



## Research Paper

# A junior doctor led near-peer acute ENT/head and neck surgery workshop for medical students



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## HIGHLIGHTS

- Near-peer teaching programs can be successfully used to teach acute surgery.
- Junior doctor led workshops improve knowledge and confidence of senior medical students.
- Use of simulation and models are effective adjuncts to facilitate practical skills training.
- Near-peer tutors report improved non-technical and communication skills.

## ARTICLE INFO

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## ABSTRACT

**Background:** Near-peer teaching (NPT) involves teaching by peers who are at a close, but not the same, level of training. This study investigated whether a novel surgical NPT workshop, designed and delivered by junior doctors using simulation models for acute otolaryngology conditions, improved the knowledge and confidence level of senior medical students.

**Methods:** A one-day NPT workshop was held for medical students in their third year of a four-year postgraduate medical degree at the University of Notre Dame, Sydney, Australia. Four acute otolaryngology/head and neck surgery problems that might be encountered by junior doctors and require prompt management were chosen. These were post-operative neck swelling, epistaxis, and tracheostomy management (obstruction and bleeding). Six junior doctors facilitated didactic tutorials and practical skills training using models. Multiple choice question mini-tests and questionnaires were administered before and after the workshop to assess changes in students' knowledge and confidence in assessment, management, and practical skills.

**Results:** The most common reason for participation was to acquire knowledge and practical skills (93.2 %). Mean correct MCQ mini-test knowledge scores increased significantly from 60 % pre-workshop to 83.9 % post-workshop ( $p < 0.05$ ). Students reported significantly increased confidence in recognition and management of all four conditions. All students favoured including the course in their curriculum and would recommend the course to others. The tutors subjectively reported valuable teaching experience.

**Conclusion:** NPT is an effective method for teaching medical students how to assess and manage acute otolaryngology/ENT surgery conditions that may present as emergencies for junior medical officers on the ward.

## Key message

Near-peer teaching programs can be successfully used to teach acute surgery to senior medical students with improvements with both knowledge and confidence. Tutors also benefit with improved non-

technical and communication skills. They should be considered a valuable adjunct in the medical curricula.

*Abbreviations:* ENT, Ear nose and throat surgery; MCQ, Multiple choice question; NPT, Near-peer teaching; UNDA, University of Notre Dame.

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## Introduction

The progression from medical student to junior doctor involves a steep learning curve, stressful work environment and long hours. In some studies, internship was associated with elevated psychiatric morbidity and burnout of up to 70 %, with resultant suboptimal patient care [1–3]. Although contrasting data is also available, the first month of internship has been shown to be associated with increased patient mortality and decreased efficiency in hospitals [4,5]. Two of the primary objectives to be achieved by the time of graduation are that medical students are knowledgeable and skilful. With an expanding medical curriculum, less didactic teaching, and often a shorter duration of medical school compared to historical undergraduate medicine programs, meeting these objectives has become more challenging. A study reported that attaining preparedness for internship and residency was the highest priority for those in the final year of medical school [6] but it has also been reported that new interns often report under-preparedness for these years in numerous domains [7].

Traditionally, medical school teaching has been provided by university academic staff or senior hospital doctors. A systematic review of senior clinicians' attitudes to teaching medical students found that there was limited time for teaching which may be due to increased clinical responsibilities and other duties [8]. The number of medical students has increased substantially over the past decade, which may further contribute to the strain on teaching resources [9]. In this setting, many undergraduate programs have introduced near-peer teaching (NPT), which is defined as teaching delivered by junior doctors or students who are close to, but not at the same level in the training continuum as those being taught [10].

Since being introduced by Hendelman et al. in 1986, the benefits of NPT have become increasingly recognised and this form of learning has gained attention as a useful adjunct to formal clinical skills training within medical curricula [10–12]. One reported benefit is that, due to cognitive congruence and a similar knowledge framework, near-peer teachers could provide education at a more accessible level; they may better anticipate learning problems, and reframe their teaching to provide clearer explanations [13]. Others suggest that social congruence plays a role. That is, holding similar social positions to students, near-peer tutors may be better placed to create a 'positive learning environment' [14]. Importantly, several studies have shown NPT does not disadvantage the recipient of teaching when compared to outcomes of teaching by academic staff [15–17].

The benefits of near-peer teaching across numerous domains including anatomy, basic surgical skills, general practice, obstetrics and gynaecology, as well as non-clinical skills such as professionalism have been described [18–21]. There are relatively fewer publications on the effectiveness of NPT for teaching acute surgical conditions using models. We found only one report on the implementation and effectiveness of NPT teaching for ear, nose, and throat (ENT)/otolaryngology or head and neck surgery scenarios [22]. Furthermore, undergraduate teaching modules, including for NPT, are typically developed by academic faculty, whereas we report a teaching workshop developed and led by a junior doctor collaborating with other junior doctors.

The primary aim of this study was to determine the effectiveness of an acute surgery NPT program for senior medical students, delivered as a one-day workshop by junior doctors. We hypothesised that this program would improve students' knowledge and confidence for the selected acute surgical scenarios.

## Materials and methods

Ethical approval for this study was obtained (University of Notre Dame Australia (UNDA) School of Medicine Human Research Ethics Committee 2020/019155S). The otolaryngology/head and neck or ear, nose, and throat (ENT) surgery component of the medical curriculum at UNDA was reviewed. A focus group of 15 senior medical students and 6

junior doctors was convened and topics were selected from the curriculum. The topics selected were ones that the junior doctors considered clinically important because they may be encountered by interns and junior residents (including after-hours), and they may require decisive management. These topics were epistaxis, post-operative neck swelling, and tracheostomy bleeding or obstruction. The workshop was approved by surgery faculty members.

All senior (third-year) UNDA medical students attending the St Vincent's & Mater Clinical School were invited to participate. During compulsory "Back-to-Base week" lectures which are attended by all students, an announcement was made that a near-peer teaching pilot would be held as a supplement at the conclusion of the week. All students were also provided with a handout outlining what the teaching program entailed. Participation in the program was voluntary and without remuneration. There were no specific exclusion criteria and all students who volunteered to participate were included. Students' participation or performance in the program did not contribute in any way to their assessment by the medical school.

Tutors were junior medical officers and general surgery trainees in their 2nd to 5th post-graduate year. Junior doctors were recruited to teach via email and were asked to rank their topic preferences. Prior to the NPT workshop, tutors attended an orientation session reviewing the topics and skills that they would be teaching. Pre-prepared slides, including learning objectives for each topic, were provided to tutors to aid the didactic teaching session. All course content was prepared by surgical trainees based on the University's Year 3 and 4 curricula. This was reviewed by a Surgeon and University Faculty member for factual accuracy. Teaching equipment used included: nasal packing models of the nasal cavity and nasal packing tampon (Smith and Nephew, North Ryde, Sydney NSW Australia) (Fig. 1), tracheostomy observation models (T.O.M) models (Passy Muir, Main Medical, Beresfield NSW Australia) (Fig. 2) and SimMan mannequins (Laerdal Medical, Orpington, UK) modified with a 3D printed cricothyroidotomy trainer airway [23], haematoma pocket created with lubricant gel packets dyed red, strap muscle layer and artificial skin with running sutures to enhance surgical realism (Fig. 3). Tutors were instructed in the correct use of these models. The tutors were given autonomy in how they conducted the didactic and practical skills components of the session. Each topic was allocated 45 min for teaching with an additional 15 min for questions and feedback. Set times for break and pre- and post-intervention testing were included in the program. An attending surgeon and faculty member was also present during the sessions to help if requested by a tutor, however their input was not required in any of the sessions.

A pre-workshop paper survey was completed. Data collected were sex, reasons for attendance, ratings for each topic taught, and overall impression and perceived utility of the program. Other information collected included potential interest in becoming a surgeon and prior



**Fig. 1.** Anatomical nasal packing model with perspex plate covering medial surface and nasal tampon device.



Fig. 2. Tracheostomy observation model (T.O.M) model and SimMan.

clinical experience in otolaryngology surgery.

A mini-test with ten “one best answer” multiple choice questions (MCQs) covering all topics in the workshop was used to evaluate the knowledge-based learning outcomes. The test was completed under timed test conditions before and after the workshop, and class average normalised knowledge gain was calculated ( $\langle g \rangle = (\langle \text{Post} \rangle - \langle \text{Pre} \rangle) / (100 - \langle \text{Pre} \rangle)$ ) to measure changes. The results were collated and analysed using the Analysis ToolPak (Microsoft Office Excel). Paired *t*-test analysis of complete sets of before and after test scores was performed with  $p < 0.05$  indicating statistical significance.

Self-reported confidence scores in the management of included scenarios and practical skills were assessed pre- and post-workshop with Likert-type scale items arranged from 1 to 4. For assessment and management of the surgery topics, a score of 1 indicated the student was not confident in recognising the condition; a score of 2 indicated moderate confidence in recognising the condition; a score of 3 indicated confidence in recognising but not managing the condition and a score of 4 indicated confidence in both recognising and managing the condition. For self-assessment of practical skills, a score of 1 indicated the student was not confident; 2 was confident only in simulation; 3 was confident with senior supervision, and a score of 4 indicated confidence to perform independently but with assistance when required.

Using a modified Likert scale from 1: ‘strongly disagree’ to 5:

‘strongly agree’, the students evaluated the workshop on the clarity of the learning objectives, content presentation, course format, teacher performance and knowledge as well as usefulness and relevance to internship. Free text comments were also encouraged. Simple descriptive statistics were employed to analyse the data.

Junior doctor tutors completed a separate feedback form on prior teaching experience, and time and resources taken to prepare prior to the workshop. They also provided retrospective responses reflecting on the benefits derived from their participation, motives, and barriers to NPT, as well as areas for course improvement.

## Results

Information regarding the 59 3rd year medical students who attended the workshop is shown in Table 1. Six junior doctors (two surgically inclined resident medical officers, two junior surgery trainees, and two senior surgery trainees) volunteered to teach.

Both the pre- and post-workshop MCQ mini test was completed by 41/59 (69.5 %) students. The students' mean correct score improved from 6.0/10 pre-workshop to 8.4/10 post-workshop ( $P < 0.05$ , two tailed paired *t*-test). The class average normalised knowledge gain was +60 % [20].

The students' evaluation of their confidence in assessing and managing the acute surgical scenarios is shown in Table 2. The proportion of respondents giving the two highest Likert scores (3 or 4) improved significantly (chi-squared test,  $P < 0.05$ ) for all the workshop topics except epistaxis assessment and management, which was the only topic the students had been taught previously.

All three practical skills demonstrated and practised showed an improvement in self-reported confidence after attending the workshop (Table 3). A mean level of confidence of 1.38 pre-course and 2.81 post-course demonstrated an increase in confidence by 103.6 %.

As shown in Table 4, feedback from the students regarding the workshop content and the NP tutors was generally very positive, but most students did not agree that there was sufficient time to learn the practical skills.

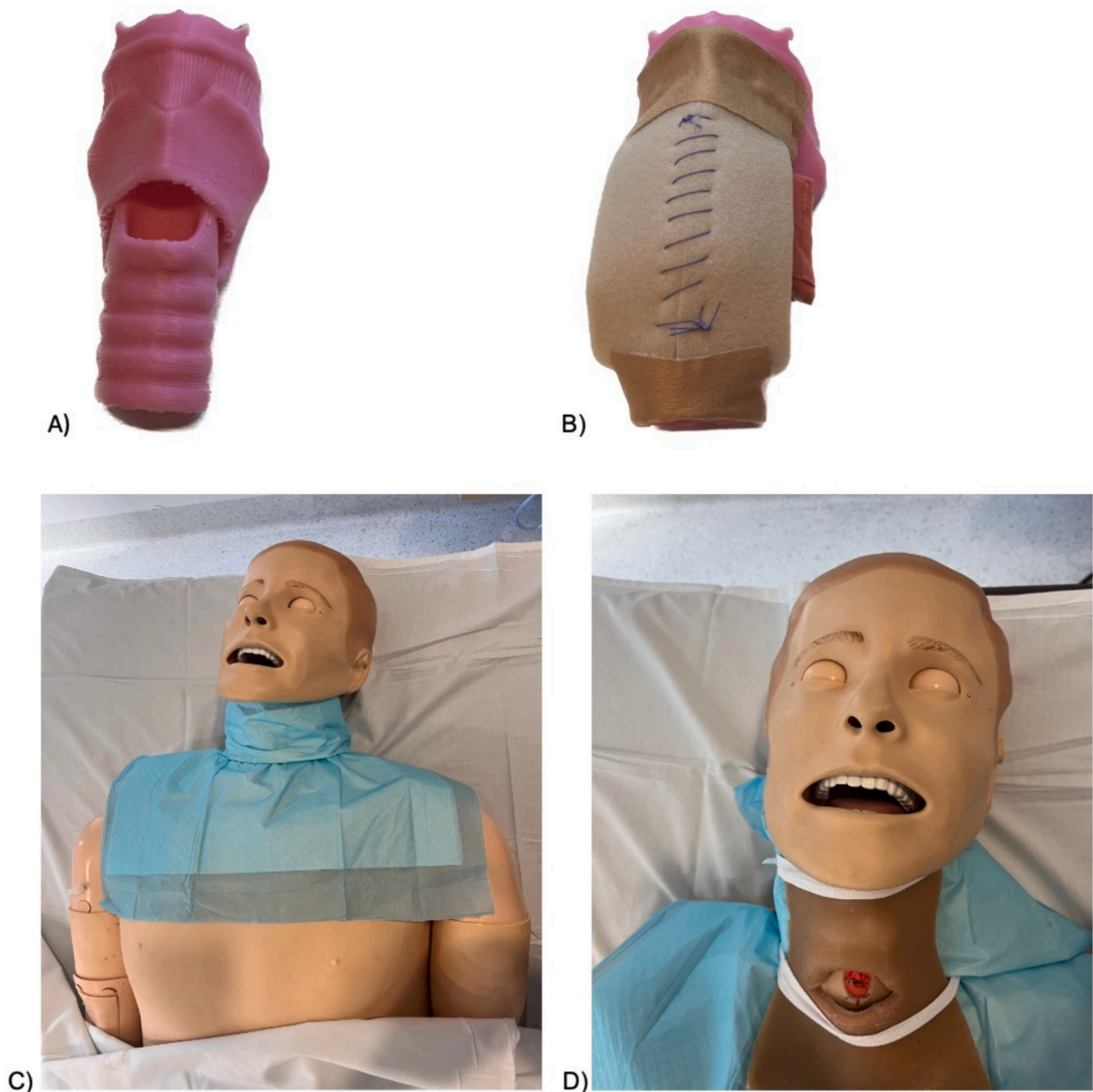
In narrative reflections as a group, all six junior doctor tutors viewed the workshop as beneficial for developing their own knowledge of the topics, as participation prompted them to study the topics more thoroughly. Additionally, tutors stated improved confidence in their teaching style as well as other transferable skills such as public speaking. The tutors regarded teaching as an essential skill for surgeons and agreed that this and similar programs could play a role in their professional development as surgery educators.

## Discussion

This study demonstrates that an effective near-peer teaching (NPT) workshop to teach acute surgery clinical scenarios can be developed by motivated surgery trainees. Although there are numerous examples of NPT organised by academic staff, very few publications report the organisation and delivery of surgical NPT by tutors who are junior doctors. In view of the increasing demands on academic staff, our study indicates that it is reasonable to encourage surgery residents to develop an NPT workshop. This may also fulfill research and teaching requirements for surgery trainees [24].

Developing a successful teaching program requires considerable planning and preparation. For our NPT workshop, this included the identification of appropriate clinical scenarios, for which we focussed on those that are likely to be encountered by interns or residents on surgical wards, sometimes after hours, or could be surgical emergencies. The Year 3 and Year 4 curriculum and learning objectives were provided by the UNDA for review. Topics were refined based on informal feedback from a focus group of junior doctors and senior medical students. As a result of this process, acute otolaryngology scenarios that can be surgical emergencies were chosen for the workshop. Although tracheostomy





**Fig. 3.** Mannequin moulage.

A) 3D printed cricothyroidotomy trainer.

B) Strap muscle layer with running vicryl sutures placed to enhance surgical realism.

C) SimMan mannequins modified with underlying cover to protect mannequin. 3D printed airway, haematoma and artificial skin covering placed over this.

D) Mannequin after opening of skin and strap layers exposing haematoma.

complications are uncommon, all members of the focus group expressed uncertainty or anxiety regarding assessment and initial management. St Vincent's Hospital Sydney performs numerous head and neck, endocrine and laryngeal procedures each year. In hours, these patients are cared for post operatively by the General Surgery and ENT/Head and Neck Surgery teams. However, after hours any complications or clinical deteriorations may be raised with Junior Medical Officers prior to escalation to the surgical team.

We limited group sizes to ten students per session to maximize participant involvement and correspondingly recruited an adequate number of tutors. This smaller group size enabled tutors to provide

individualised feedback on the practical skills performed. Students were not externally assessed in their ability to perform the taught practical skills and clinical assessments. However, the small group facilitator led model enabled tutors to observe and correct students during their practice attempts. The ability for self-assessment is routinely fostered during medical school as recognition of one's clinical abilities and limitations is vital for patient care [25]. Although over- and under-estimation can occur, meta-analyses have shown in general students are able to accurately self-assess their abilities and knowledge, especially in their later years [26].

The medicine course at UNDA, like many others, is compressed into

**Table 1**  
Characteristics of student participants.

	Students (N = 59)	N (%)
Sex	Male	32 (54.2)
	Female	27 (45.7)
Interest in career in Surgery	Yes	29 (49.2)
Previous ENT clinical exposure	No	59 (100)
Reason for attendance (Multiple allowed)	Increase knowledge/practical skills	55 (93.2)
	Internship preparation	48 (81.4)
	Exam preparation	49 (83.1)
	Interest in surgery	14 (23.7)

**Table 2**  
Assessment and management confidence.  
Self-assessed confidence before and after institution of near-peer teaching.

Outcome (N = 41)		Mean score	Responses of Likert 3 or 4 (%)
Epistaxis	Before	2.88	31 (76)
	After	3.71	40 (98)
Tracheostomy obstruction	Before	1.59	2 (5)
	After	2.89	17 (41)
Tracheostomy bleed	Before	1.49	3 (7)
	After	2.90	29 (71)
Post-operative neck swelling	Before	1.76	7 (17)
	After	3.15	36 (95)

**Table 3**  
Practical skills confidence.  
Self-assessed confidence before and after institution of near-peer teaching.

Outcome (N = 41)	Before (SD)	After	P-value*	Effect size <sup>?</sup>
Nasal packing	1.88 ± 0.68	3.29 ± 0.68	<0.05	2.08
Trouble shooting tracheostomy	1.12 ± 0.40	2.59 ± 0.74	<0.05	2.46
Post-operative neck swelling	1.15 ± 0.42	2.56 ± 0.74	<0.05	2.34

\* Calculated using paired t-test.

<sup>?</sup> Calculated using Cohen's D.

**Table 4**  
Course evaluation.  
Post-NPT workshop questionnaire.

	Mean score (N = 41)	Responses of Likert 4 or 5 (%)
Content enhanced my knowledge	4.54	41 (100)
Teaching was relevant to internship	4.59	40 (97)
Instructor demonstration was useful	4.60	41 (100)
Instructors were knowledgeable	4.56	41 (100)
Instructor feedback was helpful	4.24	34 (83)
Sufficient practice time	3.15	18 (44)
Would recommend to others	4.61	41 (100)
General comments	"It was excellent" "All CCS (clinical and communication skills) sessions should be run this way" "All demonstrators were great teachers"	

four intense years. One consequence of this is that surgical subspecialties such as otolaryngology/head and neck surgery may be taught through lectures, tutorials, and practical sessions but students may not have the benefit of rotating through a clinical attachment in this field. One British study reported that undergraduate medical students receive on average one week's exposure to ENT surgery prior to graduation [22]. Similarly,

a near-peer mentorship study for otolaryngology-head and neck surgery noted that medical students in the USA have no exposure to this field at some medical schools [27]. None of the 3rd year students in our study had previous clinical exposure to ENT surgery.

This is the first report of a NPT initiative that provided hands-on clinical simulation for acute otolaryngology/head and neck surgery clinical scenarios. After pre-workshop training, the junior doctor tutors delivered a workshop that incorporated the use of simulation models. Prior to the workshop, the management of epistaxis and the nasal packing practical skills station had the highest proportion of students who reported feeling confident. This may be due to the previous clinical skills sessions noted above. Despite this, 29 % of participants indicated they did not feel confident performing nasal packing either in simulation or clinical practice. Other studies also report low levels of confidence in managing ENT presentations amongst students, possibly translating to high rates of referral for ENT review [28–30]. Additionally, despite the higher scores pre-workshop, there was a statistically significant improvement in students' confidence when performing nasal packing after the NPT session. Although repetition of a previously taught skill may account for some of this improvement, all participants reported that tutor demonstrations and feedback were helpful. This finding, in addition to free text comments by students that they felt 'more comfortable asking questions' and that the tutors provided 'tips and tricks' indicate that social and cognitive congruence may have been contributing factors.

Whilst feedback from the junior doctor tutors was generally positive, improved knowledge amongst the tutors was not formally assessed; in other studies, it has been difficult to clearly demonstrate a substantial knowledge gain, for example in future examination results [31]. Congruent with the literature [32], reported barriers to prior or continued involvement in teaching included conflicting clinical duties and a lack of organisation to ward-based teaching programs (Table 5). Whilst all the tutors indicated their willingness to participate in future teaching programs, we recognise that not all near-peer teachers may have the same experience.

As NPT may not be formally recognised or remunerated, tutors may be self-selecting - individuals with an interest in education may actively seek out teaching opportunities [33]. Despite the universal nature of teaching within medicine, doctors often receive little or no formal training on how to teach during their medical school or junior doctor years [34]. This was noted to be true amongst our near-peer tutors, who despite demonstrating enthusiasm and a desire to be well-prepared, lacked formal educational experience. Bulte et al. suggests that tutors should be trained in essential styles of teaching, be provided with skills to facilitate learning, and understand how to troubleshoot potential student-teacher incompatibilities [35]. Tutors were not required to undertake structured teacher training or formally coached on methods of education; however, all had prior experience facilitating medical student tutorials or informal "bedside" teaching. Some tutors raised concerns that requirements for formal training would limit their ability to engage in NPT due to time constraints and conflicting clinical responsibilities. This study has suggested future avenues for research, in particular formalized tutor education, and its impact on students'

**Table 5**  
Tutor feedback.

Reasons for volunteering	"to pass on advice that I received" "have an interest in medical student education... apply for a conjoint appointment in future" "to give back... prepare them for internship" "to show them the proper way to insert a Rapid Rhino"
Barriers to teaching	Unpredictability of work schedule Conflicting work/personal priorities Time required to prepare/find resources Perceived lack of knowledge Lack of teaching qualification

learning experience and junior doctor participation.

A weakness of NPT is its informal nature, with the focus determined by individual teachers deciding what information is more or less important. By providing pre-prepared slides and learning objectives for each topic we were able to ensure factual accuracy and mitigate potential knowledge deficits. Tutors appreciated being able to review the slides and interact with teaching models in advance, with one stating this “allowed me to focus on engaging with the students, instead of worrying about missing information”. Having a Surgeon or Faculty observing sessions at various points, allowed tutors to receive informal feedback on their teaching whilst keeping the tutorials as student-centred as possible.

To ensure that NPT initiatives are sustainable, we must invest in individuals who take time to participate as tutors. As demonstrated in numerous other teaching programs, a commitment to ‘teaching the teachers’ was recognised as being vital to the success and longevity of NPT programs [36].

This study had several limitations. We surveyed a sample of students from a single institution. Due to the novel nature of using near-peer teaching within this institution, it was decided to conduct this pilot program at a single clinical school within UNDA. This enabled oversight and input from University faculty if any issues were identified during the preparation or running of the workshop. Whilst this resulted in a smaller sample size of 59 students, we felt that the students were sufficiently representative of the larger UNDA medical student cohort. The results may not be applicable to other universities due to differences in medical curricula. Although 100 % of eligible students attended the teaching program, 18 participants (30 %) left prior to completion of the post course assessment and evaluation. The most common reason given was pre-organised transportation as the course was held at the end of the day.

There is the potential for selection bias as only junior doctors interested in surgical education volunteered to participate as near-peer tutors; other junior doctors may be less effective as tutors. Additionally, this NPT pilot program was run as an adjunct rather than a replacement of the curriculum. Although we obtained quantitative and descriptive outcome measurements before and after participation in the teaching program, there was no objective comparator with faculty-based teaching sessions. The duration of improvement to knowledge and confidence levels is difficult to determine within this study design, however, we would expect longitudinal studies to reveal some durability. We also did not assess the cost. Whilst suppliers of the surgical simulation models may reasonably expect that the teaching aids used for this pilot workshop are purchased rather than borrowed for future workshops, these models would be reusable and could be shared between education settings for ENT teaching.

Additional research into the format of NPT teaching for surgery, the potential benefits of standardised tutor training and formal recognition of such teaching is needed to ensure that NPT programs are viable. NPT has demonstrable benefits for both participants and tutors and can be expected to ultimately benefit patients. We hope that this study will encourage further research into NPT as a formal component of the surgical curriculum for medical schools.

## Conclusion

This study demonstrates that NPT is an effective method of improving the knowledge and confidence of senior medical students in the clinical management of ENT conditions. The hands-on component and use of simulation and models to practice technical skills showed additional benefits to learning. Therefore, junior doctor developed NPT programs should be considered a useful tool to supplement ENT education in medical school curricula.

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## Ethics approval and consent

Ethical approval was granted from the University of Notre Dame Australia (UNDA) School of Medicine Human Research Ethics Committee 2020/019155S. Informed consent was sought from all participants.

## CRedit authorship contribution statement

**Wendy Liu:** Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tamara Preda:** Writing – review & editing. **Warren Hargreaves:** Writing – review & editing, Supervision, Conceptualization. **Reginald V. Lord:** Writing – review & editing, Supervision, Conceptualization.

## Declaration of competing interest

The authors declare they have no conflicts of interests.

## Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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