Hypothesis: Surgical undergraduate education in a rural setting is feasible and sound in terms of educational outcomes.

Design: The final-year surgical curriculum at the University of Adelaide, Adelaide, South Australia, was restructured to include the option of a rural surgical term.

Setting: Five provincial center hospitals in rural South Australia.


Main Outcome Measures: End-of-year results and subjective ward assessments were compared between the group of students who completed rural surgical terms and the remainder of the student group who participated in tertiary hospital-based electives. Subjective student feedback was obtained in a survey conducted by the Clinical Education Development Unit at the University of Adelaide.

Results: No significant (P = .45) differences in examination results were noted between the rural and city groups. A significant (P < .01) finding was observed in the subjective assessments, indicating that it was more difficult for the rural group to obtain an A grade compared with the city group. The rural students ranked the level of teaching and supervision highly and enjoyed the overall rural experience.

Conclusion: Surgical undergraduate education is practical in a rural setting and, for educational outcome, seems to be at least as effective as city-based surgical clerkships in preparing students for final examinations.

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Surgical undergraduate education is under siege within the tertiary teaching hospital system not only in Australia but also throughout the world.1 The rapid turnover of patients and increasing financial pressures placed on surgical staff significantly effect the teaching resources available to the student.2 The time-honored surgical apprenticeship for senior students is under scrutiny as an effective learning experience. Many medical educators would argue that the clerkship within the superspecialized environment of the tertiary referral center fails to adequately prepare the student for life as an undifferentiated graduate.3,4 Other opportunities for surgical education are being used (eg, day surgical units5 and ambulatory care clinics6). A potential surgical teaching environment within major rural hospitals also exists in Australia. Given the breadth of surgery that occurs within many of these institutions, it could be said that the provincial hospital, rather than the city tertiary hospital, might be the ideal environment to educate the undergraduate in basic surgical principles. The regional hospital is also in many cases well placed to deliver an environment in which the unique health problems specific to the indigenous population7 can be appreciated by the medical undergraduate. In addition to preparing the student for final surgical examinations, the rural surgical terms may also have the added benefit of encouraging more graduates to take up the challenge of rural surgical practice.

One of the major influences on a medical graduate to choose to practice in a rural area is whether the graduate had exposure to rural medicine at the undergraduate level.8 Many studies,9,10 predominantly in the field of community medicine, have also demonstrated a clear relationship between good rural exposure at the early postgraduate level and eventual rural practice location. Some countries are establishing
**PARTICIPANTS AND METHODS**

The study was conducted at the University of Adelaide, Adelaide, South Australia. The undergraduate medical course is of 6 years’ duration and, traditionally, the final-year surgical component has consisted of an 8-week clerkship on a general surgical ward based in a tertiary teaching hospital within the metropolitan area. For student assessment, a ward report was given and at the end of the year a written paper was completed and an observed structured clinical examination was performed. The subjective ward assessment comprised 3 clinical categories, and 1 of 3 grades could be awarded (A, B, or C). The clinical categories were the ability to obtain a medical history and perform a physical examination, the ability to synthesize and use clinical information, and interpersonal and communication skills.

For several years, the Department of Surgery at the University of Adelaide has provided 24-hour resident specialist surgical cover to Port Augusta, a major regional town in rural South Australia. Faculty staff rotate for 1 week at a time to Port Augusta, and for many academic surgeons this is their only experience in rural surgery. Realizing the teaching potential that such a term could offer to students, significant changes were implemented to the final-year surgical term so that rural terms were available for interested students. The 8-week general surgical term was to be decreased to 4 weeks, and the remaining 4-week block was to become a surgical elective block, with several of the choices being rural surgical terms in 1 of 5 provincial centers. Students not interested in rural terms could opt for orthopedics; plastics; ears, nose, and throat; vascular; day surgery; or several other subspecialty choices. The 5 regional centers that agreed to take part in the project were Mount Gambier, Port Augusta, Port Lincoln, Port Pirie, and Whyalla. These towns have approximately 15,000 to 25,000 inhabitants, although in each case, the town caters for a larger population in surrounding districts. The distance from Adelaide is from 250 km (Port Pirie) to 600 km (Port Lincoln).

Assessment procedures were largely unaltered, other than the fact that there was no mandatory long case observation requirement for the surgical elective term. Students who participated in the rural terms were asked to complete a log documenting their rural and metropolitan surgical experiences.

Outcome was measured in the form of examination results between the rural and nonrural surgical elective-term groups. The Clinical Education Development Unit at the University of Adelaide also undertook an independent evaluation of the rural terms in the form of an entirely voluntary student survey following the completion of their rural terms.

While the teaching and long-term workforce potential of rural surgical terms could be significant, the educational efficacy of the terms must be assessed before large-scale curricular changes are instituted.

The aim of this study is to develop rural surgical terms for final-year medical students and to measure outcomes between the student undertaking the rural terms and the remainder of the class who completed their surgical terms in the urban setting.

### RESULTS

A total of 118 students commenced the sixth and final year of the medical undergraduate course at the University of Adelaide in 1998. Forty-three students undertook a rural surgical term in 1 of 5 South Australian provincial centers—Mount Gambier, Port Augusta, Port Lincoln, Port Pirie, and Whyalla.

Twenty-nine students from the rural surgical term group completed the survey conducted by the Clinical Education Development Unit. The questionnaire was essentially a postplacement evaluation and aimed to quantify (using a 10-point Likert scale) the clinical experience, the teaching quality, and the enjoyment factor of the terms. The opportunities for the students to complete the clinical learning objectives, as described in the sixth-year curriculum guide, were also documented. Students were asked to record their thoughts on the advantages and disadvantages of the term and to comment on whether they would consider a career in rural practice.

Twenty-two (76%) of the students rated the usefulness of the clinical experiences gained as at least 8 of 10 and commented that the surgical conditions seen were of a greater variety and a less specialized nature when compared with their experience at the tertiary teaching hospital. Close to 80% (n=23) of the group rated the surgical experience gained at 7 of 10 or more. Nineteen (66%) of the students believed that the placement helped to reinforce the course objectives, giving a rating of at least 7 of 10. Twenty-four (83%) of the students rated the level of supervision and teaching at least 7 of 10. Twenty-two (76%) of the survey group gained intravenous access; observed or performed a rectal examination and proctoscopy, endotracheal intubation, urinary catheterization, sigmoidoscopy, and gastrointestinal tract endoscopy; performed a surgical scrub; tied surgical knots; administered local anesthetics; and closed surgical wounds. For the enjoyment factor, 23 (79%) of the students rated the placement as at least 7 of 10, with 25 (86%) of the 29 feeling positive about working in a rural practice in the future.

Three categories of final examination results were scrutinized. These were the final surgical result, the clinical competency score, and the overall final examination result obtained by the students. When compared with the group of students who remained in Adelaide to complete their surgical elective terms, no statistically significant differences in the students undertaking a rural surgical term were noted in any of the 3 categories (Table 1).

A difference was seen in the subjective assessments: it was significantly (P<.01) more difficult for a student undertaking a rural term to obtain an A grade compared with students in the city.
Of those students who correctly completed their logs, there was a significant ($P < .01$, t-test) difference in the numbers of procedures seen in the rural hospitals compared with the tertiary institutions. On average, it was calculated that 5-fold more procedures were seen in the rural setting (Table 2).

### Table 1. Objective Assessment Results: Comparison Between City-Based SCAPs and Rural SCAPs

<table>
<thead>
<tr>
<th>Variable</th>
<th>City Location</th>
<th>Rural Location</th>
<th>P value ($t$ test)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Competency Score</td>
<td>64.80</td>
<td>65.28</td>
<td>.75</td>
</tr>
<tr>
<td>Surgical Result</td>
<td>64.89</td>
<td>65.16</td>
<td>.43</td>
</tr>
<tr>
<td>Overall Result</td>
<td>64.56</td>
<td>64.71</td>
<td>.45</td>
</tr>
</tbody>
</table>

*SCAP indicates Selective Community Ambulatory Placements (represents the elective options available to the students).
†Significant at $P < .05$.

### Table 2. Operative Case Experience Comparison, City vs Rural

<table>
<thead>
<tr>
<th>Variable</th>
<th>City Location</th>
<th>Rural Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of logs completed</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>No. of cases, mean</td>
<td>11.1</td>
<td>58.9</td>
</tr>
<tr>
<td>SD</td>
<td>5.2</td>
<td>23.4</td>
</tr>
</tbody>
</table>

*Significant at $P < .01$ ($t$ test).

The difficulty in providing surgical services to rural and remote areas has gained increasing prominence during the past decade. As a generation of general surgeons with a broad range of experiences approach retirement, the question of who will replace them arises. The United States, Canada, South Africa, and Australia are among the countries grappling with the rural surgical workforce dilemma.13-16

South Australia is a prime example of the surgical workforce maldistribution problem.17 The fourth largest state in Australia, South Australia occupies an area of 984 377 km$^2$ (Texas, by comparison, is 695 676 km$^2$) (Figure). At the rural surgical term project commencement in 1998, there were 7 resident general surgeons working and living outside of a 100-km radius from Adelaide. Eighty percent of the state’s population resides within the metropolitan and outer metropolitan areas of Adelaide. By including the surgeon provided by the University of Adelaide at Port Augusta, a total rural population of approximately 300 000 was cared for by 8 specialist general surgeons. Workforce estimation is a complex challenge, but one barometer of service provision is the surgeon-population ratio.18 Current opinion is that there should be a surgeon-population ratio of 1:10 000.19 The surgeon-population ratio for rural South Australia at the project’s commencement was 1:37 500.

While visiting surgeons from Adelaide and general practitioner surgeons provide the smaller country hospitals with surgical services, the bulk of the emergency work falls to the few resident surgeons within the provincial hospitals.20 Road trauma, often retrieved from the far reaches of the outback, farming accidents, and the significant health problems of the indigenous population are the challenges faced by the rural surgeon. While air retrieval services, including the Flying Doctor Service, are well developed, situations still continue to arise in which the rural surgeon is required to undertake lifesaving surgery without the backup of specialty colleagues.

The difficulty of constant on-call duties, lack of locum cover, and general workload have the potential to lead to rural surgeon burnout and further exacerbate the workforce crisis.19 Strengthened efforts are being made in Australia and overseas to address the problem of enticing surgeons to work and live in the rural setting.

One of the reasons often given by young surgeons as to why they do not want to practice in rural regions is the feeling that they are not trained sufficiently to cope with the wide range of surgical conditions that could potentially present in a country location.20 In Australia, an advanced training program with a rural surgical theme has been developed to cater for potential rural surgeons and the scheme is expected to significantly address the rural surgical workforce shortage.

Another solution canvassed by colleges of general practice is the training of rural general practitioners to perform a range of surgical procedures.22 This proposal has been met with a generally lukewarm response from surgical colleges that still fundamentally believe that the rural population deserves and has a right to surgical care from an appropriately trained surgeon.23

Overseas studies24 suggest that postgraduates who undertake rural terms during their training are more likely to practice in a rural location on completion of their specialty. While this evidence has centered mainly on community medicine programs, studies14 that suggest the same occurs for surgical trainees are emerging.
It is generally accepted that the 2 most influential determining factors in a graduate’s decision to undertake rural practice are a rural upbringing and exposure to rural medicine as an undergraduate. It is with rural surgical terms that surgical faculty can have a significant impact on students’ future career choices. If one student per year becomes sufficiently inspired by his or her rural term to follow the path of rural surgery, then this will have the flow-on effect to secure the long-term future of rural surgery in South Australia.

The impetus for the establishment of rural surgical terms was undoubtedly related to the surgical service provided by the University of Adelaide at Port Augusta. No difficulties were encountered in changing the surgical curriculum to accommodate these changes because all surgical staff connected with the faculty curriculum committee had personal experience at Port Augusta and, on occasion, Port Pirie and Whyalla. For many senior consultants, a new appreciation of the complexities of rural surgery was gained, as was respect for the quality of care provided by local medical staff.

Current opinion is that the end result of undergraduate medical education should produce an undifferentiated graduate. The rural surgical terms provide an excellent opportunity to give the student good exposure to a broad range of surgical conditions and their management. The same experience cannot be guaranteed on the general surgical units within the metropolitan hospitals. An examination of the logs demonstrated the greater number of operative opportunities and technical skills practiced in the rural setting compared with the city hospitals. For a student who wants to become a general practitioner, the value in assisting with inguinal hernias and varicose veins and performing minor procedures is far more beneficial than lurking in the background of an operating theater while a specialist procedure is being performed. The value of rural terms in the teaching and acquisition of procedural skills has long been documented.

The objective assessment of final examination results showed that there was no difference between the rural and nonrural groups. This concurs with several other studies of surgical undergraduate teaching outside of the academic tertiary hospital and should allay fears that teaching standards do not automatically decline once the student learning environment is moved from its usual location. There was no difference in examination results between the rural group, who effectively completed 8 weeks of general surgery, and the group who completed 4 weeks of general surgery and 4 weeks of a subspecialty. This confirms the results of a previous study that demonstrated that basic general principles can be taught on surgical units other than the general surgery unit. The subjective assessment of the students by their rural preceptors revealed that it was significantly more difficult to obtain the highest grade for a rural surgical term. This finding may reflect that the rural students were more closely monitored by their rural tutors, and may be a more accurate reflection of the students’ progress than those provided by their city counterparts, where student contact, at times, was fleeting. Studies have also shown that subjective assessments with less than 4 descriptors or grades are inherently flawed because of the preceptor’s reluctance to award the lowest grade.

The impact of the rural surgeons as positive role models in their teaching capacity cannot be underestimated. Twenty-four (83%) of the students who completed the evaluation study rated the level of supervision and teaching as at least 7 of 10. Several studies have examined the significant influence that positive role models have on future career choices. The perceived advantages of the rural term were less competition for teachers and patients, more practical responsibility, less formality, and feeling part of a team. Most students enjoyed the rural experience and felt positively about working in a rural practice.

Despite the many advantages of the rural terms, the student group identified several disadvantages. These include missing lectures, missing family and friends, traveling, and financial costs. Of greater significance is ensuring that the rural surgeon is not overburdened by the presence of students and that the delicate educational ecosystem that prevails in the rural hospitals is not overwhelmed by large numbers of students. University departments should attempt to provide as much support as possible for the rural surgeons, and an example of this may be by providing locum cover.

An objective assessment of the revised final-year surgical curriculum at the University of Adelaide demonstrates no significant difference between the group who undertook rural surgical terms and the group who remained in the city for their surgical elective terms. A subjective assessment of the rural terms by the students concluded that they were enjoyable and that a positive learning environment existed. This suggests that surgeons are able to participate in a more community-based medical education program for undergraduates without compromising learning standards.

While long-term follow-up of the rural surgical students is needed, the rural terms may encourage more graduates to consider rural surgery as a career. Surgical undergraduate teaching in the rural hospital is feasible and effective.

**REFERENCES**

Risk Factors for the Presence of Varices in Cirrhotic Patients Without a History of Variceal Hemorrhage

Atif Zaman, MD, MPH; Thomas Becker, MD, PhD; Jodi Lapidus, PhD; Kent Benner, MD

Background: Current medical management dictates that all cirrhotic patients without a history of variceal hemorrhage undergo endoscopic screening to detect large varices. However, referral for endoscopic screening of only patients at highest risk for varices may be most cost-effective. The aim of this case-control study was to identify clinical, laboratory, and radiologic findings that predict the presence of varices in patients with cirrhosis.

Methods: Three hundred patients without a history of variceal hemorrhage underwent upper endoscopy as part of an evaluation before liver transplantation. Cases defined as the presence of any varices and cases defined as the presence of large varices were used for examining the risks associated with finding varices on upper endoscopy. Logistic regression was performed to evaluate associations between the presence of varices and patient characteristics.

Results: Platelet count and Child-Pugh class were independent risk factors for the presence of any varices and the presence of large varices. For the presence of any varices, a platelet count of $90 \times 10^3/\mu L$ or less (odds ratio [OR], 2.3; 95% confidence interval [CI], 1.4-4.0) and advanced Child-Pugh class (OR, 3.0; 95% CI, 1.6-5.6) were independent risk factors. For large varices, a platelet count of $80 \times 10^3/\mu L$ or less (OR, 2.3; 95% CI, 1.4-3.9) and advanced Child-Pugh class (OR, 2.8; 95% CI, 1.3-3.8) were independent risk factors associated with varices.

Conclusions: Low platelet count and advanced Child-Pugh class were associated with the presence of any varices and with large varices. These factors allow identification of a subgroup of cirrhotic patients who would benefit most from referral for endoscopic screening for varices.

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