



Brief Communication

The making of a (new) surgeon: Opportunities for repeated messaging on NOTSS in the Canadian medical system

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ARTICLE INFO

Keywords:

Nontechnical skills
NOTSS
Surgical safety
Critical safety incidents

ABSTRACT

Proficiency in nontechnical skills (NTS) contributes to reduction in critical safety incidents and improvement in patient safety outcomes. Despite evidence demonstrating the importance of NTS in patient safety, there remains limited NTS specific curricula and formal teaching in Canadian surgical programs. We propose a three-stage longitudinal approach to education surrounding NTS using the Nontechnical skills for surgeons (NOTSS) framework.

Introduction

Advancements in surgical safety have evolved over three distinct waves [1]. The first wave brought about improvements in surgical technique and adoption of advanced technology such as improved pre-operative imaging and minimally invasive modalities. The second wave delivered an increased emphasis on standardization through wider adoption of protocols and checklists, such as the World Health Organization's Surgical Safety Checklist (SSCL). Despite the initial findings of reduction in morbidity and mortality with the use of the SSCL under study settings, the results varied when SSCLs were applied widely; certain centres experienced stagnant or even worse outcomes despite the use of the same safety checklist [2]. This suggests that perhaps effective implementation of the SSCL may rely not only on simple adherence, but also on the associated behaviours and communication skills during the checklist. The more recent third wave in surgical safety centers around high reliability organizing that is achieved through attention to front line behaviours and teamwork. To achieve improvement in team performance, variability in these front line behaviours, known as nontechnical skills (NTS) are worth considering.

This paper serves to highlight the importance of NTS in improving patient safety, to promote a framework by which to quantifiably practice NTS, and to provide a three-stage approach to NTS education at the levels of undergraduate medical education, postgraduate education, and practicing surgeon.

Non-technical skills

NTS are defined as a set of social and cognitive skills that support high quality, safe, effective, and efficient interprofessional care [3]. The social skills include concepts such as teamwork and communication, while the cognitive skills are encompassed by data-synthesis skills such as data gathering and application. Discussions and research around NTS in the context of safer surgery have been growing in recent years [4]. Studies have shown repeatedly that lapses in NTS are contributing factors to patient safety concerns, including both patient complaints and safety incidents [5]. This is especially applicable in the operating room, where nearly half (43 %) of errors can be attributed to lapses in communication [6].

To implement NTS behaviours in a measurable way in healthcare systems, an early introduction and repeated exposure to NTS throughout training and practice may benefit learners. With a shared vocabulary and understanding of NTS, learners along the continuum from medical student to staff surgeon may begin to employ NTS in the OR.

The NOTSS framework

Developed in the mid-2000s at the University of Aberdeen, the Non-Operative Technical Skills for Surgeons (NOTSS) framework aims to provide a systematic approach to describe and practice NTS [7]. The NOTSS framework is organized into four categories: Situation

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Category	Elements
<i>Situational Awareness</i>	
	Gathering information
	Understanding information
	Projecting and anticipating future state
<i>Decision Making</i>	
	Considering options
	Selecting and communicating option
	Implementing and reviewing decisions
<i>Communication and Teamwork</i>	
	Exchanging information
	Establishing a shared understanding
	Co-ordinating team activities
<i>Leadership</i>	
	Setting and maintaining standards
	Supporting others
	Coping with pressure

Fig. 1. NOTSS framework.

Awareness, Decision Making, Leadership, and Communication and Teamwork. Within each of these categories, there are several elements which describe the categories (Fig. 1). Finally, for each element, there exists a set of behaviours, both good and poor, which can be attributed to said element. Through categorizing specific behaviours associated with each skill, NOTSS enables more tangible and objective methods of NTS training and assessment in the OR.

The NOTSS framework has been evaluated in a variety of surgical specialities, and demonstrates an effective means of evaluating NTS in an OR setting [8]. Given its validity and OR-specific behaviour-based approach to NTS, the NOTSS framework provides an ideal avenue by which to educate training and practicing surgeons.

Repeated messaging

We propose education on the NOTSS framework on three levels: undergraduate medical education, postgraduate medical education (residency), and continuing medical education for practicing surgeons.

Undergraduate medical education

A review of Canadian undergraduate medical curricula demonstrated that less than 1 % of learning objectives in surgery and anesthesiology rotations were related to NTS [9]. An early introduction to the concepts of NTS through the NOTSS framework may provide medical students with the vocabulary and knowledge to identify positive and negative behaviours in their early interactions in the OR, priming them to consider not just the technical aspects in their surgical education, but also the intra-operative communication, situation awareness, leadership, and decision making that lead to better outcomes.

Postgraduate medical education

In 2022, the Canadian Medical Protective Association (CMPA) produced a learning module that aims to help close the knowledge gap of NTS in medical education. This learning module provides an explanation of the NOTSS framework and a hands-on application of the framework to a surgical case, with the intention of helping surgical residents to reflect on their experiences in the OR as related to NTS. This module was piloted for a group of post-graduate year two residents, with positive feedback. Through such modules, surgical “bootcamps” in the beginning of residency provide an opportunity to equip new trainees with a shared language and understanding of NTS, and strategies for how they might apply the NOTSS behaviours as residents. The learning module will be piloted in Surgical Foundations for first year residents at several universities across Canada during the 2023 academic year.

Continuing medical education (practicing surgeons)

Finally, for NTS to be fully embraced and used in the OR, buy-in and positive demonstration of these behaviours by attending surgeons is necessary. Internal review of CMPA data mirrors the literature as it documents NTS as contributing factors in critical safety incidents (CSI) [10]. In response, the CMPA has piloted an electronic learning activity (ELA) in 2023 based on a simulated CSI. The pilot project will be distributed to practicing surgeons registered with the CMPA. The learning module features a CSI, with subsequent analysis using the NOTSS framework, to re-introduce practicing surgeons to the language and practice of NTS. The CMPA plans to guide future development with a robust evaluation strategy to optimize and distribute ELAs to a variety of surgical specialities.

NTS are important across the spectrum of education; for the surgeon in practice who is teaching, role modelling, and leading in the OR, for the surgeon in training who is gaining competencies both in technical

and non-technical skills, and for the medical student who is reflecting on a potential career in surgery and on the competencies that are essential to the making of a safe surgeon.

CRediT authorship contribution statement

Meghan Boersma Robertson: Writing - Original Draft, Review & Editing, **Alex Lee:** Writing – Review & Editing, **Nada Gawad:** Writing – Review & Editing, **Richard Mimeault:** Writing – Review & Editing, **Fady Balaa:** Writing – Review & Editing, Supervision.

Funding sources

MBR, AL, NG, RM, and FB reported no biomedical financial interests or potential conflicts of interest.

Ethics approval

NA.

Declaration of competing interest

MBR, AL, NG, RM, and FB reported no biomedical financial interests or potential conflicts of interest. FB and RM are employees of the Canadian Medical Protective Association.

References

- [1] The next wave of hospital innovation to make patients safer. <https://hbr.org/2016/08/the-next-wave-of-hospital-innovation-to-make-patients-safer>. [Accessed 27 August 2022].
- [2] Urbach DR, Govindarajan A, Saskin R, Wilton AS, Baxter NN. Introduction of surgical safety checklists in Ontario, Canada. *N Engl J Med* 2014;370(11):1029–38.
- [3] Gordon M, Baker P, Catchpole K, Darbyshire D, Schocken D. Devising a consensus definition and framework for non-technical skills in healthcare to support educational design: a modified Delphi study. *Med Teach* 2015;37(6):572–7.
- [4] Gjeraa K, Spanager L, Konge L, Petersen RH, Østergaard D. Non-technical skills in minimally invasive surgery teams: a systematic review. *Surg Endosc* 2016;30(12):5185–99.
- [5] Hernandez LV, Klyve D, Feld L, Nalini G, Feld A. Do nontechnical skills affect legal outcomes after endoscopic perforations? *Am J Gastroenterol* 2020;115(9):1460–5.
- [6] Gawande AA, Zinner MJ, Studdert DM, Brennan TA. Analysis of errors reported by surgeons at three teaching hospitals. *Surgery* 2003;133(6):614–21.
- [7] Flin R, Yule S, Paterson-Brown S, Maran N, Rowley D, Youngson G. Teaching surgeons about non-technical skills. *Surg J R Coll Surg Edinb Irel* 2007;5(2):86–9.
- [8] Wood TC, Maqsood S, Nanavaty MA, Rajak S. Validity of scoring systems for the assessment of technical and non-technical skills in ophthalmic surgery—a systematic review. *Eye* 2021;35(7):1833–49.
- [9] Lee A, Finstad A, Gawad N, Boet S, Raiche I, Balaa F. Nontechnical skills (NTS) in the undergraduate surgical and anesthesiology curricula: are we adequately preparing medical students? *J Surg Educ* 2021;78(2):502–11.
- [10] Detailed analysis surgical safety in Canada: a 10-year review of CMPA and HIROC medico-legal data. https://www.cmpa-acpm.ca/static-assets/pdf/research-and-policy/system-and-practice-improvement/SSC_Detailed_Analysis_Report-e.pdf. [Accessed 24 June 2023].