to evaluate teamwork components, communication, situation-awareness, decision-making, and role responsibility in interprofessional obstetric teams. Has a total of 11 items, scored on a 10-point scale and a "target fixation item behaviour" evaluated with yes or no. Each item has a global descriptive anchor. Construct and accuracy validity were tested, as well as inter-rater agreement.

The Non-Technical Skills Nurse Anaesthetists (N-ANTS) (Lyk-Jensen et al., 2014) is an anaesthetist specific teamwork assessment tool that was devised from psychological research which identified requisite teamwork skills and structured them into a hierarchal taxonomy based on NOTECHS. Behaviours are examined in 15 elements within four categories: task-management, teamwork, situation-awareness, and decision-making. Exemplar markers are included to guide the assessor in grading the anaesthetist in each element using a 4-point numeric, with a summary score given for each behavioural category. There is also an option to mark behaviours as "not observed" and each element possesses a comment box for qualitative feedback. Content validity was tested.

The Leadership Behaviour Description Questionnaire (LBDQ) (Cooper and Wakelam, 1999) was a frequently used and widely evaluated measure of leadership behaviour including two factors to describe it, consideration and initiating structure. Consideration is the extent to which leaders show consideration towards members of the team which is deemed to be relatively unimportant when studying emergency situations as there is limited time to build relationships. Initiating structure is the extent

to which a leader manages the structural aspects of the team and includes elements such as detailing what and how things should be done with clear command and control structures. LBDQ was considered to be applicable to measure resuscitation teams' leadership performance based upon their command and control ability. LBDQ has a total of 9 items, rated on a 5-point scale. LBDQ was found to have unidimensional validity and inter-rater agreement.

The Emergency Team Dynamics (ETD) (Cooper and Wakelam, 1999) was used to measure emergency teams and emergency care practitioners. ETS was a tool to measure not only what individuals do in terms of their tasks but also how they interact together. ETS is composed of 7 items measuring leadership and teamwork, rated on a 5- point scale. ETD was found to have face, content and unidimensional validity and inter-rater agreement.

The Communication Competency Questionnaire (CCQ) (Cooper et al., 2007) was used for rating communication skills in emergency care practitioners. CCQ is composed of 13 items, rated on a 7-point scale. CCQ was found to have face, content and one-dimensional validity and inter-rater agreement.

3.6. Conclusion

High-fidelity simulation-based non-technical skills training is considered a powerful teaching tool, which becomes more relevant in prelicensure nursing education. The assessment of non-technical skills is highly important and several instruments have been developed to be used in various domains in order to meet this need. All these instruments assess very similar categories of non-technical skills, in specific multidisciplinary teams, including nurses, and present validation evidence. However, to our knowledge, no theoretically-based and easy-to-use assessment instrument has been published or developed and validated specifically for the assessment of non-technical skills of nurses, relevant for use in high-fidelity simulation-based training for prelicensure nursing students. All reviewed articles presented instruments assessing non-technical skills on nurses but in the context of specific multidisciplinary teams, working on a specific context, with specific procedures. Moreover instruments cannot just be transferred from one context to another (Flin and Patey, 2011) as they were not tested in all areas and/or contexts. Although the results

referred to a variety of available valid and reliable non-technical skills assessment instruments that could be tested in other areas and/or contexts, there is a need for the development of an instrument focusing on non-technical skills assessment relevant to be used in high-fidelity simulation-based training for prelicensure nursing students regarding nursing general activities. This review highlights the importance of the development of such an instrument as it could assess non-technical skills in order to enable a greater understanding of these skills and enhance prelicensure nursing students' performance and patient safety in their future practice. In the light of this, improving non-technical skills is becoming a strategic priority within healthcare institutions and also within medical and nursing schools at international level (Sevdalis, 2013). Human error cannot be eliminated, but efforts can be made to minimize, identify and mitigate errors by ensuring that students have appropriate non-technical skills to cope with the risks and demands of their future work (Flin and Maran, 2015). This review suggests that incorporating non-technical skills training in prelicensure nursing education curriculum, and in all healthcare education areas with high-fidelity simulation-based training for prelicensure nursing students working on multidisciplinary students' teams, these outcomes can be reached more efficiently, and successful results can emerge.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of Interest None.

3.7. References

Baker, D., Capella, J., Hawkes, C., Gallo, J., Clinic, C., 2011. Development of the trauma team performance observation tool. In: Paper Presented at the 26th Annual Meeting of the Society for Industrial and Organizational Psychology. IMPAQ International, Chicago, IL.

Boet, S., Bould, M., Fung, L., Qosa, H., Perrier, L., Tavares, W., Reeves, S., Tricco, A., 2014. Transfer of learning and patient outcome in simulated crisis resource management: a systematic review. Can. J. Anaesth. 61 (6), 571–582. doi: 10.1007/s12630-014-0143-8.

Campos, L., Saturno, P., Carneiro, A., 2010. A qualidade dos cuidados e dos serviços. Plano Nacional de Saúdepp. 2011–2016. Retrieved from. http://pns.dgs.pt/files/2010/07/Q2.pdf.

Capella, J., Smith, S., Philp, A., Putnam, T., Gilbert, C., Fry, W., Harvey, E., Wright, A., Henderson, K., Baker, D., Ranson, S., Remine, S., 2010. Teamwork training improves the clinical care of trauma patients. J. Surg. Educ. 67 (6), 439–443. doi: 10.1016/j.jsurg.2010.06.006.

Cooper, S., Cant, R., 2014. Measuring non-technical skills of medical emergency teams: an update on the validity and reliability of the team emergency assessment measure (TEAM). Resuscitation 85 (1), 31–33. doi: 10.1016/j.resuscitation. 2013.08.276.

Cooper, S., Wakelam, A., 1999. Leadership of resuscitation teams: lighthouse leadership. Resuscitation 42 (1), 27–45.

Cooper, S., O'Carroll, J., Jenkin, A., Badger, B., 2007. Collaborative practices in unscheduled emergency care: role and impact of the emergency care practitioner: quantitative findings. Emerg. Med. J. 24, 630–633. doi: 10.1136/emj. 2007.048058.

Cooper, S., Cant, R., Porter, J., Sellick, K., Somers, G., Kinsman, L., Nestel, D., 2010a. Rating medical emergency teamwork performance: development of the team emer- gency assessment measure (TEAM). Resuscitation 81 (4), 446–452. doi: 10.1016/j.resuscitation.2009.11.027.

Cooper, S., Endacott, R., Cant, R., 2010b. Measuring non-technical skills in medical emergency care: a review of assessment measures. Open Access Emerg. Med. 2, 7–16. doi: 10.2147/OAEM.S6693.

Dieckmann, P., 2010. Simulation in Medical Education: Regional Meeting for Medical Educators.

Flin, R., Maran, N., 2015. Basic concepts for crew resource management and non-tech- nical skills. Best Pract. Res. Clin. Anaesthesiol. 29 (1), 27–39. doi: 10. 1016/j.bpa.2015.02.002.

Flin, R., Patey, R., 2011. Non-technical skills for anaesthetists: developing and applying ANTS. Best Pract. Res. Clin. Anaesthesiol. 25 (2), 215–227. doi: 10. 1016/j.bpa.2011.02.005.

Flin, R., O'Connor, P., Crichton, M., 2008. Safety at the Sharp End: A Guide to Non-technical Skills. Ashgate, Aldershot.

Garbee, D., Paige, J., Barrier, K., Kozmenk, V., Kozmenko, L., Zamjahn, J., Bonanno, L., Cefalu, J., 2013. Interprofessional teamwork among students in simulated codes: a quasi-experimental study. Nurs. Educ. Perspect. 34 (5), 339–344.

Goodstone, L., Goodstone, M., Cino, K., Glaser, C., Kupferman, K., Dember-Neal, T., 2013. Effect of simulation on the development of critical thinking in associate degree nursing students. Nurs. Educ. Perspect. 34 (3), 159–162.

Guise, J., Deering, S., Kanki, B., Osterweil, P., Li, H., Mori, M., Lowe, N., 2008. Validation of a tool to measure and promote clinical teamwork. Simul. Healthc. 3 (4), 217–223. doi: 10.1097/SIH.0b013e31816fdd0a.

Gundrosen, S., Solligård, S., Aadahl, P., 2014. Team competence among nurses in an intensive care unit: the feasibility of in situ simulation and assessing non-technical skills. Intensive Crit. Care Nurs. 30 (6), 312–317. doi: 10.1016/j.iccn. 2014.06.007.

Healey, A., Undre, S., Vincent, C., 2004. Developing observational measures of performance in surgical teams. Qual. Saf. Health Care 13 (1), 33–40. doi: 10. 1136/qhc.13.suppl_1.i33.

Hull, L., Arora, S., Kassab, E., Kneebone, R., Sevdalis, N., 2011. Observational teamwork assessment for surgery: content validation and tool refinement. J. Am. Coll. Surg. 212 (2), 234–243. doi: 10.1016/j.jamcollsurg.2010.11.001.

Irwin, A., Weidmann, A., 2015. A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. Res. Soc. Adm. Pharm. 11 (5), 1–11. doi: 10.1016/j.sapharm.2014.11.006.

Jepsen, R., Ostergaard, D., Dieckmann, P., 2014. Development of instruments for assessment of individuals' and teams' non-technical skills in healthcare: a critical re- view. Cogn. Tech. Work 17 (1), 63–77. doi: 10.1007/s10111-014- 0306-y.

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. Crit. Care Med. 34 (38), 2167–2174. doi: 10.1097/01.CCM.0000229877.45125.CC.

Lai, A., Haligua, A., Bould, D., Everett, T., Gale, M., 2016. Learning crisis resource management: practicing versus an observational role in simulation training – a ran- domized controlled trial. Anaesth. Crit. Care Pain Med. doi: 10.1016/j. accpm.2015.10.010.

Lyk-Jensen, H., Jepsen, R., Spanager, L., Dieckmann, P., Ostergaard, D., 2014. Assessing nurse anaesthetist's non-technical skills in the operating room. Acta Anaesthesiol. Scand. 58 (7), 794–801. doi: 10.1111/aas.12315.

Malec, J., Torsher, L., Dunn, W., Wiegman, D., Arnold, J., Brown, D., Phatak, V., 2007. The mayo high performance teamwork scale: reliability and validity for evaluating key crew resource management skills. Simul. Healthc. 2 (1), 4–10. doi: 10.1097/SIH.0b013e31802b68ee.

Mishra, A., Catchpole, K., McCulloch, P., 2009. The Oxford NOTECHS system: reliability and validity of a tool for measuring teamwork behavior in the operating theatre. Qual. Saf. Health Care 18 (2), 104–108. doi: 10.1136/qshc.2007. 024760.

Mitchell, L., Flin, R., Yule, S., Mitchell, J., Coutts, K., Youngson, G., 2012. Evaluation of the scrub practitioners list of intraoperative non-technical skills system (SPLINTS). Int. J. Nurs. Stud. 49 (2), 201–211. doi: 10.1016/j.ijnurstu.2011.08. 012.

Nguyen, N., Elliott, J., Watson, W., Dominguez, E., 2015. Simulation improves non-technical skills performance of residents during the perioperative and intraoperative phases of surgery. J. Surg. Educ. 72 (5), 957–963. doi: 10.1016/j.jsurg. 2015.03.005.

Pearson, E., McLafferty, I., 2011. The use of simulation as a learning approach to non-technical skills awareness in final year student nurses. Nurse Educ. Pract. 11 (6), 399–405. doi: 10.1016/j.nepr.2011.03.023.

Robertson, E., Hadi, M., Morgan, L., Pickering, S., Collins, G., New, S., Griffin, D., McCulloch, P., Catchpole, K., 2014. Oxford NOTECHS II: a modified theatre team non-technical skills scoring system. PLoS One 9 (3). doi: 10.1371/ journal.one.0090320.

Sevdalis, N., 2013. Non-technical skills and the future of teamwork in healthcare settings. In: The Health Foundation Inspiring Improvement, Retrieved from. http:// patientsafety.health.org.uk/sites/default/files/resources/non_technical_skills_an d_ the_future_of_teamwork_in_healthcare_settings.pdf.

Sevdalis, N., Davis, R., Koutantji, M., Undre, S., Darzi, A., Vincent, C.A., 2008. Reliability of a revised NOTECHS scale for use in surgical teams. Am. J. Surg. 196 (2), 184–190. doi: 10.1016/j.amjsurg.2007.08.070.

Sevdalis, N., Lyons, M., Healey, A.N., Undre, D., Darzi, A., Vincent, C.A., 2009. Observational teamwork assessment for surgery (OTAS): construct validation with expert vs. novice raters. Ann. Surg. 249 (6), 1047–1051. doi: 10.1097/ SLA.0b013e3181a50220.

Steinemann, S., Berg, B., DiTulio, A., Skinner, A., Terada, K., Anzelon, K., Ho, H., 2012. Assessing teamwork in the trauma bay: introduction of a modified “NOTECHS” scale for trauma. Am. J. Surg. 203 (1), 69–75. doi: 10.1016/j.amjsurg.2011. 08.004.

Thomas, L., Gala, C., 2013. Building a culture of safety through team training and engagement. Postgrad. Med. J. 89, 394–401. doi: 10.1136/postgradmedj- 2012-001011rep.

Walker, S., Brett, S., McKay, A., Lambden, S., Vincent, C., Sevdalis, N., 2011. Observational skill-based clinical assessment tool for resuscitation (OSCAR): devel- opment and validation. Resuscitation 82 (7), 835–844. doi: 10.1016/j. resuscitation.2011.03.009.

PART II EMPIRICAL STUDIES

Chapter 4. Non-technical skills assessment scale in nursing: construction, development and validation.

Pires, S., Monteiro, S., Pereira, A., Stocker, J., Chaló, D., Melo, E. (2018). Non-technical skills assessment scale in nursing: Construction, development and validation. *Revista Latino-Americana de Enfermagem*, *26*, e3042. doi: 10.1590/1518-8345.2383.3042

4.1. Abstract

Introduction of non-technical skills during nursing education is crucial to prepare nurses for clinical context, and increase patient safety. We found no instrument developed for this purpose.

Goals: Construct, develop and validate a non-technical skills nursing assessment scale.

Method: Methodological research study. Based on the literature review and researchers experience on healthcare non-technical skills and the knowledge of the principles of crisis resource management, a list of 63 items with five-point Likert scale was constructed. The scale was applied to 177 nursing graduation students. Descriptive statistics; correlations; internal consistency, and exploratory factor analysis, to examine the scale psychometric qualities, were performed.

Results: Scale items present similar values for mean and median. Maximum and minimum showed well distribution by all response options. Most items present a significant and positive relationship. Cronbach-alpha presented a good value (.94), and most correlations were significant and positive. Exploratory factor analysis Kaiser-Meyer-Olkin test obtained the value of .849 and Bartlett's test showed adequate sphericity values ($\chi 2=6483.998$; $p=.000$). One factor model explained 26% of the total variance.

Conclusion: Non-technical skills training and its measurement could be included in graduate or postgraduate courses in healthcare professions or until used to ascertain needs and improvements in healthcare contexts.

Descritores: Competências Não-Instrumentais; Gestão de Recursos em Situações de Crise; Cuidados de Saúde; Enfermagem; Estudantes de Enfermagem; Qualidades Psicométricas.

Descriptors: Non-technical Skills; Crisis Resource Management; Healthcare; Nursing; Nursing Students; Psychometric Qualities.

Descriptores: Habilidades No Técnicas; Gestión de Recursos en Situaciones de Crisis; Cuidado de la Salud; Enfermería; Estudiantes de Enfermería; Calidades Psicométricas.

4.2. Introduction

The term non-technical skills (NTS), was primarily used in the aviation industry in a simulation-based safety training program known as crew resource management designed to educate pilots and their crews about the limitations of human performance, understanding cognitive errors, behavioral analysis, communication, conflict-resolution, and decision-making. The successful training prototype from aviation was adapted to healthcare contexts and became crisis resource management (CRM), providing a simulation-based model for teaching NTS to healthcare professionals based on 15 acting principles: know the environment, anticipate and plan, call for help early, exercise leadership and followership, distribute the workload, mobilize all available resources, communicate effectively, use all available information, prevent and manage fixation errors, cross (double) check, use cognitive aids, re-evaluate repeatedly, use good teamwork, allocate attention wisely, and set priorities dynamically[1].

NTS training such as in communication, teamwork, leadership, decision-making and situation-awareness, has proved to improve professionals' performance[2] and several healthcare courses and majors have begun to recognize them as playing an important role to increase patients' safety and successful clinical outcomes. Indeed, it is now well acknowledged that NTS are essential skills to be acquired by different healthcare professionals[3].

Specifically, in nursing graduation, NTS training is the interface between the real clinical contexts, in which future nurses will enter. Therefore, it is essential for nursing graduation students to develop not only clinical and technical skills but also NTS. Once challenges in the treatment of patients are often not due to a lack of clinical expertise, but to a failure on non-technical skills[2]. In order to effectively provide NTS training, it is essential to have an instrument to measure these skills. Several instruments have been developed to be used in various domains (operating room, resuscitation teams, obstetric teams, trauma teams, trauma resuscitation, healthcare teams in acute settings and emergency environment) in order to meet this need[4-21], but in the context of specific multidisciplinary teams, working on a specific context, with specific procedures [22].

However, no theoretically-based and easy-to-use assessment instrument has been

published or developed and validated specifically for the assessment of NTS of nurses' activities in general. Such an instrument is necessary to benchmark good NTS and to guide formative feedback to nursing students' future practice, and that is what we aim to discuss in this paper: present the development and validation studies of a scale built based on NTS theories and previous studies, specifically adapted for nursing graduation students, as it can assess NTS in order to enable a greater understanding of these skills and enhance nursing graduation students performance and patient safety in their future practice[22].

In this sense, since there was no specific instrument for the context of nursing education, we carried out a panel discussion to adapt CRM principles to the context of nursing practice, according to the language and the specific activities performed in nursing.

4.3. Method

To develop Non-Technical Skills Assessment Scale in Nursing (NTS-NAS), several phases were undertaken. Firstly, based on the literature review and researchers' experience on the topic, the research team, constituted by nurses, nursing teachers, one anesthesiologist and three psychologists, developed a list of sentences (items) for each of the 15 principles of CRM that would be our 15 scale dimensions (know the environment, anticipate and plan, call for help early, exercise leadership and followership, distribute the workload, mobilize all available resources, communicate effectively, use all available information, prevent and manage fixation errors, cross (double) check, use cognitive aids, re-evaluate repeatedly, use good teamwork, allocate attention wisely, and set priorities dynamically). This process resulted in a 64 items list organized into a single-answer format in a five-point Likert scale where students had to rate their level of agreement. Items examples are: "I know every team members name", "I call all patients by their names". Based on the scale main assessment topic it was entitled "Non-technical Skills Assessment Scale in Nursing". The scale was preceded by a set of instructions with the following content: "Given your scope of care, please complete the following questionnaire according to how you evaluate your usual performance. Use the scale of responses presented to

evaluate each of the items. Choose the "not applicable" option when the item does not apply to your situation". Secondly, all 64 items were reviewed by a panel discussion of three nursing experts and the study researchers who sought to identify possible gaps in the clarity of the statements, their representativeness for the construct and the content validity of each item, thus ensuring the construct validity. The panel discussed all items one by one until every member agreed that they were representative, observable, comprehensive and adequate to the competences of nursing graduation students. Furthermore, experts also assessed the suitability of the items to the clinical, low and high-fidelity simulation context. Some changes were made such as: panel decided to eliminate "Mobilize all available resources" CRM principle / scale dimension, for its difficult measurement, by the context and the fact that nursing graduation students do not yet have the autonomy to do so; some words have been replaced; some items were eliminated and other included; some items were removed from one principle and included in another. Thirdly, the research team conducted a pre-test involving six senior nursing students to discuss and verify their understanding of NTS-NAS. Some changes in the instructions were necessary: "*Please complete the following questionnaire according to how you evaluate your usual performance, taking into account your latest experience in a nursing team. Use the scale of responses presented to evaluate each of the items.* Choose the option "Not applicable" when the item does not apply to your situation. *It should take into account the definition of the following concepts: Scenarios: concerns different diagnostic hypotheses / starting points, prior to decision-making. Leader: concerns the person in charge of the care team*".

The NTS-NAS and informed consents were analyzed by Nursing Course Director from Health School of Aveiro University and approved by Scientific Committee of the Doctoral Program in Psychology of Aveiro University. Questionnaires were confidential, voluntary, anonymous, and collectively administered between October 2016 and January 2017, by the principal investigator, to nursing graduation students in classrooms during regular school hours, and standardized oral instructions were given. Participants took between 5 and 15 minutes to answer. No major doubts emerged during administration.

The central objective on the construction and development of the NTS-NAS was to evaluate NTS usage in the nursing learning process in order to be used in clinical, low and high-fidelity simulation training contexts.

NTS-NAS was constructed and developed in Portuguese, however, in this paper we will translate any necessary parts to English.

To select the sample, we considered the following inclusion criteria: have to be 2nd, 3rd or 4th grade nursing graduation students, because clinical experience and knowledge is required to answer the scale; and exclusion criteria: 1st grade nursing graduation students (these students have no clinical experience and knowledge yet to answer the scale).

The study version of the scale resulted in a 63 items list, with a five-point Likert scale: "totally disagree", "partially disagree", "neither agree nor disagree", "partially agree", and "totally agree", and a "non-applicable" option. It is subdivided in 14 dimensions that correspond to the 14th CRM principles: know the environment, anticipate and plan, call for help early, exercise leadership and followership, distribute the workload, communicate effectively, use all available information, prevent and manage fixation errors, cross (double) check, use cognitive aids, re-evaluate repeatedly, use good teamwork, allocate attention wisely, and set priorities dynamically.

In order to analyze psychometric qualities of the NTS-NAS, SPSS (version 23.0) was used. The following statistical analyses were performed: descriptive statistics (for sensitivity); correlations; internal consistency (Cronbach's alpha), and exploratory factor analysis.

4.4. Results

The scale was applied to a random sample of 177 nursing graduation students from Health School of Aveiro University, Portugal.

Participants were from both genders (83.6% were female nursing graduation students and 16.4% were male nursing graduation students), distributed across 2nd, 3rd and 4th grades (42.9%, 40.7%, and 16.4%, respectively), and all of them have already experience with clinical practice in their internships, but no experience in crisis resource management or high-fidelity simulation.

Firstly, NTS-NAS with a 14 dimension´s model, regarding the analysis of NTS-NAS's sensitivity, the use of descriptive statistics allowed the exploration of the central tendency, dispersion and distribution measures (Table 1).

Table 1 – Measures of central tendency, dispersion, and distribution. Aveiro, Portugal, 2016

Dimension	Its*	Mean	Mode	Md†	SD‡	Min§	Max‖	Skewness	Kurtosis
Know¶	8	33.07	37	34	3.83	18	40	-.78	.77
Antic**	8	32.54	38	33	3.95	19	40	-.37	-.05
Call††	5	23.53	25	25	2.03	16	27	-1.3	1.3
Exerc‡‡	11	47.82	55	48	5.95	28	61	-.58	.03
Distr§§	2	8.10	9	8	1.30	2	11	-.78	1.9
Comm‖‖	6	25.43	27	26	3.37	11	31	-.80	1.2
Infor¶¶	1	4.34	5	4	.71	2	5	-.80	.14
Prev***	1	4.32	4	4	.64	3	5	-.40	-.69
Cross†††	5	21.45	24	22	2.67	14	26	-.46	-.56
Use‡‡‡	2	8.11	8	8	1.51	4	12	-.28	-.33
Evalu§§§	4	17.13	16	17	2.06	12	21	-.23	-.76
Team‖‖‖	7	29.53	30	29	3.37	21	38	.43	.42
Attent¶¶¶	2	9.03	10	9	1.06	6	10	-.62	-.77
Prior****	1	4.24	5	4	.80	2	6	-.60	-.43

*Its – Number of items from the dimension.
†Md – Median.
‡SD – Standard deviation.
§Min – Minimum.
‖Max – Maximum.
¶Know – Know the environment.
**Antic – Anticipate and plan.
††Call – Call for help early.
‡‡Exerc – Exercise leadership and followership.
§§Distr – Distribute the workload.
‖‖Comm – Communicate effectively.
¶¶Infor – Use all available information.
***Prev –Prevent and manage fixation errors.
†††Cross – Cross (double) check.
‡‡‡Use – Use cognitive aids.
§§§Evalu – Re-evaluate repeatedly.
‖‖‖Team – Use good teamwork.
¶¶¶Attent – Allocate attention wisely.
****Prior – Set priorities dynamically.

Overall, NTS-NAS's dimensions mean is not being affected by extreme values (outliers). In its turn, skewness and kurtosis coefficients are close to unity, which indicates inexistent or minimum deviations to normality in terms of participants' distribution. Finally, maximum and minimum values are clearly distant from each other, showing that participants' answers are generally well distributed by all response options. Hence, we can conclude that these indicators suggest that subjects' responses are within the parameters of the normal curve.

Generally, all dimensions present a significant and positive relationship, which suggests that the higher their NTS competency in one dimension, the higher will also be the other dimension, and vice-versa (Table 2).

Table 2 – Correlations among non-technical skills assessment scale in nursing dimensions. Aveiro, Portugal, 2016

Dimension	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.Know*	.57†	.33†	.64†	.57†	.46†	.32†	.35†	.36†	.40†	.41†	.24†	.44†	.38†
2.Antic‡		.40†	.53†	.50†	.44†	.42†	.48†	.34†	.49†	.54†	.31†	.43†	.35†
3.Call§			.41†	.38†	.42†	.35†	.36†	.44†	.24†	.53†	.32†	.60†	.39†
4.ExercII				.60†	.47†	.21†	.28†	.40†	.34†	.31†	.29†	.45†	.40†
5.Distr¶					.56†	.27†	.35†	.42†	.35†	.42†	.39†	.48†	.44†
6.Comm**						.41†	.40†	.47†	.28†	.39†	.44†	.40†	.52†
7.Infor††							.62†	.47†	.37†	.38†	.28†	.26†	.41†
8.Prev‡‡								.38†	.36†	.40†	.19§§	.27†	.32†
9.CrossIIII									.32†	.43†	.32†	.41†	.44†
10.Use¶¶										.43†	.22†	.30†	.27†
11.Evalu***											.30†	.50†	.33†
12.Team†††												.27†	.33†
13.Attent‡‡‡													.36†
14.Prior§§§													

*Know – Know the environment.
†p<.05 – Significance below .05.
‡Antic – Anticipate and plan.
§Call – Call for help early.
IIExerc – Exercise leadership and followership.
¶Distr – Distribute the workload.
**Comm – Communicate effectively.
††Infor – Use all available information.
‡‡Prev –Prevent and manage fixation errors.
§§p<.01 – Significance below .01.
IIIICross – Cross (double) check.
¶¶Use – Use cognitive aids.
***Evalu – Re-evaluate repeatedly.
†††Team – Use good teamwork.
‡‡‡Attent – Allocate attention wisely.
§§§Prior – Set priorities dynamically.

The dimensions that relate the most are “Know the environment” and “Exercise leadership and followership” (r=.64); “Call for help early” and “Allocate attention wisely” (r=.60); “Exercise leadership and followership” and “Distribute the workload” (r=.60); and “Use all available information” and “Prevent and manage fixation errors” (r=.62). Contrary, the dimensions that relate less are “Exercise leadership and followership” and “Use all available information” (r=.21); “Prevent and manage fixation errors” and “Use good teamwork” (r=.19); and, “Use cognitive aids” and “Use good teamwork” (r=.22).

The analysis of Cronbach's alpha reveals good internal consistency values for almost all 14 dimensions, with reference to the critical value of .70 (Table 3).

Table 3 – Cronbach's alpha values and corrected item-total correlation. Aveiro, Portugal, 2016

Dimension	Item	Alpha	Alpha if item deleted	Correlation
Know*	8	.77	Alpha always <	.39 - .60
Antic†	8	.73	Alpha > to .74 if item 12 excluded	.33 - .58
Call‡	5	.85	Alpha > to .87 if item 57 excluded	.50 - .68
Exerc§	11	.88	Alpha always <	.31 - .76
Distrll	2	.54		. 38
Comm¶	6	.74	Alpha always <	. 41- .60
Cross**	5	.68	Alpha always <	.34 - .61
Use††	2	.42		.27
Evalu‡‡	4	.71	Alpha always <	.39 - .62
Team§§	7	.36	Alpha > to .41 if item 50 excluded Alpha > to .55 if item 52 excluded	-.01-.36
Attentllll	2	.71		-.56

*Know – Know the environment.
†Antic – Anticipate and plan.
‡Call – Call for help early.
§Exerc – Exercise leadership and followership.
llDistr – Distribute the workload.
¶Comm – Communicate effectively.
**Cross – Cross (double) check.
††Use – Use cognitive aids.
‡‡Evalu – Re-evaluate repeatedly.
§§Team – Use good teamwork.
llllAttent – Allocate attention wisely.

Indeed, most coefficients were above .70, with the exception of "Cross (double) check" (.68); "Distribute the workload" (.54); "Use cognitive aids" (.42); and "Use good teamwork" (.36) dimensions. For the other dimensions, the coefficients were situated between .71 and .88, with "Know the environment", "Exercise leadership and followership" and "Call for help early" dimensions being the most consistent ones. These results suggest that "Cross (double) check", "Distribute the workload", "Use cognitive aids", and "Use good teamwork" dimensions had not a solid internal consistency and, hence, may not be assessing what they are supposed to assess. Furthermore, "Use all available information", "Prevent and manage fixation errors", and "Set priorities dynamically" dimensions could not be tested once they have only one item each. Considering the items in particular, the exclusion of four items could potentially benefit the respective dimension's internal consistency. It was also analyzed the correlation indexes for the corrected item-total, which corresponds to the correlation of each item with the total score of the respective dimension excluding the item itself. Therefore, a low coefficient (bellow .30) would suggest that the item is not

measuring the same construct measured by the other items included[23]. Overall, these correlations corroborate the results of internal consistency, since “Use good teamwork” dimension is the one that presents lower correlation coefficients, meaning that probably some items are not measuring “use good teamwork” itself. Indeed, four items of this dimension present coefficients lower than .30: item 50 (-.02); item 51 (.27); item 52 (-.01); and item 56 (.28). Finally, items 44 and 45 are also pointed out here with a very low correlation with the overall “use cognitive aids” dimension (.27), indicating that may also not be measuring “use cognitive aids” itself.

Regarding NTS-NAS’s factorial validity or underlying structure, exploratory factor analysis in principal components using varimax rotation and fixing 14 factors (which correspond to NTS-NAS’s dimensions) was performed. In the test of Kaiser-Meyer-Olkin (KMO) it was obtained the value of .849, which indicates a good fit of this factorial model to the present sample. In its turn, the Bartlett's test showed also adequate sphericity values ($\chi 2$=6483.998; p=.000), suggesting that the intercorrelation matrix differs from an identity matrix, and therefore NTS-NAS variables are correlated (as we had already confirmed). However, when analyzing the component matrix and the scree plot there is a clear discrepancy between the first and the other 13 factors, as all 63 items are saturated in the first factor (Figure1).

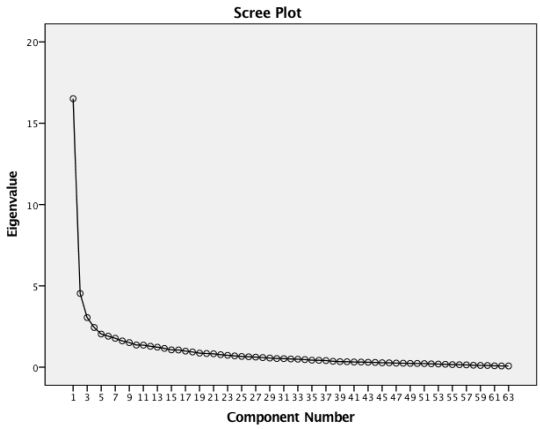


Figure 1 – Scree Plot from non-technical skills assessment scale in nursing exploratory factor analysis.

Therefore, we can assume that NTS may be better assessed in a unidimensional structure rather than in a multidimensional one. Given these surprising and unexpected results for the factorial validity, a whole new assessment for NTS-

NAS's psychometric qualities assuming a unidimensional structure was performed.

Sensitivity analysis was performed for all 63 items. Overall, NTS-NAS's items present similar values for mean and median. Maximum and minimum values show that answers were well distributed by all response options. Also, most skewness (skew) and kurtosis (kurt) coefficients are close to unity, which indicates inexistent or minimum deviations to normality in terms of participants' distribution, except for items: 4 (kurt= 1.475), 5 (kurt= 1.608), 19 (skew= -1.896; kurt= 3.480), 20 (kurt= 1.947), 24 (skew= -2.003; kurt= 8.315), 25 (skew= -2.606; kurt= 12.123), 30 (kurt= 3.047), 35 (kurt= 1.489), 51 (kurt= 1.633), 58 (skew= -1.586; kurt= 2.151), and 61 (skew= -2.251; kurt= 6.209).

Most items present a significant and positive relationship, except for item 52 ("I was involved in situations of conflict with other team members") that presented a significant but negative correlation. This is because this is a negative item (refers to conflicts involvement) while all the other items are formulated in a positive way. Therefore, a negative correlation between this item and the other items suggests that the higher their NTS competency, the less they were involved in conflictual situations and vice-versa. Items that relate the most are: 23-22 (r=.83); 24-25 (r=.73); 27-29 (r=.69); 26-27 (r=.68); 25-30 (r=.67); 26-28 (r=.65); 19-20 (r=.63); 9-10 (r=.62); and 15-16 (r=.62). Contrary, items that relate less are 1-40 (r=.15); 9-35 (r=.15); 15-23 (r=.15); 26-47 (r=.15); 28-49 (r=.15); and 37-44 (r=.15).

Some items present non-significant correlation, for example, items 1-11, 1-59, 2-19, 3-10, 4-35. These results suggest that those items most related are referred to the same context or activities, and are integrated in the same CRM principle of action. And the contrary happens with those less or non-significantly related, although they also refer to NTS.

The analysis of Cronbach's alpha reveals a good internal consistency value of .94.

It was also analyzed the correlation indexes for the corrected item-total. Indeed, four items present coefficients lower than .30: item 13 (.29); item 40 (.28); item 52 (-.02); and item 53 (.12).

Regarding NTS-NAS's factorial validity, exploratory factor analysis in principal components and with one factor fixed, as previously discussed, was performed. In the test of Kaiser-Meyer-Olkin (KMO) it was obtained the value of .849, which indicates a good fit of this factorial model to the present sample. Bartlett's test also showed also

adequate sphericity values ($\chi 2=6483.998$; $p=.000$), suggesting that the intercorrelation matrix differs from an identity matrix, and therefore NTS-NAS variables are correlated (as we had already confirmed). The total model explained 26% of the total variance. Globally the factor loadings were between .37 and .73, which suggest that the items are influenced by the underlying factor and, therefore, belong to this unidimensional model. Also, items present communality values between .24 and .53.

4.5. Discussion

Although some of the results for the NTS-NAS with 14 dimensions were satisfactory, presenting good sensitivity, correlations and internal consistency, the exploratory factor analysis made it clear that a multidimensional structure with 14 dimensions is not viable. Surprisingly, this analysis pointed out the possibility of a unidimensional structure for NTS-NAS. This may be because in general all items measure the same construct (NTS), and it may not be subdivided. Considering this unidimensional model, most of the results were also satisfactory except for the skewness and kurtosis of some items, which may be due to the fact that students did not want to compromise themselves with disagreement scale options, answering instead towards what is expected them to know and behave (social desirability). In other way, the reason for some items to present a non-significant correlation can be explained by the fact that even though they integrate NTS, they do not have to do with each other in the sense that they refer to different contexts and activities (for example items 2 “I know the equipment / clinical material that is available” and 19 “The team leader is clearly established”). As per the exploratory factor analysis with one factor only, the results were overall satisfactory, with the unidimensional model explaining 26% of the total variance.

To conclude, although the NTS-NAS was built based on the 14 CRM principles and it was expected that 14 dimensions would be found, a unidimensional structure of this questionnaire emerged and seems to be valid. In this sense, final version of NTS-NAS resulted in a 63 items list, with one dimension, NTS, with a five-point Likert scale: “totally disagree”, “partially disagree”, “neither agree nor disagree”, “partially agree”, and “totally agree”, and a “non-applicable” option.

4.6. Conclusion

This research was conducted in order to construct, develop and validate an instrument that could measure and represent NTS in nursing practice. Although more studies are needed to further validate the NTS-NAS unidimensional model, with a more representative sample of students/professionals from different healthcare settings, this instrument seem to be appropriate to adequately assess NTS in nursing clinical contexts. On one hand, it is suggested this instrument to be used in training settings whether in curricular internships or even in specific workshops/intervention programs that focus not only on technical but also on NTS. These types of intervention and respective assessment may significantly improve nursing students' performance, confidence, and self-efficacy, and be an added value as it can help them to better adjust to the complex clinical context, improve their clinical performance and ultimately, contribute to patients' safety and wellbeing. On the other hand, NTS training and NTS-NAS measurement could also be included in postgraduate courses in healthcare professions and even be used to ascertain needs and improvements in healthcare contexts, such as in hospitals and private practices.

4.7. References

1.Lindamood K, Rachwal C, Kappus L, Weinstock P, Doherty E. Development of neonatal intensive care multidisciplinary crisis resource training program. Newborn Infant Nurs Rev. 2011; 11(1):17–22. doi: http://dx.doi.org/10.1053/j.nainr.2010.12.011

2.Irwin A, Weidmann A. A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. Res Soc Admin Pharm. 2015;11(5):1-11. doi: http://dx.doi.org/10.1016/j. sapharm.2014.11.006

3.Boet S, Reeves S, Bould D. Call for an internationally recognized interprofissional simulation-based disease/ injury independent, crisis resource management training certification. Resuscitation. 2015; 92:7. doi: http:// dx.doi.org/10.1016/j.resuscitation.2015.03.027

4.Baker D, Capella J, Hawkes C, Gallo J, Clinic C. Development of the trauma team performance observation tool. Chicago, IL. [Internet]. 2011 [cited March 18, 2015].

Available from: https://www. researchgate.net/profile/Fadekemi_Oginni/post/Measurement_tool_questionnaire_for_In-service_Training_outcomes_evaluation/attachment/59d63d1979197b8077999f87/AS:418410061156354%4014767681 40408/download/Trauma%2Bteam%2Bassessment%2B tool.pdf+&cd=2&hl=pt-PT&ct=clnk&gl=pt&client=safari

5.Cooper S, Wakelam A. Leadership of resuscitation teams: Lighthouse leadership. Resuscitation. 1999; 42(1):27-45. doi: http://dx.doi.org/10.1016/S0300-9572(99)00080-5

6.Cooper S, O'Carroll J, Jenkin A, Badger B. Collaborative practices in unscheduled emergency care: Role and impact of the emergency care practitioner: Quantitative findings. Emerg Med J. [Internet]. 2007 [cited March 18, 2015];24:630-3. Available from: https://www.ncbi.nlm. nih.gov/pmc/articles/PMC2464656/

7.Cooper S, Cant R, Porter J, Sellick K, Somers G, Kinsman L, et al. Rating medical emergency teamwork performance: development of the team emergency assessment measure (TEAM). Resuscitation. 2010; 81(4):446-52. doi: http://dx.doi.org/10.1016/j. resuscitation.2009.11.027

8.Cooper S, Cant R. Measuring non-technical skills of medical emergency teams: An update on the validity and reliability of the team emergency assessment measure (TEAM). Resuscitation. 2014; 85(1):31-3. doi: http:// dx.doi.org/10.1016/j.resuscitation.2013.08.276

9.Guise J, Deering S, Kanki B, Osterweil P, Li H, Mori M, et al. Validation of a tool to measure and promote clinical teamwork. Simulation in Healthcare. 2008;3(4):217-23. doi: http://dx.doi.org/10.1097/SIH.0b013e31816fdd0a

10.Healey A, Undre S, Vincent. Developing observational measures of performance in surgical teams. Qual Saf Health Care. 2004; 13(1):33-40. doi: http://dx.doi. org/10.1136/qhc.13.suppl_1.i33

11.Hull L, Arora S, Kassab E, Kneebone R, Sevdalis N. Observational teamwork assessment for surgery: Content validation and tool refinement. J Am Coll Surg. 2011; 212(2):234-43. doi: http://dx.doi.org/10.1016/j. jamcollsurg.2010.11.001

12.Kim J, Neilipovitz D, Cardinal P, Chiu M, Clinch J. 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. Crit Care Med. 2006; 34(38):2167-74. doi: http:// dx.doi.org.10.1097/01.CCM.0000229877.45125.CC

13.Lyk-Jensen H, Jepsen R, Spanager L, Dieckmann P, Ostergaard D. Assessing nurse anaesthetists non-technical skills in the operating room. Acta Anaesthesiol Scand. 2014; 58(7):794-801. doi: http://dx.doi. org/10.1111/aas.12315

14.Malec J, Torsher L, Dunn W, Wiegman D, Arnold J, Brown D, et al. The mayo high performance teamwork scale: Reliability and validity for evaluating key crew resource management skills. Simul Healthcare. [Internet]. 2007 [cited March 18, 2015];2(1):4-10. Available from: http://www.lmher.com/resources/ Mayo%20Sim%20Eval%20copy.pdf

15.Mishra A, Catchpole K, McCulloch P. The Oxford NOTECHS system: Reliability and validity of a tool for measuring teamwork behavior in the operating theatre. Qual Saf Health Care. 2009; 18(2):104-8. doi: http:// dx.doi.org/10.1136/qshc.2007.024760

16.Mitchell L, Flin R, Yule S, Mitchell J, Coutts K, Youngson G. Evaluation of the scrub practitioners list of intraoperative non-technical skills system (SPLINTS). Int J Nurs Stud. 2012; 49(2):201-11. doi: http://dx.doi. org/10.1016/j.ijnurstu.2011.08.012

17.Robertson E, Hadi M, Morgan L, Pickering S, Collins G, New S, et al. Oxford NOTECHS II: A modified theatre team non-technical skills scoring system. Plos One. [Internet]. 2014 [cited March 18, 2015];9(3). Available from: http://journals.plos.org/plosone/ article?id=10.1371/journal.pone.0090320.

18.Sevdalis N, Davis R, Koutantji M, Undre S, Darzi A, Vincent CA. Reliability of a revised NOTECHS scale for use in surgical teams. Am J Surg. 2008; 196(2):184-90. doi: http:/dx.doi.org/10.1016/j.amjsurg.2007.08.070

19.Sevdalis N, Lyons M, Healey AN, Undre D, Darzi A, Vincent CA. Observational teamwork assessment for surgery (OTAS): Construct validation with expert vs. novice raters. Ann Surg. 2009; 249(6):1047-51. doi: http://dx.doi.org/10.1097/SLA.0b013e3181a50220

20.Steinemann S, Berg B, DiTulio A, Skinner A, Terada K, Anzelon K, et al. Assessing teamwork in the trauma bay: Introduction of a modified “NOTECHS” scale for trauma. The Am J Surg. 2012; 203(1):69-75. doi: http://dx.doi.org/10.1016/j.amjsurg.2011.08.004

21.Walker S, Brett S, McKay A, Lambden S, Vincent C, Sevdalis N. Observational skill-based clinical assessment tool for resuscitation (OSCAR): Development and

validation. Resuscitation. 2011; 82(7):835-844. doi: http://dx.doi.org/10.1016/j.resuscitation.2011.03.009

22.Pires S, Monteiro S, Pereira A, Chaló D, Melo E, Rodrigues A. Non-technical skills assessment for prelicensure nursing students. An integrative review. Nurse Educ Today. 2017; 58:19-24. http://dx.doi. org/10.1016/j.nedt.2017.07.015

23.Field A. Discovering Statistics Using SPSS, Sage. [Internet]. 2005 [cited April 5, 2017]. Available from: http://www.soc.univ.kiev.ua/sites/default/files/library/elopen/andy-field-discovering-statistics-using-spss-third-edition-20091.pdf

Chapter 5. Course structure.

Pires, S., Monteiro, S., Pereira, A., Chaló, D., Melo, E. (2019). Non- technical skills in nursing education: Construction of a high-fidelity simulation-based course. *European Journal of Public Health, 9*, Issue Supplement_2. doi:10.1093/eurpub/ckz097.006

5.1. Abstract

Introduction: Patient safety is the most important aspect to ensure a quality healthcare service. Therefore, professionals must have knowledge of threats to patient safety and experience in caring for patients when extraordinary clinical problems arise (Lucas & Edwards, 2017). The majority of healthcare education curriculums emphasize technical skills and forget that non-technical skills (NTS) remain an important component for example in rapid responsive teams on emergency settings (Porter, Cant, & Cooper, 2018).

Objetives: Construction of a NTS course for nursing students.

Methods: The course was designed and developed based on NTS, crisis resource management principles (CRM) and some developed programs such as the, Neonatal Intensive Care Multidisciplinary Crisis Resource Training (Lindamood et al. 2011); Simulated Trauma and Resuscitative Team Training (Gillman et al. 2016); and TeamSTEPPS (United States Department of Defense and the Agency for Healthcare Research and Quality). It includes a one four-hour theoretical session and two three-hour practical sessions with four different scenarios that last approximately 15 minutes and are immediately followed by a focused and structured debriefing for 45 minutes.

Results: Students showed greater satisfaction with the the practical sessions. These results may be due to the fact that the practical sessions are more appealing and interesting as students can put the acquired knowledge in the theoretical session into practice. Therefore, high-fidelity simulation was well received as it offered benefits not inherent in traditional nursing education modalities, in the way that both technical and NTS are fundamental to a new paradigm of currently evolving education (Halamalek et al. 2000).

Conclusions: in a time where increased effort is focused on improving the quality of healthcare delivered while minimizing adverse events, a methodology that allows to learn and practice critical skills in a safe environment is invaluable.

5.2. Construction and Development

The NTS Nursing Course (NTSNC) was designed and developed based on NTS such as communication, leadership, mutual support, situation-awareness, and

decision-making; CRM principles (know the environment; anticipate and plan; call for help early; exercice leadership and followership; distribute the workload; mobilize all available; communicate effectively; use all available information; prevent and manage fixation errors; cross (double) check; use cognitive aids; reevaluate repeatedly; use good teamwork; allocate attention wisely; set priorities dynamically) and some already developed programs namely Neonatal Intensive Care Multidisciplinary Crisis Resource Training, designed to improve patient safety and achieve Children´s Hospital Boston specific goals to improve the accuracy of patient identification, the effectiveness of communication among healthcare professionals, the safety of using medications, the response time to changes on patient´s condition, and to identify safety risks (Lindamood et al. 2011); Simulated Trauma and Resuscitative Team Training, designed by a multidisciplinary team with the intent to address the individual needs of each discipline and to promote training together as a team (Gillman et al. 2016); and TeamSTEPPS (Team Strategies & Tools to Enhance Performance & Patient Safety), an evidence-based program from United States Department of Defense and the Agency for Healthcare Research and Quality, aimed at optimizing performance among healthcare professionals, enabling them to respond quickly and effectively to any situation arised.

The NTSNC is an ten-hour course whose learning objectives are: 1) define a team and its members' responsabilities and roles; 2) define NTS concept and its importance in healthcare, more precisely in nursing; 3) describe NTS such as communication, leadership, mutual support, situation-awareness, and decision-making; 4) define CRM as a structured strategy for NTS improvement and describe its principles, adapted for nursing activities; and finally, 5) apply NTS and CRM principles to clinical four scenarios in HFS environment.

The course was divided in three sessions: one four-hour theoretical session; and two three-hour practical sessions.

5.3. Course structure

Didatic training has been shown to improve attitudes and awareness of NTS compared to conventional training (Khan et al., 2017). Even though a high degree of

technical expertise is important, this alone is not enough to prevent errors (Myers et al., 2016).

The NTSNC theoretical session introduced all the investigation concepts in order to acknowledge the importance to educate healthcare professionals on NTS, as essential skills to the quality of healthcare delivery and to prevent and mitigate errors and patient injuries and harms (Table 1).

Table 1 – Non-Technical skills Nursing Course structure.

Theoretical session	Instructors and students presentation.
	Course objectives.
	Background: NTS, CRM, HFS.
	Exercise 1: Teamwork.
	Team and its members.
	Discussion on NTS such as communication, lidership, mutual support, situation-awareness, decision-making.
	Exercise 2: Teamwork.
	Discussion on CRM principles and acting strategies (briefing, huddle, debriefing, SBAR, call-out, check-back, checklist, feedback).
Practical sessions	Visit to simulation room: overview of mannequin and equipment.
	Scenario 1: Acute Chronic Obstructive Pulmonary Disease. Debriefing 1.
	Scenario 2: Medication Error (Hypoglycemia). Debriefing 2.
	Scenario 3: Febrile Seizure in Pediatrics. Debriefing 3.
	Scenario 4: Acute Lung Edema. Debriefing 4.
	Reflection on learning and NTS training impact on students' performance.

The practical sessions took place at SIMULA, where an initial and general orientation to the simulation equipment (mannequins and monitors) and sessions ground rules (behavioral expectations, confidentiality of course experiences, and security of contents of the practical scenarios) was conducted. In this context, students

had the opportunity to briefly interact with the human patient simulator and learn its capabilities (and limitations).

Full-scale simulations included a realistic child or adult mannequins and monitors placed in a realistic clinical environment. Monitors and mannequins interfaced with a computer program to project and display vital signs, voice, and sometimes, movements.

To assure that the practical sessions would be more effective, the experimental group (N=20) was divided in two smaller groups of ten students each and then these students were divided in active (N=5) and observer participants (N=5). Active participants managed the first simulated crisis scenario while observers viewed the scenario via live video transmission and then participants changed position for the second scenario, different from the first one. Practical session's contents and the four HFS scenarios were the same for both groups.

Each HFS scenario was introduced and initiated with a briefing by giving students the patient chart and information about the clinical case scenario and instructing them to proceed as a nursing team with a real patient. During each scenario students should manage a crisis that would arise regarding not only technical skills but essencially NTS. The simulations involved a variety of learning challenges that reflected scenarios that students would be likely to face in practice. This included opportunities to demonstrate care management, communication, and clinical skills in real time fluid situation. Scenarios lasted approximately 15 minutes and were immediately followed by a focused and structured debriefing discussion, for 45 minutes. Each session was recorded in its entirety (scenarios and debriefing). Debriefing was conducted in a different room with all participants and an expert instructor, using the videos of the scenarios, to promote reflective practice on NTS and CRM principles and acting strategies and to identify strengths and weaknesses areas for their future performance improvement.

5.4. References

Gillman, L., Brindley, P., Paton-Gray, J., Engels, P., Park, J., Vergis, A., & Widder, S. (2016). Simulated trauma and resuscitation team training course: Evolution of a multidisciplinary trauma crisis resource management simulation course.

American Journal of Surgery, *212*(1), 188-193 doi: 10.1016/j.amjsurg.2015.07.024

Halamalek, L.P., Kaegi, D.M., Gaba, D.M., Sowb, Y.A., Smith, B.C., Smith, B.E., & Howard, S.K. (2000). Time for a new paradigm in pediatric medical education: Teaching neonatal resuscitation in a simulated delivery room environment. *Pediatrics*, *106*(4), 1-6. Retrieved from: http://pediatrics.aappublications.org/content/pediatrics/106/4/e45.full.pdf

Khan, R., Scaffidi, M., Walsh, C., Lin, P., Al-Mazroui, A., Chana, B., … Grover, S. (2017). Simulation-based training of non-technical skills in colonoscopy: Protocol for a randomized controlled trial. *JMIR Research Protocols*, *6*(8): e153. doi: 10.2196/resprot.7690

Lindamood, K., Rachwal, C., Kappus, L., Weinstock, P., & Doherty, E. (2011). Development of neonatal intensive care multidisciplinary crisis resource training program. *Newborn & Infant Nursing Reviews, 11*(1), 17–22. doi: 10.1053/j.nainr.2010.12.011

Lucas, A., & Edwards, M. (2017). Development of crisis resource management skills: A literature review. *Clinical Simulation in Nursing, 13*, 347-358. doi: 10.1016/j.ecns.2017.04.006

Myers, J., Powell, D., Psirides, A., Hathaway, K., Aldington, S., & Haney, M. (2016). Non-technical skills evaluation in the critical care air ambulance environment: Introduction of an adapted rating instrument – an observational study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 24*(24). doi: 10.1186/s13049-016-0216-5

Porter, J., Cant, R., & Cooper, S. (2018). Rating teams' non-technical skills in the emergency department: A qualitative study of nurses' experience. *International Emergency Nursing, 38*, 15-20. doi: 10.1016/j.ienj.2017.12.006

Chapter 6. Non-technical skills in nursing education: effectiveness of a high-fidelity simulation-based training course.

Pires, S., Monteiro, S., Pereira, A., Stocker, J., Chaló, D., Melo, E. (2019). Non-technical skills in nursing education: Effectiveness of a high-fidelity simulation-based training course. (*Submitted*).

6.1. Abstract

Literature refers that patients are commonly affected by preventable adverse events associated with non-technical skills failures. Non-technical skills training programs address to prepare for, respond to, and mitigate adverse events in healthcare.

This study took place at Center for Clinical Simulation of Aveiro University. Third year prelicensure nursing students were included in two groups: control group (N=27), and experimental group (N=20, who participated in the training course developed, focusing on non-technical skills and crisis resource management acting principles). The study was divided in two different moments, before the implementation of the course, and after the implementation of the course. The course was then divided in three sessions: one four-hour theoretical session; and two three-hour practical sessions, each including two high-fidelity simulation-based different scenarios, four in total.

Regarding non-technical skills, we found significant differences in the experimental group in eleven items after intervention. As per participants' self-confidence levels, those who participated seem to have significantly increased confidence in their skills. Regarding social-demographic variables, it seems that students from primary healthcare tend to present better non-technical skills than students from maternal health specialty.

Overall these results seem to suggest that the course developed was effective in increasing students' knowledge and awareness on non-technical skills. It was demonstrated that the development and application of the structured course is feasible and positive changes in behavior can be measured through the instruments developed. Then, consideration must be given in integrating non-technical skills training into nursing education.

6.2. Keywords

Non-technical Skills; Crisis Resource Management; High-Fidelity Simulation-Based Training; Healthcare; Nursing Education; Nursing Students.

6.3. Introduction

Non-technical skills (NTS) such as communication, leadership, mutual support, situation-awareness, and decision-making are crucial to ensure patient safety, especially when managing crises[1]. Medical errors are common in crisis situations and the majority is due to NTS failures[2-5]. Therefore, understanding what NTS are, their relevance for healthcare and importance to patient outcomes is increasingly being recognized.

Indeed, crisis resource management (CRM) is a set of direct acting principles that encompass NTS, that were adapted from aviation industry to healthcare context, providing a simulation-based model for teaching and improving these skills within healthcare professionals and reduce errors[6-7]. CRM principles include: know the environment, anticipate and plan, call for help early, exercise leadership and followership, distribute the workload, mobilize all available resources, communicate effectively, use all available information, prevent and manage fixation errors, cross (double) check, use cognitive aids, re-evaluate repeatedly, use good teamwork, allocate attention wisely and set priorities dynamically[8].

Literature states that learners need to actively practice so that learning is effective[1]. Following this directive, in order to effectively provide NTS training, high-fidelity simulation has been shown to be an effective tool to teach CRM acting principles as it offers a safe environment for trainees to develop, practice and refine their knowledge and skills with no risk of harm to real patients[9]. High-fidelity simulation includes a realistic child or adult mannequins and monitors placed in a realistic clinical environment. Monitors and mannequins interface with a computer program to project and display vital signs, voice and, sometimes, movements. These mannequins mimic diverse parameters of human physiology (cardiovascular, pulmonary, metabolic, and neurological systems). Such programs that use high-fidelity simulation-based training proved to also improve participants' self-efficacy and confidence[10]. In fact, literature refers to several studies that emphasized NTS' improvement and successful clinical performance after its training courses[11-24]. Therefore, the development of NTS training programs in healthcare learning

environments may significantly improve students' performance and self-confidence, and can be an added value as it can help them to adjust to the complex clinical context[22-23].

However, even though recent literature has highlighted the necessity of introducing NTS training and assessment within healthcare professionals[10;13;17;19;20;21;22;24] there is still little focus on a coherent and systematic integration of these skills into healthcare learning settings, such as nursing education[15;25;26].

6.4. Objective

Therefore, the main purpose of this study was to develop and examine the efficacy of a high-fidelity simulation-based course focusing on NTS and CRM acting principles for undergraduate nursing students in order to promote its knowledge and usage as well as increase confidence on their clinical performance, with the ultimate objective of improving patient care and safety and contribute to error reduction in their future practice.

6.5. Method

The present study took place at Center for Clinical Simulation of Aveiro University, in the School of Health of Aveiro University and the Scientific Committee granted respective approval.

In order to recruit participants all 3rd year prelicensure nursing students were invited to participate in the study and were informed of the purpose of the study, nature of their involvement, and potential benefits and risks in participating. Then, a written informed consent was obtained from those who volunteered to participate. Confidentiality was guaranteed in that data would be reported as group data only. Students were also informed that taking part in the study was entirely voluntary and had no impact on their curricular evaluations. It should be noted that it was not

possible to randomize the sample as there were students who volunteered only to answer the questionnaires and be included on control group.

Forty-seven students volunteered to participate in the study: twenty-seven students in the control group, and twenty students in the experimental group. The control group attended the usual classes. The experimental group attended the usual classes and participated as well in the high-fidelity simulation-based training course, focusing on NTS and CRM principles, developed for this study.

The study was divided in two moments, before the implementation of the course to the experimental group (phase 0), and after the implementation of the course to the experimental group (phase 1). There was a drop-out of fifteen participants from the control group (experimental group remained the same), being that only thirty-two participants completed the study and were included in the analyses (control group = 12; experimental group = 20). The drop-out was due to the fact that these students were not present in all sessions where questionnaires were administered, as the sessions occurred in usual classes. Participants' ages ranged between 20 (68.2%) and 39 years old (Mean=21.34; Standard Deviation=3.75), primarily female (85.1%). All participants were at the 3rd year of undergraduate in nursing, and had no experience in high-fidelity simulation, and knowledge or experience on NTS or CRM principles. The last experience on an internship was in 2nd year. The specialties experienced were 63.8% in primary health, 34% in maternal health, and 2.2% in cardiology.

To evaluate the course four instruments were constructed: a sociodemographic questionnaire (age, gender, class, year, experience in high-fidelity simulation, knowledge and experience with NTS, knowledge and experience on CRM principles, and specialty of the last internship accomplished); the Non-Technical Skills Assessment Scale in Nursing (NTSN); a self-confidence questionnaire; and a satisfaction questionnaire.

The NTSN was used to evaluate students' NTS performance in nursing activities and consists of a unidimensional scale, constituted by a list of 63 items with a five-point Likert scale: "totally disagree", "partially disagree", "neither agree nor disagree", "partially agree", and "totally agree", and a "non-applicable" option. For its construction and development, all norms were followed, namely, analysis of

items for construct representativeness, its comprehensibility and suitability to nursing students' competences, and application context. It was reviewed by three nursing experts, besides the study researchers, and then tested in a group of six senior nursing students. In relation with the scale psychometric qualities, most items present a significant and positive relationship. Cronbach alpha presented a good value .94, and exploratory factor analysis with one factor explained 26% of the variance.

The self-confidence questionnaire was used to evaluate participants' confidence in their performance, with four items using a five-point Likert scale: "not at all confident", "little confident", "confident", "very confident"; "extremely confident", and a "non-applicable" option.

Lastly, the satisfaction questionnaire was used to evaluate the experimental group satisfaction with the course in general and its contents in particular, with 17 items using a four-point Likert scale: "insufficient", "sufficient", "good", "very good", and a "non-applicable" option. The questionnaire was divided in four evaluation areas: structure and content, instructor, resources and teaching materials, and global appreciation.

The Non-Technical Skills Nursing Course (NTSNC) was designed and developed based on NTS and CRM principles and acting strategies and some already developed programs, such as the Neonatal Intensive Care Multidisciplinary Crisis Resource Training program[27]; the Simulated Trauma and Resuscitative Team Training course[28]; and the TeamSTEPPS training curriculum developed by the United States Department of Defense and the Agency for Healthcare Research and Quality. The NTSNC learning objectives aimed to provide an overview on the course objectives (general and learning session´s objectives); define a team and its members responsibilities and roles; define NTS concept and understand its importance in healthcare, more precisely in nursing practice; describe NTS such as communication, leadership, mutual support, situation-awareness, and decision-making; define CRM as a structured strategy for improving NTS and describe its principles, adapted for undergraduate nursing students; and finally, apply NTS and CRM principles to clinical scenarios in high-fidelity simulation environment.

The course was divided in three sessions: one four-hour theoretical session; and two three-hour practical sessions, each including two high-fidelity simulation-based different scenarios, four in total. The theoretical lecturer introduced the NTS and CRM principles and acting strategies. The practical sessions took place in high-fidelity simulation environment, where an initial and general orientation to the simulation equipment (mannequins and monitors) was conducted. In this context, students had the opportunity to briefly interact with the human patient simulator and learn its capabilities (and limitations). To assure that the practical sessions would be more effective, the experimental group was divided in two smaller groups of ten students each and then these students were divided in active (Sample=5) and observer participants (Sample=5). Active participants managed the first simulated crisis scenario while observers viewed the scenario via live video transmission and then participants changed position for the second scenario, different from the first one. Practical session's contents and the four high-fidelity simulation scenarios were the same for both groups.

Each high-fidelity simulation scenario was introduced and initiated with a briefing by giving students information about the clinical case scenario and instructing them to proceed as a nursing team. During each scenario students should manage a crisis that would arise regarding not only technical skills but essentially NTS. Scenarios lasted approximately 15 minutes and were immediately followed by a focused and structured debriefing discussion, for 45 minutes. Debriefing was conducted in a different room with all participants and an expert instructor, using videos of the scenarios, to promote reflective practice on NTS and CRM principles and acting strategies and identify strengths and weaknesses areas for their future performance improvement. At the end of the theoretical and each high-fidelity simulation scenario debriefing on practical sessions, a satisfaction questionnaire was administrated.

All participants (control and experimental groups) answered the sociodemographic questionnaire, the NTSN, and the self-confidence questionnaire: before, immediately and six months after the course implementation to the experimental group. Besides these, the experimental group also answered the

satisfaction questionnaire five times: after the theoretical session, and after each high-fidelity simulation scenario.

Differences on control group and experimental group were analyzed to evaluate progression on students' NTS performance in nursing activities in general, as well as their self-confidence levels. With this purpose, results from NTSN and self-confidence questionnaire were compared in each group (control and experimental) and between groups and phases. Social-demographic variables were also used to perform further differential studies within the sample (results from phase 0 were used to control intervention related variables). Finally, satisfaction levels with the course developed for the experimental group were also explored in order to understand what sessions contributed the most to students' NTS improvement (phase 1). SPSS was used to run paired and independent samples T-test, as well as Analysis of Variance (ANOVA) and lastly Analysis of Repeated Measures to compare all three phases.

6.6. Results

Considering the NTS, we found no significant differences in total scale results. This suggests that overall there is no difference between control and experimental group for the total score obtained in the NTSN nor across phases 0 and 1 within each group (before and after the intervention).

However, when performing the same analyses for each NTSN items from phase 0 to phase 1, we found significant differences in the experimental group in 11 items (Table 1).

Table 1 – Differences on NTSN* items in the experimental group. Aveiro, Portugal, 2017

Item	Phase 0			Phase 1			Paired Samples T-test		
	N†	Mean	SD‡	N†	Mean	SD‡	t§	dfll	p¶
6	20	4.15	.933	20	4.85	.489	-3.390	19	.003
7	20	4.00	.858	20	4.75	.550	-3.943	19	.001
8	20	2.90	.788	20	4.15	1.424	-3.206	19	.005
9	20	4.40	.754	20	3.65	.587	3.470	19	.003
14	20	3.50	.513	20	4.20	.410	-4.765	19	.000
17	20	4.25	.851	20	3.60	1.046	2.668	19	.015
31	20	3.50	.688	20	4.20	.696	2.896	19	.009
33	20	4.25	.639	20	3.90	.308	2.666	19	.015
35	20	4.30	.733	20	4.85	.366	-3.240	19	.004
43	20	4.40	.681	20	3.90	1.021	2.364	19	.029
51	20	4.45	.686	20	4.80	.410	-2.666	19	.015

*NTSN – Non-Technical Skills Assessment Scale in Nursing.
†N – Sample.
‡SD – Standard deviation.
§t – Student's t-test value.
lldf – Degrees of freedom.
¶p – Significance value.

The means increased in the majority of the 11 items, such as in item 6 ("I know all team members' names"), 7 ("I know patients' names"), 8 ("I know who's the patients' relatives"), 14 ("I contribute to the clear definition of the strategy and intervention plan"), 31 ("I acknowledge to the team my own limitations"), 35 ("I use a technical language when communicating with the team"), and 51 ("I am receptive to other team members' opinions even when they are different from mine"), except for items 9 ("Mobilize all available resources to resort patients' information"), 17 ("Proceed to the proper hand hygiene before intervening"), 33 ("Always address people directly by name"), and 43 ("Always confirm medication before its preparation and administration").

In the control group we also found significant differences in four items from phase 0 to phase 1 (Table 2).

Table 2 – Differences on NTSN* items results on control group. Aveiro, Portugal, 2017

Item	Phase 0			Phase 1			Paired Samples Test		
	N†	Mean	SD‡	N†	Mean	SD‡	t§	dfǁ	p¶
12	12	4.75	1.288	12	3.75	1.288	2.253	11	.046
21	12	4.42	.900	12	3.83	.577	2.244	11	.046
33	12	3.17	.835	12	4.00	.603	-3.079	11	.010
62	12	4.83	.389	12	4.17	.718	2.966	11	.013

*NTSN – Non-Technical Skills Assessment Scale in Nursing.
†N – Sample.
‡SD – Standard deviation.
§t – Student's t-test value.
ǁdf – Degrees of freedom.
¶p – Significance value.

However, contrary to the experimental group, except in item 31, the means decreased in the majority of items, such as item 12 ("I have prior access to information/history and current situation of the patient"), 21 ("Leader knows how to communicate with the team"), and 62 ("I am focused on the patient during care").
As per participants' self-confidence levels, there were no significant differences across groups (control and experimental) in both phases 0 and 1, nor between phase 0 and phase 1 in the control group. Nonetheless, we found significant differences between phase 0 and phase 1 in the experimental group. More specifically, students who participated in the NTSNC seem to have significantly increased confidence in their skills (Significance=.025), as the overall mean was higher after the implementation of the course.

Regarding social-demographic variables, we found no significant differences in NTSN total scale for gender nor for internship specialty. Although there were also no differences between males and females in all NTSN items, there were 12 items that presented significant differences between two specialties: primary healthcare and maternal health. Curiously, NTSN means are always higher in primary healthcare rather than in maternal health, except for item 52 ("I was involved in situations of conflict with other team members"). This is because it is a negative item (refers to conflicts involvement) while all the other items are formulated in a positive way. Therefore, it suggests that the lower the mean, the less they were involved in conflictual situations (Table 3).

Table 3 – Differences in NTSN* items between primary healthcare maternal health in phase 0. Aveiro, Portugal, 2017

Item	Primary health care			Maternal Health			Independent samples T-test		
	N†	Mean	SD‡	N†	Mean	SD‡	t§	df‖	p¶
1	30	4.63	.556	16	4.19	.655	2.434	44	.019
6	30	4.60	.675	16	3.44	.964	4.295	23	.000
12	30	4.93	1.172	16	3.88	.806	3.600	41	.001
14	30	3.70	.702	16	3.19	.655	2.411	44	.020
15	30	3.67	.758	16	3.19	.655	2.136	44	.038
26	30	4.27	.828	16	3.38	1.025	2.998	26	.006
27	30	4.33	.802	16	3.44	1.094	3.173	44	.003
29	30	4.20	.761	16	3.56	1.153	2.254	44	.029
50	30	5.13	1.042	16	4.31	.793	2.750	44	.009
52	30	1.73	1.258	16	3.19	2.344	-2.310	20	.032
61	30	4.57	.504	16	4.88	.342	-2.456	41	.018
63	30	4.53	.629	16	4.50	.516	2.315	44	.025

*NTSN – Non-Technical Skills Assessment Scale in Nursing.
†N – Sample.
‡SD – Standard deviation.
§t – Student's t-test value.
‖df – Degrees of freedom.
¶p – Significance value

To evaluate participants' satisfaction with the course in general and its contents in particular (structure and content, instructor, resources and teaching materials, and global appreciation), differences on the satisfaction questionnaire results were performed. We found significant differences between theoretical and practical sessions 1 and 2 in the structure and content area (Table 4).

Table 4 – Differences on satisfaction questionnaire results. Aveiro, Portugal, 2017

	Theoretical session			Practical session 1			Practical session 2			ANOVA*		
	N†	Mean	SD‡	N†	Mean	SD‡	N†	Mean	SD‡	F§	df‖	p¶
Structure**	20	3.66	.247	20	3.90	.126	20	3.89	.190	9.5	2	.000
Instructor	20	3.87	.256	20	3.88	.224	20	3.94	.111	.714	2	.494
Resources††	20	3.70	.410	20	3.83	.373	20	3.83	.335	.745	2	.480
Global	20	3.83	.296	20	3.88	.311	20	3.93	.232	.629	2	.537

*ANOVA – Analysis of variance.
†N – Sample.
‡SD – Standard deviation.
§F – test F for variance analysis.
‖df – Degrees of freedom.
¶p – Significance value.
**Structure – Structure and content.
††Resources – Resources and teaching materials.
‡‡Global – Global appreciation.

6.7. Discussion

Based on the results previously presented we can assume that the experimental group revealed better results in comparison with the control group between phase 0 and 1. Although no statistically significant differences were found in general NTSN scores, maybe explained by the fact that students did not want to compromise themselves with disagreement scale options, answering instead towards what is expected them to know and behave (social desirability), when we analyzed the activities and skills described by each item, we found statistically significant and positive differences between phases 0 and 1 for the experimental group. This means that these students increased their knowledge reflected in their performance in NTS in some activities, contrary to the control group. Besides NTSN unidimensionality, and even though all items integrate and measure the same construct, they do not have to do with each other in the sense that each item refer to a different context and/or activity. For example, item 2 “I know the equipment / clinical material that is available” and item 19 “The team leader is clearly established” measure the same construct – NTS, but refer to a specific activity and are not correlated. Therefore, we can conclude that there is a positive progression in experimental group students' perception on their knowledge and then performance in NTS after the course sessions developed and implemented in this research. This seem to reinforce other researches’ results, such as The Simulated Trauma and Resuscitative Team Training curricula which is also associated with improvement in team CRM skills over the duration of the course[28].

Nonetheless, some items presented a decrease on their means in the experimental group which can be explained by the fact that students were able to develop higher levels of awareness of what NTS are and of their performance on them. As so, this can be considered a somehow positive result, as students informally shared with the researchers that they’ve overestimated their responses in phase 0, as they did not have the full knowledge and experience on NTS or CRM principles and acting strategies.

In relation to control group results, the fact that they’ve demonstrated a positive progression in item 31 (“I acknowledge to the team my own limitations”) can

be due to a greater requirement for clinical skills as they are at the end of their academic career and are more aware of their capabilities and limitations at the technical level. Besides, this item also demonstrated progression in the experimental group. Finally, the fact that the academic nursing curricula doesn't include NTS training, might make it more difficult for students to feel confident and secure on their performances.

In fact, this study demonstrated that this type of training can contribute not only for a better understanding and then performance on NTS, which contribute to students' improvement on technical skills, but also to increase their self-confidence. More specifically, students who participated in the NTSNC seem to have significantly increased confidence in their skills, as demonstrated by literature. This situation will, in its turn, necessarily promote and improve the quality of care provided and decrease errors in their future practice.

Curiously, NTSN means are always higher in primary healthcare rather than in maternal health. As so, it seems that students from primary healthcare tend to present better NTS than students from maternal health specialty, especially those related to their involvement on teams' decisions and encouragement. This result shows that internships are different depending on teams' sensibility in NTS.

Finally, students from the experimental group showed greater satisfaction with the structure and content of the course in the practical sessions compared with the theoretical one. In this sense, students seem to appreciate more the practical sessions instead of theoretical session in the course structure and content. These results may be due to the fact that the practical sessions are more appealing and interesting as the students can put the acquired knowledge in the theoretical session into practice.

Therefore, these results show that high-fidelity simulation is well received by those experiencing it and offers benefits not inherent in traditional nursing education modalities, in the way that simulation-based methodologies emphasize both technical and NTS that are fundamental to a new paradigm of currently evolving education[29]. To further reinforce this focus, such programs should be incorporated in undergraduate nursing curricula from the first year in order to enable students to become familiar with the concept of NTS, CRM, and high-fidelity simulation-based

training as well, to afford the opportunity to continuously practice these skills in a safe environment and to become more competent and, consequently, confident in their skills[10]. In this sense, even though the results of the interaction of the three phases didn't demonstrate significant differences between both groups and intergroup, one thing we can conclude and evaluate, when asked what are NTS or CRM principles, only the experimental group answered correctly. This means that they are aware and have the knowledge to put in practice, contrary to the control group, that cannot improve their performance on something that did not know or learned of.

In a time where increased effort is focused on improving the quality of healthcare delivered, while minimizing adverse events, a methodology that allows teams to learn and practice critical teamwork and communication skills in a safe environment is invaluable[30].

Recognizing that a lack of NTS can produce lethal consequences and there are still limited studies related to its training in undergraduate nursing students, consideration must be recommended that this training be integrated into nursing education[10] as it is essential for undergraduate nursing students to develop not only clinical but also NTS. NTS training can enhance healthcare professionals understanding of their roles and improve communication. The majority of healthcare curriculums emphasize technical skills and forget that NTS remain an important component for rapid responsive teams on emergency settings for example. These components reflect team cohesion and team collaboration[31].

One of the limitations of our study was the size of the sample. Future studies should be tested with a bigger sample. In this sense, it was difficult to overcome this difficulty, as students do not have the experience and knowledge on the topic, and do not consider NTS as important as technical skills. It is also important to refer that the dropped out of those 15 participants, was due to the fact that they were not present at the session where they were asked to complete the questionnaires. These sessions were scheduled on normal school days, and the motive that led them to give up had nothing to do with the study because students were not informed of the classes where the questionnaires would be administered.

6.8. Conclusion

Overall, experimental group showed significant improvements in NTS nursing activities and the course was well received by them. In general terms, the results demonstrated that students who participated in NTSNC were able to focus and improve the outlined NTS necessary to complement their clinical and technical skills.

As NTS continues to increase its importance in educational settings, there is a need to ensure that this topic is explicitly embedded in undergraduate nursing education.

In this study, it was demonstrated that the development and application of a structured high-fidelity simulation-based course on NTS, is feasible and that positive changes in behavior can be measured through the instruments developed. In this sense, more studies are necessary to conduct in order to consolidate and improve these results.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest: none

6.9. References

1.Lai A, Haligua A, Bould D, Everett T, Gale M. Learning crisis resource management: Practicing versus an observational role in simulation training – A randomized controlled trial. Anaesth Crit Care Pain Med. 2016;35(4):275-81.

2.Clarke JR, Spejewski B, Gertner AS, Webber BL, Hayward CZ, Santora TA, … Blank-Reid C. An objective analysis of process errors in trauma resuscitations. Acad Emerg Med. 2000;7(11):1303-10.

3.Cooper JB, Newbower RS, Kitz RJ. An analysis of major errors and equipment failures in anesthesia management: Considerations for prevention and detection. Anesthesiology. 1984;60:34-42.

4.Houshian S, Larsen MS, Holm C. Missed injuries in a level I trauma center. J Trauma Acute Care Surg. 2002;52:715-9.

5.Nguyen N, Elliott J, Watson W, Dominguez E. Simulation improves non-technical skills performance of residents during the perioperative and intraoperative phases of surgery. J Surg Educ. 2015;72(5):957-63.
6.Hughes KM, Benenson RS, Krichten AE, Clancy KD, Ryan JP, Hammond C. A crew resource management program tailored to trauma resuscitation improves team behavior and communication. J Am Coll Surg. 2014;219(3):545-51.
7.Lucas A, Edwards M. Development of crisis resource management skills: A literature review. Clin Simul Nurs. 2017;13(8):347-58.
8.Rall M, Dieckmann P. Crisis resource management to improve patient safety. Euroanesthesia. 2005;107-12.
9.Gaba DM. The future vision of simulation in healthcare. Qual Saf Health Care. 2004;13(suppl 1):i2-i10.
10.Pearson E, McLafferty I. The use of simulation as a learning approach to non-technical skills awareness in final year student nurses. Nurse Educ Pract. 2011;11(6):399-405.
11.Bamford R, Langdon L, Rodd CA, Eastaugh-Waring S, Coulston JE. Core trainee boot-camp: a method for improving technical and non-technical skills of novice surgical trainees. A before and after study. Int J Surg. 2018;57:60-5.
12.Bierer J, Memu E, Leeper R, Fortin D, Fréchette E, Inculet R, Mathaner R. The developement of an in-situ thoracic surgery crisis simulation focused on non-technical skill training. Ann Thorac Surg. 2018;106(1):287-92.
13.Boet S, Bould M, Fung L, Qosa H, Perrier L, Tavares W, … Tricco A. Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. Can J Anaesth. 2014;61(6):571–82.
14.Dieckmann P, Graae Zeltner L, Helso A. Hand-it-on: An innovative simulation on the relation of non-technical skills to healthcare. Advances in Simulation. 2016;1:1-11.
15.Flynn FM, Sandaker K, Ballangrud R. Aiming for excellence – A simulation-based study on adapting and testing an instrument for developing non-technical skills in Norwegian student nurse anaesthetists. Nurse Educ Pract. 2017;22:37-46.

16.Goldenberg M, Fok K, Ordon M, Pace K, Lee J. Simulation-based laparoscopic surgery crisis resource management training – Predicting technical and non-technical skills. J Surg Educ. 2017;75(4):1113-9.
17.Grantcharov TP, Kristiansen VB, Bendix J, Bardram L, Rosenberg J, Funch-Jensen P. Randomized clinical trial of virtual reality simulation for laparoscopic skills training. Br J Surg. 2004;91(2):146-50.
18.Khan R, Scaffidi M, Walsh C, Lin P, Al-Mazroui A, Chana B, … Grover S. Simulation-based training of non-technical skills in colonoscopy: Protocol for a randomized controlled trial. JMIR Res Protoc. 2017;6(8):e153.
19.Lewis R, Strachan A, Smith MM. Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? a review of the current evidence. Open Nurs J. 2012;6:82–9.
20.Martinou E, Chindambaran R, Krishnasamy G, Donnell A, Vig S, Menon G. Simulation in undergraduate medical education: Designing a programme to improve medical students' non-technical skills. Int J Surg. 2015;23:15-134.
21.Murray K, McKenzie K, Kelleher M. The evaluation of a framework for measuring the non-technical ward round skills of final year nursing students: An observational study. Nurse Educ Today. 2016;45:87-90.
22.Pires S, Monteiro S, Pereira A, Chaló D, Melo E, Rodrigues A. Non-technical skills in undergraduate nursing education: Consideration for a training course development. The European Proceedings of Social & Behavioural Sciences Eissn. 2016;2357-1330.
23. Pires S, Monteiro S, Pereira A, Stocker J, Chaló D, Melo E. Non-technical skills assessment scale in nursing: Construction, development and validation. Rev Lat Am Enfermagem. 2018;26;e3042.
24.Seymour NE, Gallagher AG, Roman SA, O'Brien MK, Andersen DK, Satava RM. Analysis of errors in laparoscopic surgical procedures. Surgical Endoscopy. 2004;18(4):592-5.
25.Gordon M, Darbyshire D, Baker P. Non-technical skills training to enhance patient safety: A systematic review. Med Educ. 2012;46:1042-54.

26.Lyk-Jensen HT, Jepsen RM, Spanager L, Dieckmann P, Ostergaard D. Assessing nurse anaesthetists' non-technical skills in the operating room. Acta Anaesthesiol Scand. 2014;58:794-801.
27.Lindamood K, Rachwal C, Kappus L, Weinstock P, Doherty E. Development of neonatal intensive care multidisciplinary crisis resource training program. Newborn & Infant Nursing Reviews. 2011;11(1):17-22.
28.Gillman L, Brindley P, Paton-Gray J, Engels P, Park J, Vergis A, Widder S. Simulated trauma and resuscitation team training course: Evolution of a multidisciplinary trauma crisis resource management simulation course. Am J Surg. 2016;212(1):188-93.
29.Halamalek LP, Kaegi DM, Gaba DM, Sowb YA, Smith BC, Smith BE, Howard SK. Time for a new paradigm in pediatric medical education: Teaching neonatal resuscitation in a simulated delivery room environment. Pediatrics. 2000;106(4):1-6.
30.Brown LL, Overly FL. Simulation-based interprofessional team training. Clinical Pediatric Emergency Medicine. 2016;17(3):179-84.
31.Porter J, Cant R, Cooper S. Rating teams' non-technical skills in the emergency department: A qualitative study of nurses' experience. Int Emerg Nurs. 2018;38:15-20.

PART III CONCLUSIONS

Chapter 7. Integrative Conclusion

7.1. Main Conclusions

Considering the importance of NTS to patient care, this investigation was performed in an attempt to respond to healthcare directives on patient safety.

Hereupon, four studies were conducted, whose main conclusions will be listed below.

First, the literature reviewed in Chapter 2 demonstrated and reinforced the importance of NTS training for professionals' performance improvement and consequently errors reduction.

Otherwise, in order to effectively provide NTS training, it is essential to have an instrument to measure these skills. In Chapter 3 it was established that, based on the integrative review carried out, no instrument has been published or developed and validated for the assessment of NTS, relevant for HFS environment, in order to enable a greater understanding of these skills and enhance students' performance in their future practice.

Therefore, the necessity to have an instrument to benchmark good NTS and to guide formative feedback on nursing students training, led to a panel discussion to adapt NTS and CRM principles to nursing practice, according to the language and the specific activities performed by nurses, and in this sense, in Chapter 4 it was presented the construction, development and validation studies of the Non-technical skills Assessment Scale in Nursing (NTSN).

Then, the NTSNC was constructed and developed based on the activities included in the NTSN, and in other programs and courses already developed, as described in Chapter 5.

Finally, the NTSNC was implemented and its effectiveness studied, as presented in Chapter 6. Initially, when designing this study, it was proposed a methodology that involved three evaluation moments, such as, before the course implementation, after the course implementation, and six months after the course implementation. However, although the adopted procedure focused on evaluation

at these three times, at the third moment not all students answered the questionnaires. Thus, in order to maintain the statistical robustness of the longitudinal studies and the statistical power of the sample, we chose to consider only the first two moments. The results of this study showed that between both moments, students from experimental group increased their knowledge on NTS. This result seems to reinforce other studies results. Nonetheless, the decreasing results in some NTSN items can be explained by the fact that students were able to develop higher levels of awareness of what NTS are and of their own performance. As so, this can be considered a positive result, as students informally shared with the researchers that they've overestimated their responses before the course implementation, as they did not have the full knowledge and experience on NTS or CRM principles and acting strategies to answer NTSN in a trustworthy way. In fact, this study demonstrated that this type of training can contribute not only for a better understanding of NTS and to students' improvement on technical and NTS, but also to increase their self-confidence. More specifically, students who participated in this study seem to have significantly increased confidence in their skills. This finding has also been demonstrated by the literature reviewed. This means that they are aware and have the knowledge to put in practice in order to improve their future performance. Based on participant's feedback, the time, effort and energy expended by those involved in this investigation was well spent and rewarding.

Literature refers that medical error is common in crisis, and the majority of observed errors are non-technical in nature. In healthcare, preventing errors and avoidable adverse events for patients is paramount. High-quality clinical performance requires adequate knowledge and technical ability, but also relies on NTS such as the ability to adapt to a rapidely changing clinical situation and to function as part of a team.

7.2. Limitations

One of the limitations of our investigation was the sampling method for convenience and the size of the sample, which limits the representativeness and

generalization of the results and implies the need to use larger and more representative samples in future studies. Our sensibility to this topic, as trying to replicate the course implementation but with no success, showed us that students do not have the sufficient experience and knowledge on the topic, and do not consider NTS as important as technical skills, until they experienced and participated in NTSNC.

In other way, we realized that students demonstrated difficulty on answering the NTSN, as students informally shared with the researchers that they've overestimated their responses before the course implementation, as they did not have the full knowledge and experience on NTS or CRM principles and acting strategies, which may have influenced the results obtained.

Finally, it was not possible to assess the bias that arises in self-response questionaires, as students did not want to compromise themselves with disagreement scale options, answering instead towards what is expected them to know and behave (social desirability).

Nevertheless, the results are in agreement with those found in literature.

7.3. Implications

The studies developed and presented, tried to contribute to a better understanding of NTS concept and its importance on different healthcare specialties, namely in nursing, as demonstrated by scientific evidence.

Therefore, the NTSN was developed in order to respond to the need for an instrument to evaluate students' perception on their performance on NTS during patient care delivery and in this way increase their awareness and knowledge on NTS practice. Globally NTSN demonstrated to be appropriate to adequately assess NTS in nursing activities.

On the other hand, the NTSNC developed and the strategies worked out were well received by students and proved to be an added value in daily clinical practice, as it could improve knowledge and performance as well as increased patient safety goals.

In recent years there has been increasing focus on improving guidelines, applying knowledge on NTS and incorporating HFS training in nursing education. However, there is limited research on how these skills can be taught and evaluated and little focus on a coherent and systematic integration of non-techcinal skills into nursing education. In our investigation, students developed greater levels of knowledge and valued the possibility to practise in a safe environment without fear of making mistakes on patients, and increased feelings of self-efficacy, confidence and satisfaction. As NTS continues to increase its importance in educational settings, there is a need to ensure that this topic is explicity embedeed in nursing education. Thereby, this investigation developed a structured methodology that could be incorporated as a curricular unit in nursing graduation.

Although the present investigation has focused on nursing education, the results accomplished can be generalized to other healthcare specialties and become above all a procedure that should be implemented in healthcare institutions.

Learning how to function within an interdisciplinary team must begin early in healthcare training. In a time where increased effort is focused on improving the quality of healthcare delivered, while minimizing adverse events, a methodology that allows teams to learn and practice critical teamwork and communication skills in a safe environment is invaluable. However, there are clearly still challenges remaining to allow for seamless implementation of this training across the healthcare system.

7.4. Future Research

Future researches could replicate the validation study of NTSN with a bigger sample and contribute to the deepening of the evidence in the scope of psychometric properties of the instrument developed and the acceptance of the course implemented to reinforce the need and importance of NTS training. For instance, the professionals and/or teachers involved should not know the students in order to not influence student's behavior on practical sessions and then the results. In other way, it may be easier and more reliable to evaluate these skills if the scenario remains the same in all practical sessions. Although difficulty should

be increased for each and especially for the final session. This suggests that teachers should reinforce the importance of these skills for nursing daily practices. In future studies course sessions should be incorporated in regular classes to avoid any additional workload and to increase the size of the sample. Finally, in order to consolidate these skills over time, it should be increased the number of not only theorethical but essentialy the practical sessions.

It would also be of interest to replicate the course implementation in other healthcare professions and not only for students but also for professionals.

In this investigation, it was demonstrated that the development and application of a structured high-fidelity simulation-based course on NTS, is feasible and that positive changes in behavior can be measured through the instruments developed. In this sense, more studies are necessary to conduct in order to consolidate and improve these results.

Appendix

universidade de aveiro
theoria poiesis praxis

STATEMENT BY THE SCIENTIFIC COMMISSION

OF THE DOCTORAL PROGRAM IN PSYCHOLOGY

For the due effects it is stated that the Scientific Committee of the Doctoral Program in Psychology (9188), 3th Cycle, approved in 2014 the doctoral project of Master Sara Martins Pereira PIRES (Nr Mec. 49181), titled "Non-technical skills in nursing education: Effectiveness of a high-fidelity simulation-based program", ***taking into account scientific rigor and ethical procedures***.

30th June 2014

Director of the Scientific Committee of the Doctoral Program in Psychology

Carlos Fernandes da Silva, PhD

(Full Professor of Psychology of the Department of Education)

Projeto de Doutoramento em Psicologia:
Consentimento informado, livre e esclarecido

Competências não-instrumentais no ensino de estudantes de enfermagem:
Eficácia de um programa de formação em contexto de simulação de alta-fidelidade.

Nota Introdutória do Investigador:
Sara Martins Pereira Pires, Psicóloga.
Mestre em Psicologia Clínica e da Saúde pela Universidade de Coimbra em 2007.
Mestre em Psicologia Forense pela Universidade de Aveiro em 2011.

Enquadramento:
A literatura demonstra que grande parte dos erros em saúde se deve a fatores humanos, nomeadamente a falhas na comunicação, troca de informação e inexistência de planos de contingência. Neste sentido, o treino de competências não-instrumentais como comunicação, trabalho em equipa e tomada de decisão, contribui para a melhoria do desempenho dos profissionais de saúde, o que se traduz na segurança no doente e eficácia dos resultados clínicos.
O treino destas competências em contexto de simulação de alta-fidelidade inclui a participação ativa em cenários clínicos.

Este estudo realizar-se-á no Departamento de Educação e Psicologia da Universidade de Aveiro – DEPUA, em colaboração com a Escola Superior de Saúde da Universidade de Aveiro – ESSUA e o Centro de Simulação Clínica da Universidade de Aveiro – SIMULA, e pretende desenvolver e avaliar a eficácia de um programa de formação de competências não-instrumentais em contexto de simulação de alta-fidelidade com o objetivo de analisar o seu impacto no conhecimento, desempenho clínico, autoconfiança e autoeficácia em estudantes de enfermagem.

Papel dos Participantes:
A colaboração neste estudo é voluntária e consiste no preenchimento de questionários em três fases distintas e participação em 2 sessões teóricas e 4 sessões práticas em contexto de simulação de alta-fidelidade.
Todos os dados serão tratados de forma a garantir o anonimato dos seus participantes.

Papel do Investigador:
Os investigadores comprometem-se a:

a) Garantir **total confidencialidade** sobre os dados que forem fornecidos pelos seus participantes;
b) Utilizar os dados fornecidos pelos participantes somente para fins de investigação (os resultados têm unicamente valor coletivo).

Eu, _____, declaro ter conhecimento dos objetivos e procedimentos do estudo, bem como do meu papel enquanto participante, pelo que aceito dar o meu contributo.

Aveiro, _____ de _____ de 2016.

Assinatura: _____

Assinatura do Investigador: _____

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO ACERCA DE RECOLHA DE IMAGEM NO CENTRO DE SIMULAÇÃO CLÍNICA DA UNIVERSIDADE DE AVEIRO

Formação:_____

Data:_____

Eu_____, com cartão de cidadão nº_____, declaro que tive conhecimento e percebi os objetivos da presente formação que irá decorrer em ambiente de simulação. Estou ciente da necessidade do uso do vídeo e de fotografia como recurso pedagógico para que possa suportar o processo de aprendizagem do grupo de formandos.

Mais me foi esclarecido que todos os dados recolhidos são confidenciais e não serão transmitidos a terceiros, podendo apenas ser utilizados no âmbito de investigação com o objetivo de avaliar o impacto das sessões de simulação no processo de aprendizagem. As imagens gravadas não serão divulgadas publicamente, sendo salvaguardado o artigo 79 (Direito à imagem) do Código Cívil.

Assim, AUTORIZO, através do presente termo, que as imagens sejam recolhidas.

Aveiro, ___ de _____20__

O Formando:

_____

O Formador:

_____

Questionário Sociodemográfico

Competências não-instrumentais no ensino de estudantes de enfermagem:
Eficácia de um programa de formação em contexto de simulação de alta-fidelidade.

A preencher pelo aluno/a:

Nome: _____ Data de nascimento: _____ / _____ / _____

Curso que frequenta: _____ Ano que frequenta: _____

Tem formação e/ou experiência em simulação de alta-fidelidade? Sim: ___ Não: ___
Caso responda afirmativamente explique o contexto e número de horas de formação e/ou experiência: _____
_____
_____
_____
_____

Tem formação e/ou experiência em competências não-instrumentais? Sim: ___ Não: ___
Caso responda afirmativamente explique o contexto e número de horas de formação e/ou experiência: _____
_____
_____
_____
_____

A preencher pelo investigador/a:

Número mecanográfico atribuído: _____ / _____

Agradecemos a sua colaboração!

Questionário de Competências Não-Instrumentais

Por favor, preencha o seguinte questionário de acordo com a forma como avalia o seu **desempenho habitual**, tendo em conta a sua **última experiência clínica numa equipa de enfermagem**.

Sexo: Feminino _____ / Masculino _____

Idade: _____

Área de cuidados da última experiência clínica: _____

Deverá ter em consideração a definição dos seguintes conceitos:

Cenários: diz respeito a diferentes hipóteses de diagnóstico/pontos de partida, anteriores à tomada de decisão.

Líder: diz respeito ao responsável da equipa de cuidados.

Utilize a escala de respostas apresentada para avaliar cada um dos itens. Escolha a opção "Não se aplica" – NA – quando o item não se aplicar à sua situação.

Escala	1	2	3	4	5
Descritor	Discordo totalmente	Discordo parcialmente	Nem concordo nem discordo	Concordo parcialmente	Concordo totalmente

Item/Escala		1	2	3	4	5	NA
1	Conheço a estrutura física do serviço						
2	Conheço o equipamento/material clínico disponível						
3	Reconheço o local onde o equipamento/material clínico se encontram						
4	Sei utilizar o equipamento/material clínico disponível						
5	Conheço a dinâmica organizacional do serviço						
6	Sei o nome de cada um dos elementos da equipa do turno						
7	Sei o nome do/s utente/s						
8	Sei quem é/são o/s familiar/es de referência/acompanhante/s significativo/s do/s utente/s						
9	Recorro a todas as fontes disponíveis para recolher informação acerca do/s utente/s						
10	Analiso os dados clínicos acerca da situação atual do/s utente/s						
11	Pondero diferentes cenários e planos de intervenção em função da avaliação efetuada						
12	Preparo previamente com a equipa o acolhimento do/s utente/s no internamento						
13	Tenho acesso prévio à informação/história e situação atual do/da utente						
14	Contribuo para a identificação do problema						
15	Contribuo para a definição clara da/s estratégia/s/plano/s de intervenção						
16	Contribuo para a identificação de possíveis riscos e para o planeamento de uma estratégia de intervenção						
17	Verifico a funcionalidade do equipamento/material clínico a utilizar antes da intervenção						
18	Preparo o equipamento/material clínico necessário antes da intervenção						
19	Procedo à devida higienização das mãos antes da intervenção						
20	Utilizo as medidas de proteção individual adequadas à situação						
21	O líder da equipa é claramente estabelecido						
22	O líder é aceite por todos os elementos da equipa						
23	O líder sabe comunicar com a equipa						
24	Sei ouvir o líder						
25	Sei ouvir os outros elementos da equipa						

26	Sou ouvido/a pelo líder						
27	Sou ouvido/a pela equipa						
28	Sou encorajado/a pelo líder a dar a minha opinião						
29	Sou encorajado/a pela equipa a dar a minha opinião						
30	Compreendo o meu papel na equipa e as atividades a executar						
31	Contribuo para as decisões tomadas em equipa						
32	Informo a equipa das minhas limitações						
33	Reconheço perante a equipa as minhas limitações						
34	Estabeleço prioridades para a realização das atividades						
35	Dirijo-me sempre às pessoas diretamente pelo nome						
36	Em situação de urgência/emergência verbalizo as atividades que inicio/vou executando						
37	Utilizo uma linguagem técnico-científica quando comunico com a equipa						
38	Comunico com cada elemento da equipa de forma assertiva						
39	Solicito informação sempre que tenho dúvidas						
40	Aguardo sempre a indicação do momento em que devo iniciar a/s minha/s atividade/s						
41	Confirmo toda a informação/instruções que me é/são dada/s para indicar que as ouvi/interpretei/compreendi de forma correta						
42	Confirmo verbalmente sempre que completo uma atividade						
43	Confirmo sempre os "nove certos" antes da preparação/administração da medicação						
44	Recorro à utilização de *checklists* para confirmar a execução das minhas atividades						
45	Recorro à utilização dos protocolos enquanto guias de atuação						
46	Avalio/Monitorizo os sinais clínicos do/a utente						
47	Avalio sinais não clínicos do/a utente (psicológicos e emocionais)						
48	Avalio sinais sociofamiliares do/a utente						
49	Contribuo para a reavaliação contínua do plano de intervenção aquando da identificação de alterações no estado do/a utente						
50	Participo de forma ativa na passagem de turno						
51	Estou recetivo/a a opiniões de outros elementos da equipa, mesmo quando são diferentes das minhas						
52	Estive envolvido/a em situações de conflito com outro/s elemento/s da equipa						
53	Em situações de conflito em que não estou envolvido/a tento mediar a situação sempre na lógica de "o que está correto" ao invés de "quem está correto"						
54	Participo de forma proactiva na execução das minhas atividades						
55	Realizo as atividades planeadas						
56	Trabalho com a equipa para completar a execução das atividades em tempo útil						
57	Ajudo espontaneamente outros elementos da equipa quando necessário/em período de sobrecarga de atividades						
58	Ajudo outros elementos da equipa quando solicitado						
59	Procuro/Peço ajuda quando tenho dúvidas acerca do procedimento/equipamento/material clínico a utilizar						
60	Procuro/Peço ajuda quando tenho dificuldade em executar sozinho/a várias atividades ao mesmo tempo						
61	Procuro/Peço ajuda quando tenho dificuldade em executar a atividade que me foi designada						
62	Estou focado/a no/a utente durante a prestação de cuidados						
63	Estou atento/a às necessidades da equipa						

Agradecemos a sua colaboração!

Questionário de Autoconfiança

Competências não-instrumentais no ensino de estudantes de enfermagem:
Eficácia de um programa de formação em contexto de simulação de alta-fidelidade.

Por favor, preencha o seguinte questionário de acordo com a forma como avalia o **grau de confiança** no desempenho das suas funções, tendo em conta a sua **última experiência clínica numa equipa de enfermagem**, de acordo com a escala de resposta apresentada. Escolha a opção "Não se aplica" – NA – quando o item não se aplicar à sua situação:

Escala	1	2	3	4	5	NA
Descritor	Nada confiante	Pouco confiante	Confiante	Muito confiante	Extremamente confiante	Não se aplica

	1	2	3	4	5	NA
Reconhecer sinais e sintomas						
Avaliar com precisão o doente						
Intervir apropriadamente						
Avaliar a eficácia das intervenções implementadas						

Data: _____ / _____ / _____

Número mecanográfico atribuído: _____ / _____

Agradecemos a sua colaboração!

Questionário de Satisfação

Competências não-instrumentais no ensino de estudantes de enfermagem:
Eficácia de um programa de formação em contexto de simulação de alta-fidelidade.

Solicitamos que preencha o questionário de satisfação relativo à formação prestada no âmbito deste projeto, de acordo com a escala de resposta apresentada. Escolha a opção "Não se aplica" – NA – quando o item não se aplicar à sua situação.

Escala	1	2	3	4	NA
Descritor	Insuficiente	Suficiente	Bom	Muito Bom	Não se aplica

	1	2	3	4	NA
Estrutura e Conteúdo					
Interesse do tema					
Aplicabilidade prática do tema					
Desenvolvimento do tema					
Duração da sessão					
Formador					
Capacidade de comunicação e transmissão de conhecimentos					
Domínio dos conteúdos					
Adequação dos métodos pedagógicos					
Relacionamento com os formandos					
Facilitação de debate e partilha de experiências					
Motivação suscitada					
Clareza no discurso					
Incentivo à participação dos formandos e esclarecimento de dúvidas					
Recursos e Materiais pedagógicos					
Condições de trabalho e instalações					
Materiais e métodos pedagógicos utilizados					
Apreciação Global					
Satisfação das expectativas individuais					
Apreciação global da sessão					
Apreciação global da formação até à data					

Data: _____ / _____ / _____

Número mecanográfico atribuído: _____ / _____

Agradecemos a sua colaboração!

Sara Pires, 25 de Janeiro de 2017

Competências não-instrumentais no ensino de estudantes de enfermagem:

EFICÁCIA DE UM PROGRAMA DE FORMAÇÃO EM CONTEXTO DE SIMULAÇÃO DE ALTA-FIDELIDADE.

Sessão Teórica
1. Apresentação

1.1. **Apresentação do instrutor:**

Sara Martins Pereira Pires.

Mestre em Psicologia Clínica pela Faculdade de Psicologia e Ciências da Educação da Universidade de Coimbra.

Mestre em Psicologia Forense pela Universidade de Aveiro.

Psicóloga.

Aluna de Doutoramento em Psicologia no Departamento de Educação e Psicologia da Universidade de Aveiro.

1.2. **Apresentação do programa de formação:**

O programa é constituído por 5 sessões, com a duração de aproximadamente 120 minutos cada.

Sessão Teórica
1. Apresentação

1.3. **Objetivos e conteúdos programáticos:**

A. Compreender a **importância das competências não-instrumentais na saúde**, nomeadamente no ensino de estudantes de enfermagem;

B. Definir competências não-instrumentais, nomeadamente, **comunicação**, **liderança**, **ajuda mútua**, **tomada de consciência da situação**, e **tomada de decisão**;

C. Conhecer os **princípios-chave do CRM** e algumas estratégias de atuação na prática clínica em enfermagem;

D. Aplicar os princípios-chave do CRM em ambiente de **simulação de alta-fidelidade**.

Sessão Teórica
1. Apresentação

1.4. **<u>Apresentação dos participantes</u>:**

- Nome;
- Experiência em competências não-instrumentais;
- Experiência em "*Crisis Resource Management*";
- Experiência em simulação de alta-fidelidade;
- Expectativas.

Sessão Teórica

2.1. Enquadramento Teórico – Competências não-instrumentais

A segurança do doente é o aspeto mais importante a ter em consideração para garantir a **prestação de um serviço de qualidade,** e está intimamente ligada à redução de erros e à minimização das consequências sobre os doentes.

A ocorrência de erros ocorre em cerca de 10 em cada 100 internamentos e estima-se que cerca de metade poderiam ter sido evitados (Fragata, 2010).

A literatura demonstra que grande parte dos **erros em saúde** se deve à **falta de competências não-instrumentais**, como falhas na comunicação, troca de informação e inexistência de planos de contingência (Andersen, Jensen, Lippert, & Ostergaard, 2010; Campos, Saturno, & Carneiro, 2010; Cooper et al., 2010; Dieckmann, 2010; Doumouras & Engels, 2016; Irwin & Weidmann, 2015; Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Ostergaard, 2014; Nguyen, Elliott, Watson, & Dominguez, 2015).

Sessão Teórica

2.1. Enquadramento Teórico – Competências não-instrumentais

As **competências técnicas** descrevem procedimentos clínicos e identificam os instrumentos a utilizar em determinada situação (**o que fazer**). As **competências não-instrumentais** organizam a forma como esses procedimentos devem ser executados, antecipam os riscos que podem ocorrer e definem o papel de cada profissional na prevenção e minimização de erros (**como fazer**) (Gordon, Fell, Box, Farrell, & Stewart, 2017).

As **competências técnicas** conduzem ao **diagnóstico**, e **intervenção** com o doente. As **competências não-instrumentais** permitem **monitorizar a situação**, **tomar decisões**, **comunicar** e **coordenar todas as ações** em equipa (Kodate, Ross, Anderson, & Flin, 2012).

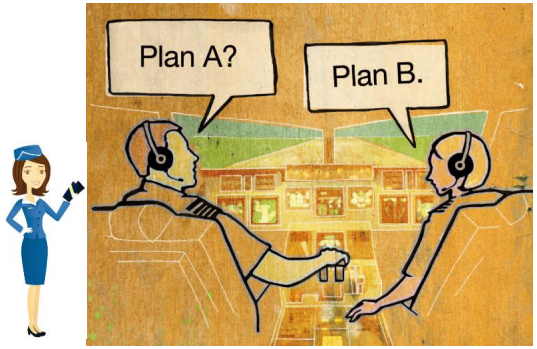
Sessão Teórica

2.1. Enquadramento Teórico – Competências não-instrumentais

As competências não-instrumentais integram assim, **competências cognitivas** (tomada de consciência da situação, e tomada de decisão) **e interpessoais** (ajuda mútua, comunicação, e liderança) que complementam as competências técnicas (Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Ostergaard, 2014; Nguyen, Elliott, Watson, & Dominguez, 2015).

Neste sentido, **o treino das competências não-instrumentais** em contexto de saúde, nomeadamente em enfermagem, contribui para **potenciar o desempenho** dos profissionais de saúde, assumindo assim um papel importante na **prevenção e redução de erros na prática clínica diária** e consequentemente na **melhoria da prestação de cuidados ao doente** (Boet et al., 2014; Boet, Reeves, & Bould, 2015; Dieckmann, Graae Zeltner, & Helso, 2016; Flin & Maran, 2015; Gundrosen, Solligård, & Aadahl, 2014; Irwin & Weidman, 2015; Lyk-Jensen, Jepsen, Spanager, Dieckmann, & Ostergaard, 2014; Martinou et al., 2015; Myers et al., 2016; Nguyen, Elliott, Watson, & Dominguez, 2015; Pires et al., 2016).

Sessão Teórica
2.2. Enquadramento Teórico – CRM



O conceito de CRM foi utilizado na **aviação**, no sentido de dar resposta a alguns estudos que demonstraram que grande parte dos acidentes aéreos se deviam a erro humano – "***Cockpit Resource Management***".

Assim, além dos pilotos, a tripulação de cabine e de torre de controlo foi também integrada neste tipo de treino em ambiente de simulação de alta-fidelidade – "***Crew Resource Management***".

Este método de treino da aviação foi **adaptado aos cuidados de saúde** por David Gaba e colaboradores no final dos anos 80 e intitulado "***Crisis Resource Management***" – CRM.

O CRM baseia-se no **treino de princípios-chave** que integram as **competências não-instrumentais** na resolução de situações críticas, **em ambiente de simulação de alta-fidelidade**, demonstrando-se uma estratégia que procura minimizar a ocorrência de erros e garantir a segurança do doente.

Sessão Teórica
2.3. Enquadramento Teórico – Simulação de Alta-Fidelidade

A prática pedagógica na educação em saúde aponta para a adoção de **estratégias ativas de ensino e aprendizagem** (Gonçalves et al., 2014).

A simulação de slta-fidelidade define-se como a **representação de situações clínicas**, num ambiente muito próximo do real.

A segurança do doente não se esgota no conhecimento e cumprimento das normas e técnicas recomendadas. Os **conhecimentos adquiridos devem ser praticados e simulados** de forma a que em novas situações, **os profissionais de saúde consigam antever eventuais situações críticas**. E não será possível antever que algo poderá correr mal, se em momento algum se esteve exposto a uma situação idêntica (Machado, 2010).

Sessão Teórica

2.3. Enquadramento Teórico – Simulação de Alta-Fidelidade

A simulação de alta-fidelidade **recria assim um ambiente ideal de aprendizagem**, **em tempo real** e **sem risco para o doente**, na medida em que utiliza **manequins assistidos por computador** que permitem **mimetizar situações clínicas reais, com fisiopatologia diversa** (cardiovascular, pulmonar, metabólica e neurológica).

A simulação de alta-fidelidade ensina também a **gerir a capacidade de se conseguir manter a calma numa situação com um desfecho negativo**, como a morte de um doente.

A simulação de alta-fidelidade surge assim como uma estratégia utilizada na formação de profissionais de saúde, tendo como ganhos, entre outros, o **desenvolvimento de competências e autoconfiança.** E estando mais confiantes, os profissionais de saúde são capazes de demonstrar **níveis de desempenho mais elevados** e de **gerir melhor as prioridades numa situação crítica** (Martins et al., 2014).

Sessão Teórica

2.3. Enquadramento Teórico – Simulação de Alta-Fidelidade

Sessão Teórica

2.3. Enquadramento Teórico – Simulação de Alta-Fidelidade

Vantagens:

a) Aumenta a **segurança do ensino de procedimentos potencialmente lesivos**;

b) Possibilita o **treino em equipa** e a **prática repetida de situações de elevado risco e baixa incidência**;

c) Permite **adaptar o treino ao plano formativo**;

d) Permite **o treino de competências não-instrumentais**;

e) Requer a **participação ativa nos cenários**;

f) Possibilita a **discussão do desempenho de cada participante e da equipa – *debriefing***.

Sessão Teórica

2.3. Enquadramento Teórico – Simulação de Alta-Fidelidade

O *debriefing* surge **imediatamente a seguir a um cenário** e trata-se de uma **discussão estruturada**, onde **todos os participantes** descrevem a sua experiência, explicando os seus pontos de vista sobre a situação clínica vivenciada, ao nível das **competências técnicas** e sobretudo das **competências não-instrumentais**, nomeadamente da utilização dos **princípios-chave do CRM**.

O *debriefing*, geralmente é apontado como o **momento em que se faz a aprendizagem**.

Sessão Teórica
Exercício 1

Os participantes deverão formar **grupos de 4-5 pessoas**.

Cada grupo terá que fazer uma fita de papel. Têm **2 minutos para realizar a atividade**.

Instruções:

1. **Cortar o papel em pedaços**,
2. **Unir as pontas de cada pedaço** com fita-cola,
3. **Unir todos os pedaços** entrelaçando-os.

Sessão Teórica
3. Equipa

Duas ou mais pessoas que **interagem de forma dinâmica**, interdependente, e que detêm **responsabilidades e papéis específicos com um objetivo comum**.

Elementos da equipa:

- Qualquer **pessoa envolvida no processo de prestação de cuidados ao doente**;
- Com **papéis e responsabilidades definidos** de forma clara;
- Respondem **perante a equipa** no que diz respeito às suas ações;
- Devem **manter-se continuamente informados**.

Sessão Teórica

4. Competências Não-Instrumentais – Conceito

Pressupõem uma **técnica e/ou recurso a estratégias de atuação** no entanto não requerem a utilização de instrumentos específicos.

São **competências interpessoais e cognitivas** que contribuem para potenciar o bom desempenho em determinada situação.

- **Comunicação**;
- **Liderança**;
- **Ajuda mútua**;
- **Tomada de consciência da situação**;
- **Tomada de decisão**.

Sessão Teórica

4.1. Competências Não-Instrumentais – Importância para a prática clínica

São vários os **obstáculos na prática clínica** que podem contribuir para a ocorrência de erros em saúde, e que o treino de competências não-instrumentais pode ajudar a minimizar:

- Tempo;
- Troca de informação;
- Comunicação;
- Conflito;
- Monitorização;
- Distração;
- Stress;
- Fadiga;
- Responsabilidades e papéis.

Sessão Teórica
4.2. – Comunicação

A comunicação é definida como a **transferência de informação de um emissor para um recetor** e inclui a capacidade de colocar questões, clarificá-las, e de assegurar que a mensagem é recebida e compreendida.

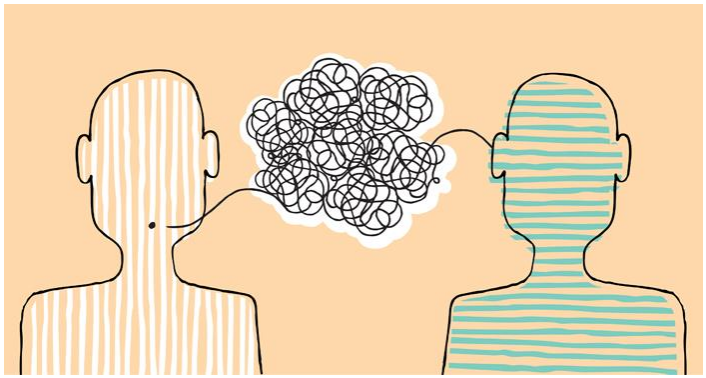
Diz respeito à **qualidade e quantidade de informação trocada** entre os elementos da equipa e pode ser **verbal** (falada, escrita) e **não-verbal** (tom de voz, postura corporal, gestos, pistas visuais: imagens, símbolos, figuras, desenhos).

A comunicação **assegura que todos os elementos de uma equipa partilham a mesma visão da situação** e **realizam as suas atividades de forma eficiente**.

A comunicação eficaz entre profissionais de saúde **melhora a prestação de cuidados ao doente**, e **ajuda na prevenção e diminuição da ocorrência de erros**.

Sessão Teórica
4.2.1. – Comunicação – Desafios

- Barreira cultural e língua;
- Ruído;
- Proximidade física;
- Motivação;
- Expetativas;
- Emoções;
- Tom de voz;
- Sobrecarga de trabalho;
- Estilos comunicacionais.



Sessão Teórica
Exercício 2

Repetir o exercício 1.

Os participantes deverão formar **as mesmas equipas**. Deve ser **nomeado um líder** que deve informar a equipa do objetivo do exercício – construir a fita de papel. No entanto, **apenas poderão utilizar a mão dominante e não poderão falar entre si**.

Têm **2 minutos para realizar a atividade**.

Instruções:

1. **Cortar o papel em pedaços**,
2. **Unir as pontas de cada pedaço** com fita-cola,
3. **Unir todos os pedaços** entrelaçando-os.

Sessão Teórica
4.3. – Liderança

É a **capacidade de planear, coordenar e maximizar as atividades** de cada um dos elementos que constituem uma equipa, **assegurando que as mesmas são compreendidas**, que **a informação é partilhada**, e que **dispõem de todos os recursos necessários** à realização das suas atividades.

É a capacidade de liderança que **mantém a equipa unida**.

Sessão Teórica
4.3. – Liderança

Liderar envolve a realização das seguintes atividades:

- **Organizar a equipa**;
- Identificar os **objetivos da equipa** e estabelecer o **plano de intervenção**;
- **Comunicar** o plano de intervenção a todos os elementos da equipa;
- **Distribuir tarefas e responsabilidades** de acordo com os conhecimentos, experiência, competências e disponibilidade de cada um dos elementos da equipa, considerando também prioridades e recursos disponíveis;
- **Monitorizar o plano de intervenção e a situação** no sentido de antecipar necessidades;

Sessão Teórica
4.3. – Liderança

- **Modificar o plano de intervenção e comunicar as alterações** a todos os elementos da equipa;
- **Monitorizar o desempenho** da equipa;
- **Gerir recursos** de forma eficaz;
- Definir **regras de conduta**;
- Garantir que **toda a informação é dada atempadamente** a todos os elementos da equipa;
- Facilitar a **troca de informação**;
- Encorajar a **ajuda mútua quando necessária**;
- Facilitar a **resolução de conflitos**;
- Modelar o **eficaz trabalho da equipa**.

Sessão Teórica
4.4. – Ajuda Mútua

É a capacidade de **antecipar as necessidades e apoiar todos os elementos de uma equipa** de forma a **prevenir a ocorrência de erros** e **minimizar os efeitos da sobrecarga de trabalho**.

Que tipo de comportamentos constituem a ajuda mútua?

- **Monitorizar o desempenho dos elementos que constituem a equipa**, no sentido de antecipar possíveis pedidos de ajuda;
- Garantir a **troca de informação**;
- **Oferecer e solicitar ajuda** quando necessário;
- **Substituir um elemento da equipa** quando este não pode realizar a atividade que lhe foi designada;
- **Alertar a equipa** para situações pouco seguras;
- **Encorajar a equipa**;
- **Comunicar de forma assertiva, clara e eficaz**.

Sessão Teórica
4.5. – Tomada de Consciência da Situação

É o processo de **monitorizar a situação** de forma a **obter o máximo de informação** e **detetar alterações de todo o meio envolvente** (doente, equipa, tempo, monitores, equipamento).

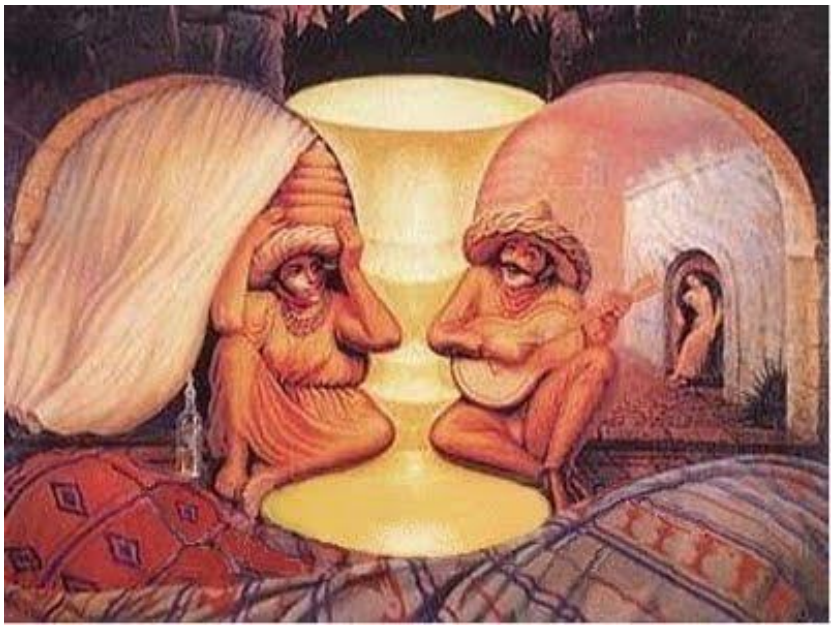
Permite **antecipar e planear** eficaz e atempadamente a intervenção ou alterações à intervenção.

Interrupções e distrações durante a intervenção **podem condicionar a eficiente tomada de consciência da situação** e consequentemente a nossa memória prospetiva, responsável pela recuperação de compromissos e intenções num determinado momento futuro (por ex. administrar a medicação daqui a 10 minutos).

Existem inúmeras barreiras à tomada de consciência da situação:

- **Estado do doente**: não monitorizar os sinais vitais;
- **Equipa**: não ajudar um elemento da equipa que está sobrecarregado de atividades;
- **Meio envolvente**: não saber onde se encontra o equipamento.

Sessão Teórica
4.5. – Tomada de Consciência da Situação



Sessão Teórica
4.6. – Tomada de Decisão

Tomada de decisão é a capacidade de:

- **Definir e diagnosticar** um problema;
- Considerar **diferentes hipóteses**;
- **Selecionar e comunicar** estas mesmas hipóteses;
- **Avaliar os riscos**;
- **Implementar e rever decisões**.

A capacidade de tomar decisões varia de acordo com: a **pressão do tempo**, a **exigência das atividades** a realizar, e a **viabilidade das hipóteses**.

Sessão Teórica

5. *Crisis Resource Management* – CRM

O CRM é um **conjunto de princípios-chave** que permitem, **coordenar e utilizar todos os recursos disponíveis**, com vista a **otimizar a segurança do doente** e os **resultados alcançados**.

Pretende:

- Sensibilizar para a **importância das competências não-instrumentais**;
- **Treinar** estas competências **em contexto de simulação de alta-fidelidade**;
- Generalizar e reforçar a **utilização destas competências na prática clínica diária**.

Sessão Teórica
5.1. Conhecer o Ambiente

Um dos pré-requisitos do treino CRM é o de **conhecer todos os recursos, humanos e materiais**.

- Estrutura física do serviço;
- Equipamento / material clínico disponível;
- Local onde o equipamento / material clínico se encontram;
- Como utilizar o equipamento / material clínico disponível;
- Dinâmica organizacional do serviço;
- Elementos que constituem a equipa;
- Doentes;
- Familiares de referência / acompanhantes significativos dos doentes.

Sessão Teórica
5.2. Antecipar e Planear

A equipa deve **considerar todas as exigências de uma situação** atempadamente, **antecipar dificuldades** e **planear possibilidades** de atuação (preparar para evitar potenciais riscos).

- Ter acesso prévio à informação / história clínica e situação atual do doente;
- Contribuir para a identificação do problema;
- Contribuir para a definição clara das estratégias / planos de intervenção;
- Contribuir para a identificação de possíveis riscos e para o planeamento de uma estratégia de intervenção;
- Preparar o equipamento / material clínico necessário antes da intervenção;
- Verificar a funcionalidade do equipamento / material clínico a utilizar, antes da intervenção;
- Proceder à devida higienização das mãos antes da intervenção;
- Utilizar medidas de proteção individual adequadas à intervenção.

Sessão Teórica

5.3. Pedir ajuda precocemente

Reconhecer as próprias limitações e pedir ajuda são caraterísticas de profissionais competentes. Não o fazer, pode colocar em risco a segurança do doente**. O pedido de ajuda deve ser realizado e preparado atempadamente**.

A ajuda inclui:

- **Capacidade de pedir ajuda** (quando existem dúvidas acerca dos procedimentos e/ou equipamentos / material clínico a utilizar; quando existem dificuldades em executar várias atividades ao mesmo tempo; quando existem dificuldades em executar a atividade designada);
- **Capacidade de ajudar** espontaneamente quando necessário, ou ajudar quando existe um pedido de ajuda por parte de um elemento da equipa.

Sessão Teórica
5.4. Liderar e Colaborar com o líder

Uma equipa precisa de um líder, que assuma o comando, distribua tarefas, comunique prioridades e recolha toda a informação disponível.

Liderar significa **coordenar, planear e comunicar** de forma clara.

- O líder deve estar claramente estabelecido;
- O líder deve ser aceite por todos os elementos da equipa;
- O líder e todos os elementos da equipa devem ter a capacidade de se escutar ativamente e de comunicar eficazmente;
- O líder e todos os elementos da equipa devem encorajar-se mutuamente a dar a sua opinião;
- O líder e todos os elementos da equipa conhecem e compreendem o seu papel e atividades a realizar;
- O líder e todos os elementos da equipa contribuem para as decisões tomadas em equipa.

Sessão Teórica
5.4. Liderar e Colaborar com o líder

Estratégia: *BRIEFINGS*

Conversa curta antes do início de um turno, e que tem como o objetivo, definir os papéis e responsabilidades de cada um dos elementos da equipa, antecipar resultados e planos de contingência.

Durante o *briefing* deve ser discutida a seguinte informação:

- Quem são os **elementos que constituem a equipa** e quais os seus papéis e responsabilidades;
- **Situação clínica** do doente;
- **Plano de intervenção** do doente;
- **Recursos disponíveis**.

Sessão Teórica
5.4. Liderar e Colaborar com o líder

Estratégia: *HUDDLE*

Reunião que permite reavaliar o plano de intervenção, de acordo com alterações na situação clínica do doente ou no desempenho da equipa.

Qualquer alteração deve ser comunicada rápida e eficazmente.

Estratégia: *DEBRIEFING*

Sessão informal onde se promove a troca de informação acerca do desempenho da equipa e de cada um dos seus elementos, com o objetivo de refletir acerca do desempenho da equipa.

Sessão Teórica
5.4. Liderar e Colaborar com o líder

Estratégia: *DEBRIEFING*

- A **comunicação** foi clara?
- Os **papéis e responsabilidades** foram compreendidos?
- As **atividades** foram distribuídas de forma equilibrada?
- Foram cometidos **erros**?
- **O que correu mal**?
- **O que correu bem**?
- **O que pode ser melhorado**?

Sessão Teórica
5.5. Distribuir tarefas

- Objetivo de **minimizar os efeitos da sobrecarga** de atividades.
- Definir as **atividades a realizar**;
- Distribuir as atividades **pelos elementos da equipa**;
- Verificar a **correta execução de atividades**.

Cada elemento da equipa deve ter a **capacidade de reconhecer e informar a equipa das suas limitações**. Só assim a distribuição de tarefas poderá potenciar o desempenho, promover a qualidade na prestação de cuidados e otimizar os resultados.

Caso seja possível, **o líder não deverá ter nenhuma atividade à sua responsabilidade** para poder monitorizar todo o meio envolvente, recolher informação e distribuir tarefas.

Sessão Teórica

5.6. Mobilizar todos os recursos disponíveis

Pessoas

Mobilizar os **recursos humanos** de forma eficiente e com o objetivo de maximizar o desempenho da equipa;

Equipamento / Materiais

Mobilizar os **recursos materiais** de forma eficiente e com o objetivo de maximizar o desempenho da equipa.

Sessão Teórica
5.7. Comunicar eficazmente

A comunicação é a chave para a resolução, com sucesso, de qualquer situação clínica, nomeadamente numa situação de crise, pois **permite que todos os elementos da equipa conheçam e compreendam a situação e atuem de forma eficaz**.

A comunicação só é eficaz quando a **mensagem é recebida e compreendida**.

A comunicação deve ser:

- **Completa**;
- **Clara**;
- **Breve**;
- **Oportuna**.

Sessão Teórica
5.7. Comunicar eficazmente

Problema: **Informação não compreendida** // Solução: **Não fazer suposições**;

Problema: **Informação confusa** // Solução: **Ser claro e preciso**;

Problema: **Informação não ouvida** // Solução: **Repetir a comunicação da informação, e verificar se a informação foi recebida e compreendida.**

- Dirigir-nos sempre às pessoas pelo nome;
- Verbalizar as atividades que iniciamos / vamos executando;
- Utilizar uma linguagem técnico-científica quando comunicamos com a equipa;
- Comunicar assertivamente com cada elemento da equipa;
- Solicitar informação sempre que existem dúvidas;
- Aguardar sempre indicação do momento em que devemos iniciar uma atividade.

Sessão Teórica
5.7. Comunicar eficazmente

Estratégia: SAAR

Ferramenta utilizada para **melhorar a troca de informação** (mudança de turno, transferência de um doente, transferência de responsabilidades) e **estruturar a comunicação** entre os elementos da equipa, garantindo que a informação é comunicada eficazmente.

Os itens que fazem parte de cada campo pretendem resumir um conjunto mínimo de dados necessários à transmissão de informações relevantes.

- **Situação**: descrição sucinta da situação clínica atual do doente;
- **Antecedentes**: história clínica prévia e outras informações relevantes;
- **Avaliação**: dados observacionais e outros meios de diagnóstico;
- **Recomendações**: plano de intervenção.

Sessão Teórica
5.7. Comunicar eficazmente

Estratégia: *CALL-OUT*

Estratégia utilizada para **comunicar ou partilhar informação**, nomeadamente durante uma situação crítica. Qualquer informação verbalizada **oralmente**, informa todos os elementos da equipa simultaneamente, ajudando-os a antecipar e a preparar os próximos passos no plano de intervenção.

Estratégia: *CHECK BACK*

Estratégia utilizada para **verificar e validar a troca de informação**. Implica que o emissor inicie uma mensagem, e o recetor confirme a mensagem recebida. Posteriormente o emissor valida a mensagem recebida pelo recetor. Esta estratégia **permite que os intervenientes assegurem que a mensagem é corretamente recebida e compreendida**.

Médico: "*Prepare-me 25 mg de x*"; Enfermeiro: "*25 mg de x*"; Médico: "*Correto*".

Sessão Teórica

5.8. Utilizar toda a informação disponível

Recolha e integração de toda a informação possível e disponível para uma melhor compreensão do caso e planeamento da intervenção.

- **Observação clínica;**
- **História clínica;**
- **Sinais vitais**;
- **Exame físico e psicológico**;
- **Informação dada pelos familiares**;
- **Alterações na situação clínica** do doente.

Todos os elementos da equipa devem recorrer a todas as fontes disponíveis para recolher informação.

Sessão Teórica
5.9. Prevenir erros de fixação

É necessário **ponderar diferentes hipóteses e planos de intervenção** em função de uma avaliação cuidada.

É importante **pedir uma segunda opinião e pensar sempre no pior cenário possível**.

https://www.youtube.com/watch?v=IGQmdoK_ZfY

Sessão Teórica
5.10. Verificar e Confirmar

Significa **validar uma ação**, com o intuito de diminuir a ocorrência de erros que possam prejudicar o doente (**confirmar que a informação é recebida e compreendida**).

Todos os elementos da equipa devem:

- Analisar os dados clínicos acerca da situação atual do doente;
- Confirmar toda a informação / instruções para indicar que as compreenderam da forma correta;
- Confirmar verbalmente sempre que completam uma atividade;
- Confirmar sempre os “nove certos” antes da preparação / administração da medicação.

Sessão Teórica

5.11. Usar apoios cognitivos

A **utilização de *checklists* para confirmar a execução das atividades e protocolos enquanto guias de atuação** ajuda a relembrar toda a informação necessária ao diagnóstico e definição do plano de intervenção.

Sessão Teórica

5.12. Reavaliar continuamente

Todos os elementos da equipa devem **avaliar e monitorizar os sinais clínicos, psicológicos e emocionais**, e sociofamiliares do doente, **e contribuir para a contínua avaliação e monitorização do plano de intervenção** aquando da identificação de alterações em todos estes parâmetros.

Na avaliação do doente:

- **História clínica**;
- **Sinais vitais**;
- **Medicação**;
- **Exames**;
- **Plano de intervenção**;
- **Fatores psicossociais**.

Sessão Teórica
5.12. Reavaliar continuamente

Na avaliação do próprio estado:

- Que **fatores poderão influenciar o desempenho e a capacidade de realizar as atividades** de forma eficiente?

Na avaliação dos elementos da equipa:

- **Fadiga**;
- **Sobrecarga de atividades**;
- **Desempenho**;
- **Stress**;
- **Competências / Limitações**;
- Etc.

Sessão Teórica
5.12. Reavaliar continuamente

Na avaliação do meio envolvente:

- **Informação** de todas as fontes;
- **Recursos humanos** disponíveis;
- **Estado de conservação do equipamento/material**.

Na avaliação dos objetivos:

- **Condição clínica** do doente;
- **Realização das atividades** de todos os elementos da equipa;
- **Adequação do plano de intervenção.**

Sessão Teórica

5.13. Trabalhar em equipa

- Participar de forma ativa na passagem de turno;
- Mediar situações de conflito sempre na lógica de “o que está correto” ao invés de “quem está correto”;
- Participar de forma proactiva na execução das atividades;
- Realizar as atividades planeadas;
- Trabalhar com a equipa para completar a execução das atividades em tempo útil.

Deve estar sempre presente o respeito por todos os elementos da equipa para que possam partilhar da mesma visão da situação (***shared mental model***).

Estratégia: *FEEDBACK*

Partilha de informação acerca do desempenho da equipa de forma a potenciar o desempenho futuro e promover relações interpessoais positivas.

Sessão Teórica
5.14. Focar a atenção criteriosamente

Significa:

- Estar focado no doente durante a prestação de cuidados;
- Estar atento às necessidades da equipa.

A tomada de consciência da situação permite que a equipa se concentre no que realmente é importante (a informação e as atividades a desempenhar).

Sessão Teórica
5.15. Estabelecer prioridades de forma dinâmica

- Estabelecer prioridades para a realização das atividades.

Reavaliar a situação é importante para poder definir prioridades.

O líder deve constantemente solicitar à equipa a monitorização e reavaliação da situação.

Sessão Teórica
6. Conclusão

Equipas com elevado desempenho:

- **Conhecem o serviço e o local onde os equipamentos estão disponíveis**;
- **Conhecem e comunicam com todos os elementos da equipa** pelo nome;
- Têm **papéis e responsabilidades claramente definidos**;
- **Partilham a mesma visão da situação** clínica alvo de intervenção;
- **Otimizam recursos**;
- Têm uma forte **capacidade de liderar e colaborar com o líder**, de escutar ativamente e comunicar eficaz e assertivamente;
- **Reúnem-se regularmente** com o objetivo de reavaliar a condição clínica do doente, os objetivos e planos de intervenção, antecipar possíveis riscos, estabelecer prioridades, e periodicamente, avaliar o seu próprio desempenho enquanto equipa;

Sessão Teórica
6. Conclusão

- **Distribuem tarefas**, e **envolvem cada um dos seus elementos na tomada de decisões**;
- **Comunicam eficaz e continuamente**, de forma a garantir que todos os elementos da equipa têm acesso à informação de que necessitam para realizar eficazmente as suas atividades;
- **Gerem os conflitos**, confiam em cada um dos seus elementos e desenvolvem capacidade de autoeficácia;
- **Integram o doente** como um elemento fundamental da equipa:
- **Conhecem todos os doentes pelo nome**;
- **Escutam ativamente** os doentes e as suas famílias;
- **Conversam com os doentes e as suas famílias** de forma a garantir que estes compreendem a informação que lhes está a ser transmitida;
- **Envolvem ativamente os doentes na prestação de cuidados**, partilhando a informação clínica relevante.


together everyone
TEAM
achieves more

Sessão Prática

1. Cenário: Agudização de Doença Pulmonar Obstrutiva Crónica

Caso clínico:

Homem de 70 anos com história de DPOC vem a uma consulta de agudos por possível infeção respiratória e, depois de subir os 30 degraus da USF, inicia um quadro de dispneia intensa.

História pessoal:

Antecedentes pessoais:

- Ex-fumador;
- DPOC de longa data medicada, com algumas recorrências à urgência;
- HTA medicada;
- Nega alergias.

Medicação: losartam, filotempo, pulmicort.

Sessão Prática

1. Cenário: Agudização de Doença Pulmonar Obstrutiva Crónica

Finalidade: Reconhecer o doente com agudização de DPOC e atuar de acordo com a patologia.

Objetivos do cenário:

- avaliação 1aria da vítima;
- pedido de ajuda;
- Monitorização;
- identificação do caso clínico;
- pedido de ajuda diferenciado (equipa médica);
- atuação inicial na abordagem terapêutica:
  - Oxigénio;
  - Broncodilatador.

Sessão Prática

2. Cenário: Troca de fármaco (hipoglicemia)

Caso clínico:

Homem de 70 anos sente-se mal na sala de espera e foi trazido para a sala de tratamentos. Vinha para uma consulta de agudos por história de vómitos intensos durante a noite.

História pessoal:

Antecedentes pessoais:

- DM tipo 2 insulinotratada;
- HTA medicada com um ARA;
- Obesidade;
- Nega alergias.

Medicação: losartam, ridsidon, esquema de insulina retard.

Sessão Prática

2. Cenário: Troca de fármaco (hipoglicemia)

Finalidade: Reconhecer a troca de fármaco e identificar o doente com hipoglicemia - atuar de acordo com a patologia.

Objetivos cenário:

- avaliação 1aria da vítima;
- pedido de ajuda;
- Monitorização;
- **glicemia capilar;**
- identificação do caso clínico.

Sessão Prática

3. Cenário: Convulsão febril em Pediatria

Caso clínico:

Menino de 5 anos (25kg) vai à USF acompanhado pela mãe a uma consulta de agudos, pois tem desde há 24h febre alta e tosse. Na sala de espera, desmaia e é trazido por uma Enf. para um gabinete de consulta que se encontrava livre e é deitado numa maca.

História pessoal:

- Sem antecedentes pessoais;
- Nega alergias;
- Sem medicação habitual.

Sessão Prática

3. Cenário: Convulsão febril em Pediatria

Finalidade: Reconhecer o doente com uma convulsão febril e atuar de acordo com a patologia.

Objetivos cenário:

- avaliação 1aria da vítima;
- pedido de ajuda;
- Monitorização;
- identificação do caso clínico;
- pedido de ajuda diferenciado: 112;
- atuação inicial na abordagem terapêutica: diazepam rectal 10mg; oxigénio; fenitoína 20mg/kg em 20 min (diluição em SF); midazolam em perfusão; antipirético;
- punção venosa e colocação de soro.

Sessão Prática

4. Cenário: Edema agudo do Pulmão

Caso clínico:

Homem de 76 anos sente-se mal na sala de espera e foi trazido para a sala de tratamentos. Vinha para uma consulta de agudos por história de cansaço e dispneia durante as últimas semanas, com edemas periféricos.

História pessoal:

Antecedentes pessoais:

- FA paroxistica;
- HTA medicada;
- Hipertrofia benigna da próstata;
- Obesidade;
- Nega alergias.

Sessão Prática
4. Cenário: Edema Agudo do Pulmão

Medicação: Lanoxin, Lasix, amlodipina, AAS, Proscar, omeprazol.

Finalidade: Reconhecer o doente com EAP atuar de acordo com a patologia.

Objetivos cenário:

- avaliação 1aria da vítima;
- pedido de ajuda;
- Monitorização;
- identificação do caso clínico;
- Posição da elevação da cabeceira/sentar a vítima;
- pedido de ajuda diferenciado: 112;

Sessão Prática
4. Cenário: Edema Agudo do Pulmão

Objetivos cenário (continuação):

- atuação inicial na abordagem terapêutica (doente consciente): oxigénio a 15L/min – alta concentração, acesso venoso (não fazer soros), furosemida (se TAS>90mmHg), nitratos (se TAS>140mmHg), morfina.
- ECG de 12 derivações;
- Reconhecer sinais de gravidade: fervores inspiratórios; ingurgitamento jugular; edemas periféricos; Hª de IC.

Bibliografia

Andersen, P.O., Jensen, M.K., Lippert, A., & Ostergaard, D. (2010). Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation, 81*(6), 695-702. doi: 10.1016/j.resuscitation.2010.01.024

Boet, S., Bould, M., Fung, L., Qosa, H., Perrier, L., Tavares, W., … Tricco, A. (2014). Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. *Canadian Journal of Anaesthesia, 61*(6), 571–582. doi: 10.1007/s12630-014-0143-8

Boet, S., Reeves, S., & Bould, D. (2015). Call for an internationally recognized interprofessional simulation-based disease/injury independent, crisis resource management training certification. *Resuscitation, 92*, 7. doi: 10.1016/j.resuscitation.2015.03.027

Campos, L., Saturno, P., & Carneiro, A. (2010). *A qualidade dos cuidados e dos serviços*. Plano Nacional de Saúde 2011-2016. Retrieved from http://pns.dgs.pt/files/2010/07/Q2.pdf

Cooper, S., Cant, R., Porter, J., Sellick, K., Somers, G., Kinsman, L., & Nestel, D. (2010). Rating medical emergency teamwork performance: Development of the team emergency assessment measure (TEAM). *Resuscitation, 81*(4), 446-452. doi: 10.1016/j.resuscitation.2009.11.027

Bibliografia

Dieckmann, P. (2010). *Simulation and Patient Safety: Connections on many levels*. Retrieved from http://www.medinfo.hacettepe.edu.tr/duyuru/SIME2010.pdf

Dieckmann, P., Graae Zeltner, L., & Helso, A. (2016). Hand-it-on: An innovative simulation on the relation of non-technical skills to healthcare. *Advances in Simulation, 1*, 1-11. doi: 10.1186/s41077-016-0031-0

Doumouras, A., & Engels, P. (2016). Early crisis nontechnical skill teaching in residency leads to long-term skill retention and improved performance during crises: A prospective, nonrandomized controlled study. *Surgery, 161*(1), 174-181. doi: 10.1016/j.surg.2016.11.022

Flin, R., & Maran, N. (2015). Basic concepts for crew resource management and non-technical skills. *Best Practice and Research Clinical Anaesthesiology, 29*(1), 27-39. doi: 10.1016/j.bpa.2015.02.002

Fragata, J. (2010). Erro médico: A segurança dos doentes – indicador de qualidade em saúde. *Revista Portuguesa de Medicina Geral e Familiar, 26*(6), 564-70. doi: 10.32385/rpmgf.v26i6.10799

Bibliografia

Gordon, M., Fell, C., Box, H, Farrell, M., & Stewart, A. (2017). Learning health 'safety' within non-technical skills interprofessional simulation education: A quantitative study. *Medical Education Online, 22*(1). doi: 10.1080/10872981.2017.1272838

Gundrosen, S., Solligård, S., & Aadahl, P. (2014). Team competence among nurses in an intensive care unit: The feasibility of in situ simulation and assessing non-technical skills. *Intensive and Critical Care Nursing, 30*(6), 312-317. doi: 10.1016/j.iccn.2014.06.007

Irwin, A., & Weidmann, A. (2015). A mixed methods investigation into the use of non-technical skills by community and hospital pharmacists. *Research in Social and Administrative Pharmacy, 11*(5), 1-11. doi: 10.1016/j.sapharm.2014.11.006

Kodate, N., Ross, A., Anderson, J., & Flin, R. (2012). Non-technical skills for enhancing patient safety: Achievements and future directions. *Japanese Journal of Quality and Safety Healthcare, 7*(4), 360-370

Bibliografia

Lyk-Jensen, H., Jepsen, R., Spanager, L., Dieckmann, P., & Ostergaard, D. (2014). Assessing nurse anaesthetists' non-technical skills in the operating room. *Acta Anaesthesiologica Scandinavia, 58*(7), 794-801. doi: 10.1111/aas.12315

Machado, H. (2010). Segurança, eventos críticos e liderança em anestesiologia. *Revista Portuguesa de Medicina Geral e Familiar, 26*(6), 564-70. doi: 10.32385/rpmgf.v26i6.10799

Martinou, E., Chindambaran, R., Krishnasamy, G., Donnell, A., Vig, S., & Menon, G. (2015). Simulation in undergraduate medical education: Designing a programme to improve medical students' non-technical skills. *Abstracts / International Journal of Surgery, 23*, 15-134

Martins, J., Baptista, R., Coutinho, V., Mazzo, A., Rodrigues, M., & Mendes, I. (2014). Autoconfiança para intervenção em emergências: Adaptação e validação cultural da *Selfconfidence Scale* em estudantes de enfermagem. *Revista Latino-Americana de Enfermagem, 22*(4), 556-61

Bibliografia

Myers, J., Powell, D., Psirides, A., Hathaway, K., Aldington, S., & Haney, M. (2016). Non-technical skills evaluation in the critical care air ambulance environment: Introduction of an adapted rating instrument – an observational study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 24*(24). doi: 10.1186/s13049-016-0216-5

Nguyen, N., Elliott, J., Watson, W., & Dominguez, E. (2015). Simulation improves non-technical skills performance of residents during the perioperative and intraoperative phases of surgery. *Journal of Surgical Education, 72*(5), 957-963. doi: 10.1016/j.jsurg.2015.03.005

Pires, S., Monteiro, S., Pereira, A., Chaló, D., Melo, E., & Rodrigues, A. (2016). Non-technical skills in undergraduate nursing education: Consideration for a training course development. *The European Proceedings of Social & Behavioural Sciences Eissn*, 2357-1330. doi: 10.15405/epsbs.2016.11.32