Medical students’ experiences of practising medical procedures on patients, other students and themselves

Michelle Bai, Helen Nicholson, Kelby Smith-Han

ABSTRACT

AIM: Development of proficient procedural skills is vital to the training of young doctors. The aim of this project was to investigate the prevalence of different ways that medical students practise clinical procedures and the relationship with professional development.

METHODS: A survey was made available online to the cohort of years 4–6 medical students at the Otago Medical School, University of Otago. Quantitative and qualitative data were collected and analysed. Statistical methods and qualitative content analysis were employed in order to categorise and infer student responses.

RESULTS: Two hundred and eighty-four of 816 (35%) students responded to the survey. A total of 23 categories of procedural skills were reported, demonstrating procedures with varying complexity and degrees of invasiveness. A small proportion, 5%, indicated they had performed invasive procedures on themselves, with a majority of these reported to be unsupervised. 77% of students reported being directly observed when performing procedures on patients for the first time, while 32% reported being supervised when practising on peers.

CONCLUSION: Students practise clinical procedures on patients, peers and in some cases themselves. Our findings suggest a need for clearer guidelines in the support and management of the safe practice of students, be it on patients, other students or on themselves.

Establishment of procedural clinical skill proficiency is a vital component of the education of medical students. In clinical attachments throughout their training, students engage in practising non-invasive and invasive procedures that range in complexity. These procedural skills are developed through repeated, longitudinal exposure to patients, are often supplemented by practice on fellow medical students and are, furthermore, aided by additional means such as simulation. Practice through repetition and exposure allows for successful mastery of a repertoire of procedural skills and forms a large component of student professional development.

Despite the importance of procedural skills development, there is limited literature describing medical students’ personal experiences and approaches to practising skills in the clinical environment. Many studies explore interventions to improve clinical skill acquisition and competency—the quality and adequacy of skill proficiency in graduates—while others reflect on current pedagogical styles in medical education. To the best of our knowledge, the autonomous practice of procedural skills by students has not been described.

This study was developed as a result of information gathered from student interviews undertaken during the production of the television documentary, Practising Medicine, which followed students from Otago Medical School during their clinical attachments. It became apparent in the making of the documentary that a few medical students were practising certain invasive techniques on themselves. This raised concerns regarding professional
behaviour, specifically safety and practising personal self-care. Part of the mastery of skills is the ability to conduct them competently and safely. Facilitation of this process is optimised by the presence of supervision and guidance, at least initially, which allows the student to refine their technique while ensuring both student and patient safety. The aim of this study was to investigate the prevalence of different ways that students practise invasive medical procedures, and their reflections of performing these procedures.

**Method**

The medical programme at the Otago Medical School is six years long. It includes a competitive Health Sciences First Year (HSFY), two years of Early Learning in Medicine (ELM) followed by three clinical years of Advanced Learning in Medicine (ALM). ALM is taught at three schools: Christchurch, Dunedin and Wellington. The Otago Medical School accepts both undergraduate and postgraduate students. Approximately 70% of students enter the program from HSFY and do so usually directly from secondary education. Another ~25% of students enter into year two following completion of an undergraduate degree. The remaining ~5% ‘Alternative’ category entrants comprise older applicants from a diverse range of backgrounds; including graduates from other health related professions.

Medical students begin their basic clinical skills learning in ELM and gain practice on patients in ALM. The Medical School has a Code of Professional Conduct for Medical Students at the University of Otago which includes a section regarding clinical skills: “As a medical student I will: Make the most of educational and clinical opportunities to extend my knowledge and further my skills with appropriate support and supervision.”

**Study design and recruitment**

Medical students currently undergoing the three years of ALM were invited to participate in an online survey regarding their clinical experiences of practising medical procedures. The survey was launched in August/September 2015 through SurveyMonkey® (surveymonkey.com) and provided to all 816 students currently enrolled in ALM (years four–six of medical study) via their student university email address. The questionnaire remained open for a period of six weeks. The sample did not exclude any ALM students, however, ELM students were excluded.

The questionnaire addressed demographic information including age, gender and ethnicity. Open questions were asked in regard to which medical procedures students had performed on patients, their peers and themselves. Students were also asked whether or not they were supervised and to indicate any difficulties and ethical concerns experienced during the practice of procedures on any persons. The meaning of ‘invasive medical procedure’ used in this survey was defined as a procedure that contains some intrusiveness to the body. For example: IV lines, wound suturing, mole removal, venepuncture, catheterisation etc. The full questionnaire can be found in Appendix A.

**Data analysis**

Quantitative survey results were explored and analysed using GraphPad Prism version 5.00 for Windows (GraphPad Software Inc, San Diego, CA, USA). Qualitative information was analysed using qualitative content analysis. This involved identifying the main themes from the responses and then calculating the frequency and proportions of procedures performed on patients, other medical students and the medical students themselves. Procedures indicated by the respondents were categorised and where appropriate, grouped, ie minor surgical procedures such as cryotherapy and lesion excisions were grouped together. Reporting of synonyms for procedures such as phlebotomy (taking blood, venesection and venepuncture) were also collapsed under one heading. A similar procedure was also applied to difficulties and ethical concerns reported by students—relevant categories were inferred from replies and the frequency of each calculated.

**Results**

Of the 816 students emailed, 284 completed the survey, a response rate of 35%. Total survey respondents were representative of the demographic of Otago
Medical School students (Table 1) and reflected cohort age, year level and localational distribution with the average age of respondents 24.0±3.4 (Mean ± SD).

Of the responses, 61% (n=174) of students surveyed were female compared with the total female cohort of 57.4%. A Chi square test indicated that our sample differed from the total cohort (p=0.005) in terms of the representation of the years. More responses were received from 5th year students compared to 4th year and 6th year—with final year students being a smaller cohort overall in the total population of 816 (4th year n=274, 5th year= n=292, 6th n=250). Sample size did not allow for any statistical analysis between responses from clinical schools and year level.

**Figure 1**: Procedures performed by students on self, unsupervised and supervised.

**Table 1**: Demographic data from study participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Response</th>
<th>Respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>20–24</td>
<td>211 (74)</td>
</tr>
<tr>
<td></td>
<td>25–27</td>
<td>51 (18)</td>
</tr>
<tr>
<td></td>
<td>28+</td>
<td>22 (8)</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>174 (61)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>107 (38)</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Year level</td>
<td>4th</td>
<td>92 (32)</td>
</tr>
<tr>
<td></td>
<td>5th</td>
<td>123 (43)</td>
</tr>
<tr>
<td></td>
<td>6th</td>
<td>68 (24)</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>NZ European</td>
<td>215 (76)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>39 (14)</td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td>25 (9)</td>
</tr>
<tr>
<td></td>
<td>Māori</td>
<td>3 (1)</td>
</tr>
<tr>
<td></td>
<td>Pacific Islander</td>
<td>2 (1)</td>
</tr>
<tr>
<td></td>
<td>NZ Euro + Māori</td>
<td>26 (12)</td>
</tr>
<tr>
<td></td>
<td>NZ Euro + Other</td>
<td>13 (6)</td>
</tr>
</tbody>
</table>
Of the 284 students surveyed, 15 students (5%, seven male and eight female) had performed procedures on themselves (Figure 1). Of these procedures, 11 were unsupervised and included: cyst removal, venepuncture, cannulation, arterial blood gas sampling and suturing. The technical aspect of performing the procedure on oneself was reported to be the most difficult aspect of self-practice, followed by pain from the procedure and anxiety performing it. When asked about ethical issues around self-practice, use of hospital supplies and safety of the procedure were the major concerns. One student reported no ethical concerns, commenting:

“The procedure was done at home with non-medical instruments outside of the hospital context, with no others involved, no equipment was taken from the hospital. Thus I see no ethical issues”.

Most students (92%; n=264) surveyed had practised medical procedures on their peers. Peer-practised procedures included: IV cannulation, venepuncture, arterial blood sampling and nasogastric tube insertion. Of the 264 students who reported practising on peers, 173 indicated they were unsupervised (with no other person present) on some of these occasions (Figure 2).

Of the difficulties experienced during the practice on fellow students (n=189), inflicting unnecessary harm or pain on peers was cited as an issue by 38% (n=71) whereas 25% (n=48) indicated procedural difficulties such as issues with technique, equipment and skill as a large barrier to their practice. Other concerns noted were lack of supervision and guidance, particularly if practising alone 12% (n=23), judgement by peers, effect on social relationship if there was failure during practice 11% (n=21), limited resources to practise with and also being expected to reciprocate to their peers 6% (n=11). Furthermore, practising on fellow students was considered not an authentic experience by 4% (n=8), as young, healthy individuals with good veins were uncommon on the wards. Other comments included one student who expressed guilt for pilfering resources:

“We felt bad taking IV lines from a nursing station once. They had four. We took all four. I’m so sorry”.

Of the 284 students, 278 reported that they had practised medical procedures on patients (Table 2). Procedures most commonly performed were intravenous cannulation performed by 94% and venepuncture performed by 92% of students. Less commonly performed procedures included general anaesthesia (1%) and lumbar puncture (2%). Table 2 shows a selection of invasive medical procedures.
Te Hauora mō ngā Iwi Katoa

practised as reported by students. A full summary can be found in Appendix B.

Procedural skills performed on patients increased in complexity as the students advanced through each year. Junior students had a lower reported frequency of performing skills such as ABGs, and minor surgery such as lesion excisions. With seniority, the frequency of these skills increased, ie ABGs in 4th year were reported by 5.5% of students, with the rate increasing to 48.5% of students by 6th year. Lumbar punctures were also performed by 7% of 6th year students.

Students were asked if they were supervised on the first attempt of any procedure on a patient. All 284 students responded to this question, of whom, 77% (n=220) reported that they were supervised during one or more first-time skills performed on a patient. Of 22% of students (n=63) reporting being unsupervised during these procedures, the most commonly performed were venepuncture and IV cannulation (Figure 3).

Table 2: A selection of reported procedures performed on patients by students, with gender and year level identified. Two respondents that did not specify gender were not included in this table. For unsupervised procedures only, see Figure 3.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Total (%</th>
<th>4th Year (%)</th>
<th>5th Year (%)</th>
<th>6th Year (%)</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous cannulation</td>
<td>267 (94)</td>
<td>84 (91)</td>
<td>116 (94)</td>
<td>67 (99)</td>
<td>103 (96)</td>
<td>162 (93)</td>
</tr>
<tr>
<td>Venepuncture</td>
<td>261 (92)</td>
<td>83 (90)</td>
<td>115 (94)</td>
<td>63 (93)</td>
<td>99 (93)</td>
<td>160 (92)</td>
</tr>
<tr>
<td>Suturing</td>
<td>176 (62)</td>
<td>42 (46)</td>
<td>77 (63)</td>
<td>57 (84)</td>
<td>64 (60)</td>
<td>110 (63)</td>
</tr>
<tr>
<td>Urinary catheterisation</td>
<td>121 (43)</td>
<td>34 (37)</td>
<td>41 (33)</td>
<td>46 (68)</td>
<td>41 (38)</td>
<td>79 (45)</td>
</tr>
<tr>
<td>Minor surgery (biopsy, excision of skin lesion)</td>
<td>87 (31)</td>
<td>12 (13)</td>
<td>30 (24)</td>
<td>45 (66)</td>
<td>28 (26)</td>
<td>58 (33)</td>
</tr>
<tr>
<td>Arterial blood gas sampling</td>
<td>59 (21)</td>
<td>5 (5)</td>
<td>21 (17)</td>
<td>33 (49)</td>
<td>24 (22)</td>
<td>35 (20)</td>
</tr>
<tr>
<td>Lumbar punctures</td>
<td>50 (18)</td>
<td>6 (7)</td>
<td>17 (14)</td>
<td>27 (40)</td>
<td>21 (20)</td>
<td>29 (17)</td>
</tr>
<tr>
<td>Vaginal or rectal examinations</td>
<td>41 (14)</td>
<td>8 (9)</td>
<td>19 (15)</td>
<td>14 (21)</td>
<td>14 (13)</td>
<td>27 (16)</td>
</tr>
<tr>
<td>Injections (medication, unspecified)</td>
<td>41 (14)</td>
<td>6 (7)</td>
<td>23 (19)</td>
<td>12 (18)</td>
<td>15 (14)</td>
<td>26 (15)</td>
</tr>
<tr>
<td>Local anaesthetic</td>
<td>39 (14)</td>
<td>11 (12)</td>
<td>13 (11)</td>
<td>16 (24)</td>
<td>13 (12)</td>
<td>25 (14)</td>
</tr>
<tr>
<td>Assisting in surgery</td>
<td>27 (10)</td>
<td>8 (9)</td>
<td>13 (11)</td>
<td>6 (9)</td>
<td>13 (12)</td>
<td>14 (8)</td>
</tr>
<tr>
<td>STI/cervical smear</td>
<td>27 (10)</td>
<td>2 (2)</td>
<td>15 (12)</td>
<td>11 (16)</td>
<td>5 (5)</td>
<td>22 (13)</td>
</tr>
</tbody>
</table>

Figure 3: Reported unsupervised procedures performed first time on patients by students.
The main difficulties raised by students when performing procedures on patients were: fear of causing pain or failing the task (33% (n=91)), lack of confidence, nervousness or shakiness (16% (n=45)) and lack of skill/practice opportunities before attempting on a patient (13% (n=37)). Less commonly reported concerns included lack of or perceived poor supervision (5% (n=15)), the patient lacking confidence in the student (7% (n=19)) and the student being unsure of how to deal with sequelae resulting from the procedure (2% (n=6)).

Overall, 49% (n=139) of respondents perceived some ethical issues when performing invasive procedures on patients. The most common (n=77) was the perception that the patient may not have given informed consent for the student to perform the procedure. Some students felt that the patient may have been unaware that they were practising certain procedures on them (eg, when performing relevant procedures on them while anaesthetised), or was not explicitly informed of the student’s level of experience, for example when introduced as a junior doctor or colleague. It was reported that sometimes supervising doctors did not explain to patients that the student was, indeed, a student. The dilemma between gaining clinical competency and causing the patient unnecessary harm was also indicated, with 34% (n=47) of students raising this concern, while 21% (n=29) of students believed that their performing the procedure resulted in a reduction of quality of care for the patient, as there were more capable staff members available. Some (8%, n=12) students perceived inappropriate supervision, ie by a senior student, or reported no supervision available at all when they practised skills.

When asked for further comments on students’ experience when practising clinical procedures, 50 students responded with a variety of perceived issues with the clinical curriculum. Of these, 39 students mentioned that there were not enough opportunities to gain practical experience before and during the clinical (ALM) years. They cited insufficient resources and safe, designated facilities for students to practice (n=4). Several students commented on reconciling the need for practice opportunities and surmounting the courage to ask patients for permission and potentially causing them harm. Inconsistency of training and experiences were also mentioned (n=9).

**Discussion**

The ability to perform basic clinical procedures is one of many graduate outcomes to be achieved by students by the completion of the medical programme. Our data show that students practise clinical procedures on patients, their peers and in some circumstances, themselves.

**Practising on oneself**

This study confirms earlier data obtained during the production of the television documentary *Practising Medicine* and identified a small proportion of medical students (5%) who had practised an invasive procedure on themselves. Part of the development of appropriate professional behaviour is self-care, where the practitioner is aware of their limitations and the need to address and maintain their wellbeing through appropriate methods, such as utilising health care services. Limited literature is available that describes the experience of self-practice, particularly in regard to students. Existing research describes extreme circumstances where individuals perform surgery on themselves, such as situations in remote conditions where the person operating is the only physician at hand, or in historical cases of surgery performed to pioneer research. A relationship between self-surgery and mental illness has also been described.

On the other hand, there is a body of literature investigating self-prescribing behaviour among doctors. Inappropriate self-treatment behaviours have many implications in regard to the poor health and self-care behaviours of doctors, and potential damage to patient and public trust. Physicians have been described as being poor patients as a result of having high-pressure work within an existing culture of neglecting one’s wellbeing. A plethora of factors contribute to the physician’s willingness to self-treat such as a perceived lack of privacy as a result of seeking treatment, and fear of professional and academic repercussions. A major concern when doctors (or medical students) self-treat is the lack of surveillance which
may prove detrimental to the individual, particularly if the self-prescribed drugs have addictive potential, or if the mole the doctor excises from their leg is cancerous, but is not sent to pathology.

It is unclear from our survey data why students decided to practice on themselves and further studies are required to explore this. In regards to self-motivated behaviours, it is evident that attitudes in medical students are cultivated from an early age. There are examples of teachers modelling invasive procedures on themselves in both the clinical and classroom setting. Demonstrations of self-surgery can be praised as good teaching, as seen in comments on the ‘Awake Endotracheal Intubation’ video, but students could also pick up messages such as ‘self-practice is acceptable among doctors’, that are not included in formal teaching, but rather form part of the hidden curriculum.

With self-treatment attitudes shaped early on by the culture of the medical school, incidence of such self-motivated behaviours while a student may be correlated with increasing likelihood of self-treatment once graduated. As Krall states, “not all who self-medicate abuse medications, but many of those who abuse started by self-medicating”. Perhaps of more concern is that while students who practised on themselves expressed technical difficulties and issues around obtaining resources, they did not describe any problems around professional behaviour. The implications for safety of the student and the possible formation of accepting attitudes to self-treatment behaviours are a concern. Addressing this at a professional development level (ie before and during students’ clinical years) would seem important to promote self-reflective attitudes and appropriate self-care.

Practising on peers

Anecdotally, students practising procedures on peers is common in order to learn a variety of skills and techniques and our data support this. Peer-assisted learning (PAL) has been observed to be an effective method for learning some procedural skills. PAL provides a comfortable learning environment that allows for mutual goal sharing between partners. Performing and experiencing what the procedure feels like through this mode of practice is beneficial to the development of professional attributes, eg empathy. Supporting this method of learning is beneficial to students. Yet, there may be challenges in PAL in informal settings without staff member involvement, as was the case for 173 of the students in this study. Risks may be related to a lack of oversight and of appropriate facilities and resources to safely conduct procedures. Several students cited the difficulty of ethically finding and using resources to practice, for example, using hospital cannulae and needles and locating disposal units such as sharps bins. Though simulation clinics are available, and their use is promoted, the opportunistic nature of the clinical education setting may not always allow easy use of these teaching facilities.

Practising on patients

The majority of students reported practising clinical procedures on patients and felt that they were adequately supervised. However, 22% of students perceived that they received inappropriate (not by a licenced practitioner) or no supervision. The most common procedures performed unsupervised by students were venepuncture and IV cannulation, which are among the most commonly performed procedures in hospitals. The reported lack of supervision should be treated with caution, as it may not equate to not knowing how to do the procedure; they may have practiced it before in another context, eg through simulation or with a fellow medical student prior to entering ALM. Perceived lack of supervision with such procedures may be due to many reasons, such as an assumed competence of students by staff. Other reasons for unsupervised practice may include students’ reticence to seek help, or conversely, they may feel that they are already competent; potentially causing them to disregard the risks involved in the process.

Students integrate theoretical learning with authentic patient encounters to facilitate their learning of professional behaviours, with competency in clinical skills characterised by the ability to perform safely to minimise harm to both student and patient. This learning process calls for appropriate mentorship and in particular, supervision. Direct observation of
medical students with actual patients by an appropriately experienced health professional is considered an important element for teaching clinical skills.\textsuperscript{30,31} This provides the student and patient with a safe learning environment should any adverse events were to occur, along with appropriate feedback for the procedure from a more experienced individual which is crucial for skill development.\textsuperscript{31,32} Without appropriate supervision and feedback the quality of education is not optimal and the likelihood of the production of professionals sufficiently prepared for clinical practice is reduced.

The survey addressed supervision of students during the first attempt on an actual patient because the authors believe this is the most appropriate time to be supervised. Our notion of supervising medical students the first time they conduct an invasive procedure is supported by Yale School of Medicine, as outlined in their “Guidelines for Performance of Invasive Procedures by Medical Students”.\textsuperscript{33} These guidelines outline the need for supervision of medical students for their first invasive procedures conducted on patients, and categorise commonly performed procedures by medical students by degree of risk (low to high) and suggest appropriate supervision for each level (eg for a low-level risk procedure such as phlebotomy, a nurse is an appropriate supervisor).\textsuperscript{33} This may be a useful starting point to provide some clarity around what is expected from students and staff regarding supervision of procedures.

Patient participation is vital for learning. However, some students were concerned that patients may not always have given informed consent for the student to practice on them. The process of obtaining informed consent should provide patients with the necessary information about the training status of the student to help them decide if they want to have a student perform the procedure.\textsuperscript{34} Consent gives students confidence while performing the procedure, as they are aware that the patient has an accurate understanding of their status. It is routine practice that patients are informed when attending a teaching hospital that there may be students involved in their care, but it was less clear whether students were always aware of this.

Limitations of study

Our low response rate of 35% and small study size (n=284) were the main weaknesses of our study. It being a purposive, non-probabilistic sample of a pre-existing cohort furthermore limits the statistical power of the study. As the study design is a survey, at the point in time when the responses were compiled, students may not have completed certain rotations and thus altogether clinical exposure is not uniform between respondents. Furthermore, the recall of procedures and experiences may be inaccurate.

Findings from this study require further validation but also pose further questions for research. These include: adverse outcomes associated with appropriate supervision in the student setting (from students not seeking supervision or from staff unavailability), students’ perceived confidence and competence while performing techniques. There may also be correlations between self-treatment behaviour and attitudes in medical school and the incidence of self-treating once in the workforce.

Conclusion

In conclusion, the survey indicates that medical students practice procedures on patients, peers and, in a small group of students, on themselves. Approximately 5% of the students who responded reported that they had practised an invasive procedure on themselves. Further studies are required to validate our data and understand why students practice on themselves. We suggest that these behaviours need to be discussed at a formal, educational level before students incorporate such acts into their professional way of life. Peer practice commonly occurs but appropriate support and resources were not always perceived to be available for students.

Our findings indicate many positive responses in regard to the clinical experience of students and the learning of procedural skills. However, they also suggest a need for clearer guidelines in the support and management of the safe practice of students, be it on patients, in peer-assisted learning, or on themselves.
Competing interests:
Nil.

Acknowledgements:
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10. Assessment Sub-Committee of the Faculty Curriculum Committee. MBChB Programme of Assessment: Policies and Procedures, University of Otago, 2015.
11. Medical School Accreditation Committee. Standards for Assessment and Accreditation of Primary Medical programs by the Australian Medical Council, 2012.


Appendix A: Survey of medical students regarding their practice of invasive procedures

Q1. Have you read the information sheet associated with this project (provided in the email as an attachment, if not please read this before continuing)?
Y   N

Q2. Have you read and do you give your consent to participate in this project?
Y   N

Demographic information:
Q3. Age:

Q4. Are you male or female?
Male   Female

Q5. Ethnicity (question taken from the 2013 Census):
Which ethnic group do you belong to?
Tick the box or write in the spaces which apply to you
☐ New Zealand European
☐ Māori
☐ Samoan
☐ Cook Island Māori
☐ Tongan
☐ Niuean
☐ Chinese
☐ Indian
☐ Other such as DUTCH, JAPANESE, TOKELAUAN. Please state: ______

Q6. What year of the medical programme are you in?
4th   5th   6th (TI)

Q7. Which School of Medicine are you attending?
Dunedin   Christchurch   Wellington

Q8. Please list any previous health professional occupations you have had: (eg nurse, physiotherapist, medical laboratory scientist, etc.):
There are five main questions below. Please read through the questions and answer them accordingly.

The term ‘medical procedure’ used in this survey is defined as a procedure that contains some invasiveness to the body. For example: IV lines; wound suturing, mole removal, phlebotomy, etc.

Given the definition above, if you are still unsure about what counts as a medical procedure, please include it anyway.

**Q9.** Have you practised medical procedures on patients?
Y   N

**Q10.** If yes, please list what medical procedures you have practised on patients (if no go to question 14):

**Q11.** Thinking of when you first conducted the procedure(s) listed in question 10, for each procedure, please indicate if you were supervised by a staff member or not (use the format in the example below):

Example:
IV line—supervised
Phlebotomy—not supervised

**Q12.** Please describe what you found to be the most difficult aspect of practicing the procedure(s) listed on patients:
Q13. Please describe any ethical issues that you had (if any) when practicing medical procedures on patients:

Q14. Have you practiced (invasive) medical procedures on other medical students?  
Y  N

Q15. If yes, please list what medical procedures you have practised on other medical students (if no, go to question 19):

Q16. Please list any procedures that you practised on another medical student where there was no other person present (type NA if not applicable):

Q17. Please describe what you found to be the most difficult aspect of practising these procedure(s) on another medical student:

Q18. Please describe any ethical issues that you had (if any) when practising medical procedures on another medical student:
Q19. Have you practised (invasive) medical procedures on yourself?
Y  N

Q20. If you answered yes to question 19, please list what medical procedures you have practised on yourself (if no go to question 24):

Q21. Please list any procedures that you practised on yourself when there was no one else present (type NA if not applicable):

Q22. Please describe what you found to be the most difficult aspect of practicing these procedure(s) on yourself:

Q23. Please describe any ethical issues that you had or considered (if any) when practising medical procedures on yourself:

Q24. Would you be interested in being involved in an interview talking about your experience of practicing medical procedures (all participants interviewed go into a draw to win a $100 New World gift card).
Y  N

If you would be willing to be interviewed, we will contact you via email, please type your student email address and your preferred personal email address below:
Q25. If you have anything else you would like to comment on regarding practising medical procedures please write it here:

Thank you very much for taking the time out to complete this survey and be part of this research study!

Appendix B: Summary of total reported types of procedures performed on patients by students, with gender and year level identified. For unsupervised procedures only, see Figure 3.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Total (%)</th>
<th>4th Year (%)</th>
<th>5th Year (%)</th>
<th>6th Year (%)</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous cannulation</td>
<td>267 (94)</td>
<td>84 (91)</td>
<td>116 (94)</td>
<td>67 (99)</td>
<td>103 (96)</td>
<td>162 (93)</td>
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<tr>
<td>Venepuncture</td>
<td>261 (92)</td>
<td>83 (90)</td>
<td>115 (94)</td>
<td>63 (93)</td>
<td>99 (93)</td>
<td>160 (92)</td>
</tr>
<tr>
<td>Suturing</td>
<td>176 (62)</td>
<td>42 (46)</td>
<td>77 (63)</td>
<td>57 (84)</td>
<td>64 (60)</td>
<td>110 (63)</td>
</tr>
<tr>
<td>Urinary catheterisation</td>
<td>121 (43)</td>
<td>34 (37)</td>
<td>41 (33)</td>
<td>46 (68)</td>
<td>41 (38)</td>
<td>79 (45)</td>
</tr>
<tr>
<td>Minor surgery (biopsy, excision of skin lesion)</td>
<td>87 (31)</td>
<td>12 (13)</td>
<td>30 (24)</td>
<td>45 (66)</td>
<td>28 (26)</td>
<td>58 (33)</td>
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<tr>
<td>Arterial blood gas sampling</td>
<td>59 (21)</td>
<td>5 (5)</td>
<td>21 (17)</td>
<td>33 (49)</td>
<td>24 (22)</td>
<td>35 (20)</td>
</tr>
<tr>
<td>Airway intubation/nasogastric intubation</td>
<td>50 (18)</td>
<td>6 (7)</td>
<td>17 (14)</td>
<td>27 (40)</td>
<td>21 (20)</td>
<td>29 (17)</td>
</tr>
<tr>
<td>Vaginal or rectal examinations</td>
<td>41 (14)</td>
<td>8 (9)</td>
<td>19 (15)</td>
<td>14 (21)</td>
<td>14 (13)</td>
<td>27 (16)</td>
</tr>
<tr>
<td>Injections (medication, unspecified)</td>
<td>41 (14)</td>
<td>6 (7)</td>
<td>23 (19)</td>
<td>12 (18)</td>
<td>15 (14)</td>
<td>26 (15)</td>
</tr>
<tr>
<td>Local anaesthetic</td>
<td>39 (14)</td>
<td>11 (12)</td>
<td>13 (11)</td>
<td>16 (24)</td>
<td>13 (12)</td>
<td>25 (14)</td>
</tr>
<tr>
<td>Assisting in surgery</td>
<td>27 (10)</td>
<td>8 (9)</td>
<td>13 (11)</td>
<td>6 (9)</td>
<td>13 (12)</td>
<td>14 (8)</td>
</tr>
<tr>
<td>STI/cervical smear</td>
<td>27 (10)</td>
<td>2 (2)</td>
<td>15 (12)</td>
<td>11 (16)</td>
<td>5 (5)</td>
<td>22 (13)</td>
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<tr>
<td>Surgical drainage</td>
<td>25 (9)</td>
<td>4 (4)</td>
<td>9 (7)</td>
<td>12 (18)</td>
<td>13 (12)</td>
<td>12 (7)</td>
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<tr>
<td>Vaccination</td>
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<td>7 (6)</td>
<td>3 (4)</td>
<td>5 (5)</td>
<td>7 (4)</td>
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<tr>
<td>Centesis/aspiration</td>
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<td>1 (1)</td>
<td>6 (5)</td>
<td>4 (6)</td>
<td>3 (3)</td>
<td>8 (5)</td>
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<td>Surgical stapling</td>
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<td>3 (2)</td>
<td>3 (4)</td>
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<td>5 (3)</td>
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<tr>
<td>Lumbar puncture</td>
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<td>5 (7)</td>
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<td>6 (3)</td>
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<tr>
<td>Spinal/epidural anaesthesia</td>
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<td>3 (4)</td>
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<td>Endoscopy</td>
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<tr>
<td>Contraceptive implant</td>
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<td>1 (0)</td>
<td>2 (3)</td>
<td>2 (2)</td>
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<tr>
<td>Uterine device insertion</td>
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<td>1 (1)</td>
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<tr>
<td>General anaesthetic administration</td>
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<td>0 (0)</td>
<td>2 (3)</td>
<td>0 (0)</td>
<td>2 (1)</td>
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<tr>
<td>Swab for culture (not sexual health)</td>
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<td>0 (0)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Defibrillation</td>
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<td>0 (0)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>1 (1)</td>
</tr>
<tr>
<td><strong>Total respondents</strong></td>
<td><strong>284</strong></td>
<td><strong>92</strong></td>
<td><strong>123</strong></td>
<td><strong>68</strong></td>
<td><strong>107</strong></td>
<td><strong>174</strong></td>
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