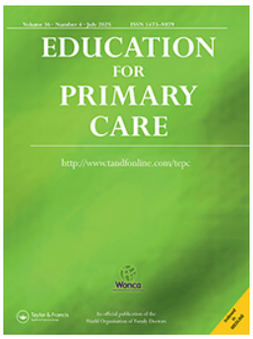

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Clinical examination performance in rural longitudinal medical programmes

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ABSTRACT

Background and aims: Rural longitudinal medical programmes immerse students in rural communities for extended periods to help foster a rural-focussed medical workforce. There is limited evidence on how medical students undertaking the same curriculum across different geographic locations perform in Objective Structured Clinical Exams (OSCEs). We aimed to investigate if there were variations in OSCE performance between students at different sites of the Flinders University Doctor of Medicine Programme.

Methods: We retrospectively reviewed data from OSCEs undertaken by all third year graduate entry students at Flinders University in 2024. Quantitative data on overall performance, discipline- and domain-level performance were compared between students based in Metropolitan South Australia, Rural South Australia and the Flinders Northern Territory (NT) Medical Programme.

Results: Data from 172 students was included, with 102 (60%) from SA metropolitan areas, 33 (20%) from the SA rural stream and 37 (20%) from the NT rural stream. Overall OSCE performance was not different between training locations. Students from rural training locations performed better in communication (mean score 84% vs 67%, $p < 0.001$) than those from metropolitan sites. Variations in performance in Medicine, Acute Care and Primary Care disciplines were seen between locations ($p < 0.001$).

Conclusion: Medical students who underwent extended periods of training in rural locations performed similarly in standardised OSCEs compared to those from metropolitan locations. Variations in domain- and discipline-level performance were seen across locations, with rural students performing better in communication skills. Further research exploring the impact of diverse training exposures on OSCE performance is required.

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OSCE; rural; communication; medical education; examination

Introduction

There is a worldwide shortage of doctors, especially outside of major metropolitan areas [1,2]. This is of particular concern in Australia, where a quarter of the population resides in rural and remote settings [3]. More limited access to medical practitioners contributes to less favourable healthcare outcomes in these regions, including higher rates of potentially avoidable death, and all-cause mortality [3].

Recognition of this health inequality has led to an increasing emphasis on training medical students within rural and regional communities, with recent Australian investment in new 'end-to-end' training programmes completely undertaken in rural Australia announced in 2024 [4]. Extended rural training results in doctors being more likely to practise in these areas after graduation [5–7].

Teaching medical students outside metropolitan areas comes with several challenges. These include less exposure to speciality services and more restricted access to tertiary teaching hospitals. Students often describe this reduced tertiary exposure as a perceived disadvantage and endorse a desire to access additional resources to meet curriculum requirements [8]. These potential shortcomings are often offset by advantages that come with proportionally smaller student numbers and higher faculty-to-student and patient-to-student ratios [8,9]. Students in rural areas consistently report more patient contact, more opportunities to perform procedures, enhanced continuity of education, and that rural supervisors are excellent role models [8,10].

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It is vital that training needs of students are adequately met regardless of training site. One of the most commonly used methods of assessing clinical competency in medical school is through Objective Structured Clinical Examinations (OSCEs), in which a student's knowledge, skills and competence are assessed against pre-specified criteria in a simulated clinical environment [11].

There is limited evidence on how medical students undertaking the same curriculum across different geographic locations perform in standardised examinations, particularly OSCEs. With the national rollout of end-to-end rural medical training and six new medical school programmes in rural Australia [4], investigating differences in student performance across diverse training settings is essential to better inform the priorities of medical education in regional settings.

We aimed to investigate if there was a significant overall difference in either OSCE performance or knowledge-based testing between students undertaking the same curriculum at different geographic locations of the Flinders University Medical Programme. We investigated if there were differences in performance among examined domains (such as history taking or communication skills), or among disciplines, including those traditionally taught in a hospital setting such as Internal Medicine.

Methods

We retrospectively reviewed data from the Doctor of Medicine (MD) OSCE undertaken by all third year graduate-entry medical students at Flinders University in 2024.

The Flinders Doctor of Medicine (MD) programme

Flinders University established its medical school in metropolitan Southern Adelaide in 1974, the first South Australian Rural Clinical School in 1997 and the Flinders Northern Territory (NT) Medical Programme in 2011. The Flinders graduate entry MD programme therefore spans a large geographic footprint, with medical students located across metropolitan South Australia (SA), the MD Rural Stream (MDRS) as well as the NT. Applicants into the Flinders MD preference a preferred location (Bedford Park metropolitan campus, MDRS or NT) and allocation of places is determined based on overall selection rank with the process described in detail online [12]. Rural sub-quotas for both SA and NT allow priority admission to those who have lived extended periods in non-metropolitan areas of Australia.

In the MDRS, students spend their entire third year based at one of four regional sites (Greater Green Triangle, Barossa, Hills Mallee Fleurieu or the Riverland). They are primarily attached to General Practices, however, also have a range of learning exposures including in rural hospital Emergency Departments, small group teaching with clinical educators, and online sessions together with metropolitan colleagues. During this time, there is a focus on parallel consulting, where students see patients independently before they are seen together with a general practitioner.

Similarly, our NT medical programme is primarily taught across a combination of community-based rural settings over the entire year, however most students also spend 20 weeks of their third year on placement at the Royal Darwin Hospital. This is the largest public hospital serving the NT, the most sparsely populated region of Australia with a population of only 262,200 (less than half that of Tasmania) in an area of 1.4 million square kilometres [13].

Finally, students in metropolitan SA spend the majority of their year on 6-week clinical placements at Flinders Medical Centre, a 600-bed public tertiary hospital providing a clinical service to a metropolitan population of over 350,000 people south of the Adelaide Central Business District. These placements are across all major disciplines (Internal Medicine, Surgery, Women's Health, Child Health, Mental Health, Primary Care, Acute/Emergency Care) where with the exception of their Primary Care rotation, students are primarily embedded as part of inpatient treating teams.

Despite being in different locations, all sites across SA and NT teach the same medical curriculum, and students undertake the same OSCE at the end of the third year of their medical degree (MD3). This OSCE is the major clinical examination of the medical degree and must be passed for students to progress into the fourth and final year of the programme. A map of Australia illustrating student numbers in each location and summarising the main clinical exposures at each site is shown in Figure 1.

Structure of the Flinders OSCE

In 2024, the Flinders MD OSCE comprised a total of eight stations in the following disciplines: Medicine, Surgery, Women's Health, Child Health, Mental Health, Primary Care, Acute Care and Generic Skills. In each station, students had two minutes of reading time followed by ten minutes of examination time with an examiner and standardised patient. Students were assessed on three of five domains: history taking, physical examination, problem formulation, management

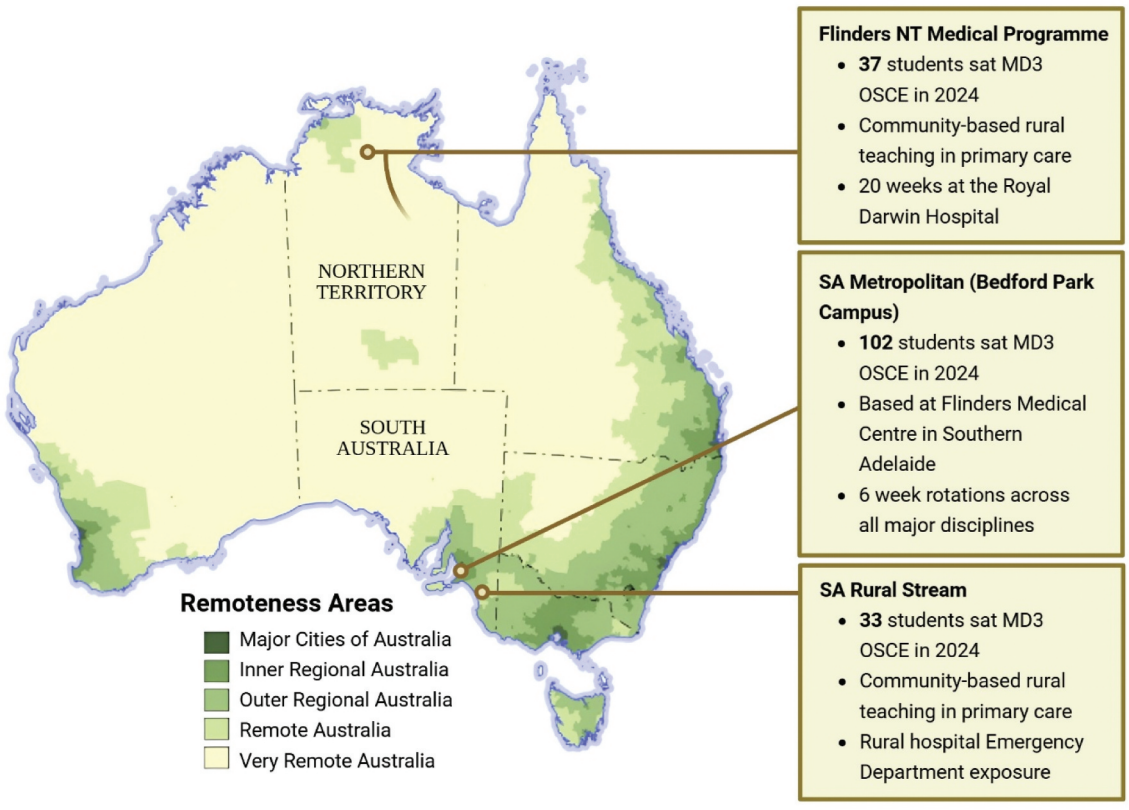

Figure 1. Location of Flinders MD3 students who undertook the OSCE in 2024. Adapted from Australian Bureau of Statistics (2023) 'Map of Australian Statistical Geography Standard Edition 3 Remoteness Areas for Australia', accessed 14 July 2025.

and communication. Each domain was assessed against pre-specified, standardised criteria as satisfactory, exceeds expectations or unsatisfactory by trained clinical assessors.

Written knowledge-based assessment in the Flinders MD

Flinders MD3 students undergo four multiple-choice-question style Progress Tests (PTs) at fixed intervals throughout the year to assess the development of functional knowledge. Progress testing is a longitudinal method of assessment that minimises test-driven learning strategies and combines results of repeated tests to increase reliability in evaluating student performance [14]. Students undergo four PTs over the course of MD3, each consisting of 120 questions distributed across a range of disciplines using a blueprint for consistent distribution, with questions generated by clinical and academic teaching staff based on material covered throughout the year. This method of programmatic assessment has been shown to optimise learning and help develop clinical reasoning, with growing literature, including from our institution, describing its effective use for health professions education [15–17].

Data analysis

Students were divided into three cohorts based on geographic location: Metropolitan SA, Regional SA (MDRS) and NT. The total OSCE score (out of 24) for each student was recorded. The frequency of students scoring between 0 and 3 satisfactory domains and the proportion of students obtaining 3/3 domains were recorded for each discipline. The performance in each domain across all disciplines as represented by a percentage of the total possible marks obtained for each student was recorded. We compared performance between both rural and metropolitan cohorts and between Metropolitan SA, MDRS and NT cohorts. A Shapiro–Wilk test was performed to assess for normality of both the OSCE and PT datasets. Mean PT scores were compared using a two-sample t-test and one-way Analysis of Variance (ANOVA) among both rural and metropolitan cohorts, and between all three groups, respectively.

Data that was not normally distributed (total OSCE score and OSCE domain performance in each discipline) was compared between the three groups using Kruskal–Wallis tests and between metropolitan and rural (combined MDRS and NT) groups using a Mann-Whitney U test with a P-value of <0.05 deemed significant. We examined for differences between OSCE domain performance in each of the three groups, and between metropolitan and rural (combined MDRS and NT) cohorts using Fisher Exact and Chi-square tests to test the null hypothesis of no association between training location and whether or not a student scored 3/3 domains in each discipline. A Bonferroni correction was performed to account for multiple comparisons when assessing levels of association between location and discipline performance. IBM SPSS Statistics for Windows v20 (International Business Machines Corp, Armonk, NY) was used for all data analysis.

In addition to total OSCE score, we assessed the frequency of students in each cohort scoring 3/3 domains in each discipline as this would provide additional information around overall OSCE performance. The primary aim of the Flinders OSCE is to assess safety and competency prior to entering the medical workforce and the marking rubric is therefore weighed heavily towards ensuring minimum standards are met rather than discriminating high performers.

Results

The total number of students who undertook the Flinders MD OSCE in 2024 was 174. Two students underwent a modified OSCE due to disability and were not included in analysis. Of the remaining 172 students, 102 (60%) were SA metropolitan, 33 (20%) were MDRS and 37 (20%) were from the NT.

Overall OSCE performance

Across all students the median score was 20.3 (standard deviation 3.0). The maximum number of satisfactory domains a student could score for each station was three. The proportion of students scoring between 0 and 3 satisfactory domains in each of the different stations is presented below for each discipline (Figure 2). Students scored highest overall in Mental Health, with 139 (81%) achieving 3/3 domains for this station, and scored poorest in Acute Care, with 94 (55%) achieving 3/3 domains for this station.

OSCE performance in different cohorts

Overall OSCE performance was not different between metropolitan and rural (SA regional and NT) cohorts (median total domain score 21/24 in both cohorts, $p = 0.39$). In each of the three cohorts, OSCE performance as represented as a percentage of the total possible number of satisfactory domains obtained for that discipline is shown in Figure 3.

On examining the proportion of students scoring 3/3 domains for each discipline, students from rural SA performed significantly better in Primary Care compared to those from the other two cohorts, with 31/33 (94%) scoring 3/3 domains compared with 56/102 (55%) in metropolitan SA and 15/37 (41%) in NT ($p < 0.001$). Rural SA students performed less well in Medicine compared with those from the other two

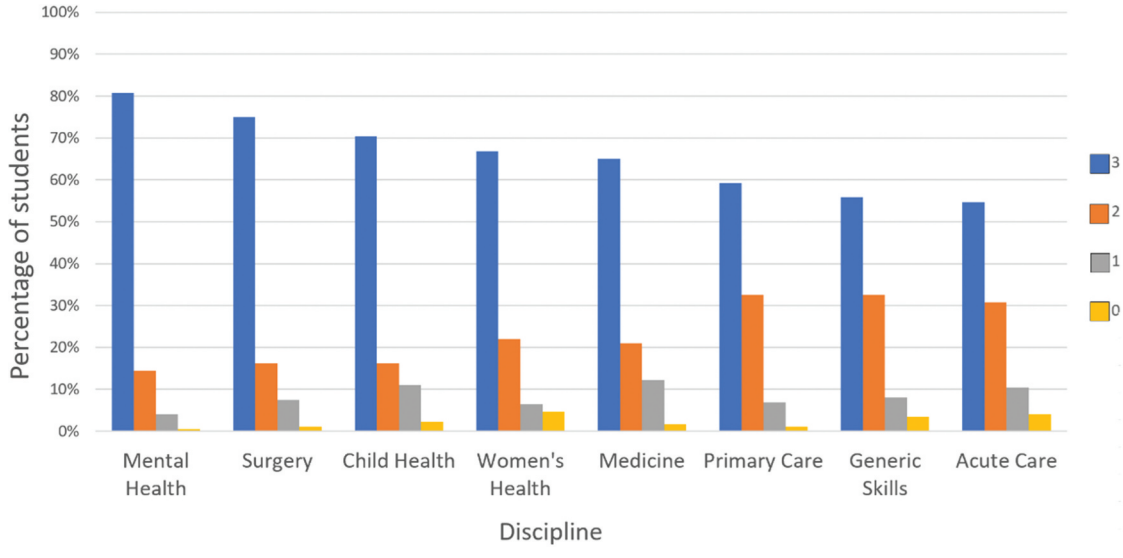

Figure 2. Percentage of students scoring between 0–3 satisfactory domains in each discipline station.

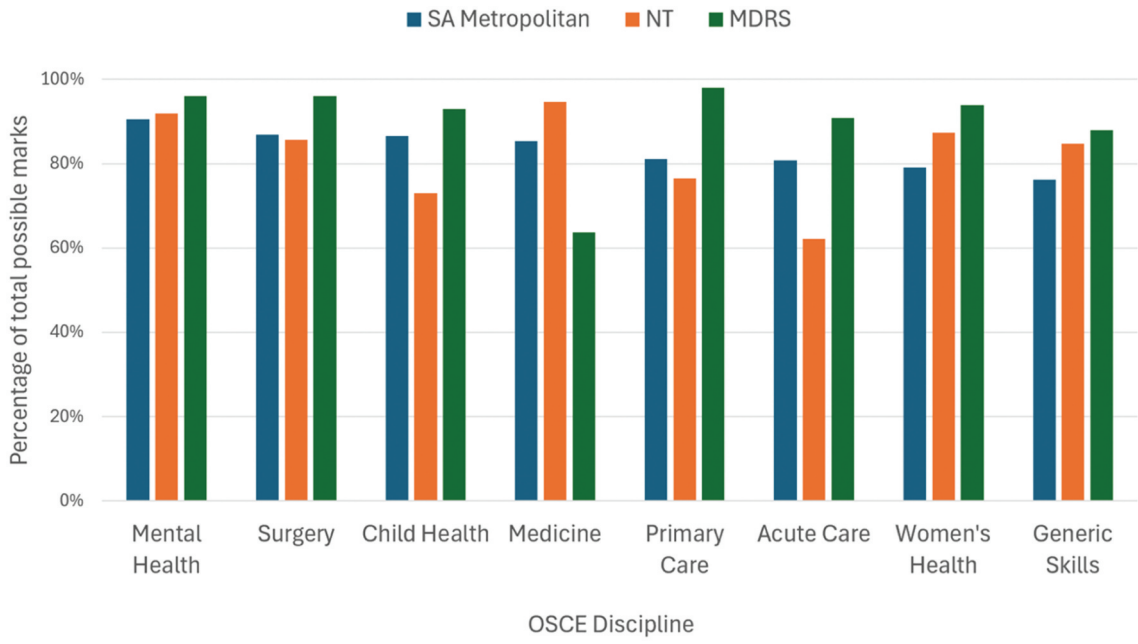

Figure 3. Performance in OSCE by discipline among different student cohorts.

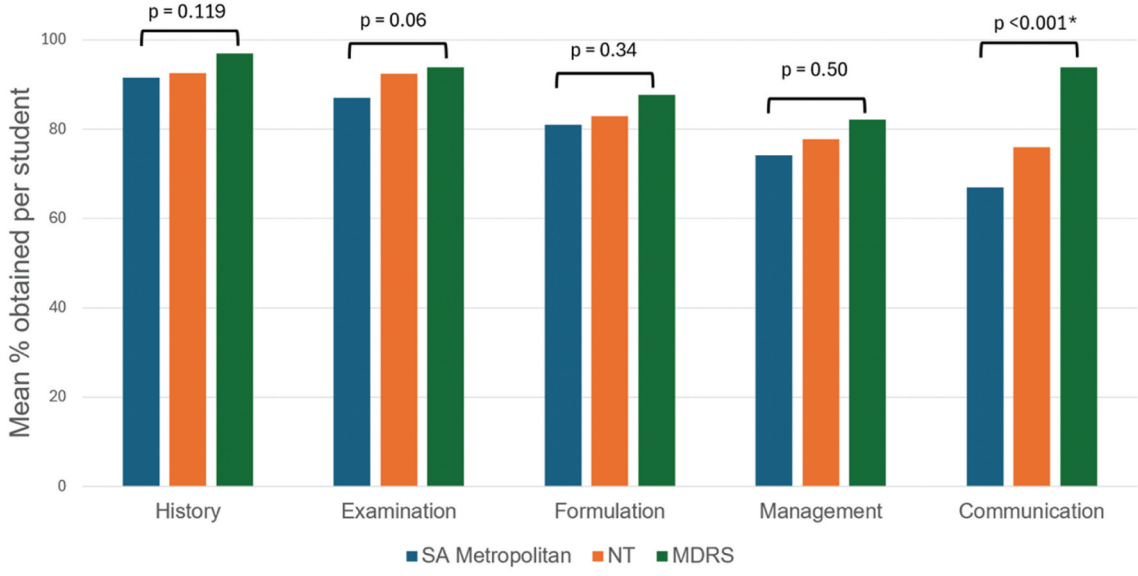

Figure 4. OSCE performance by domain among different student cohorts.

cohorts, with 10/33 (30%) scoring 3/3 domains in this discipline, compared to 69/102 (68%) in metropolitan SA and 33/37 (89%) in the NT ($p < 0.001$). NT students performed less well in Acute Care with 6/37 (16%) scoring 3/3 domains, compared with 62/102 (61%) in metropolitan SA and 26/33 (79%) in Rural SA ($p < 0.001$).

Performance in different domains for each cohort is shown in Figure 4. Students overall performed better in history and examination domains, compared to formulation, management or communication. Metropolitan students performed less well in communication compared to those from a rural location (mean score 67% vs 84%, $p < 0.001$).

Progress Test performance

Longitudinal results on written Progress Tests (PT) for each student over their MD3 year were recorded. Ten questions were removed following quality assurance procedures, and the maximum possible score was 470. Thirty (17%) students had missed one or more PTs and were not included in analysis. Of the remaining 144 students, the mean score was 291/470 with a standard deviation of 43.1. There was no significant association between PT score and total OSCE score. There was also no significant difference in cumulative PT scores between students at metropolitan and rural training locations (mean PT score 290/470 vs. 291/470, $p = 0.82$) or between all three groups ($F = 1.81$, $p = 0.17$).

Discussion

We have demonstrated that overall performance in both OSCEs and knowledge-based testing was no different among students who underwent an extended period of training in a rural area compared to metropolitan-based students. There was variation in performance among disciplines and domains, even among different rural cohorts. This suggests that different training exposures may still have an impact on student performance in clinical examinations.

The OSCE in medical education was proposed in the 1970s as a more reliable way of assessing clinical competence in medical education compared to traditional examinations [11]. Academic and administrative structures to support OSCE delivery have since been developed to ensure a high level of validity, and medical school OSCEs are commonly used worldwide, including by the majority of medical schools in Australia [18]. In addition to helping identify areas of improvement for students, OSCE performance may help predict clinical competence after graduation [19,20].

While previous studies have not demonstrated a relationship between site of learning and OSCE performance, these studies did not delve into discipline or domain-level differences in decentralised cohorts [21,22]. Similarly in our study, we did not identify group-level differences in overall performance on either the PT or OSCE between students at metropolitan and rural training sites. This is a crucial finding that strongly supports the assertion that medical students who undergo extended periods of training in rural locations across the Northern Territory and Rural South Australia perform no worse in standardised clinical examinations when compared to those in metropolitan Adelaide, despite inevitable differences across diverse clinical exposures. Our study reduced the effect of potential bias that has previously been proposed from rural examiners being more familiar with individual students, with MDRS students travelling to a metropolitan location for their OSCE [21].

In terms of overall score, students among all sites scored highly. This is due to the primary aim of the Flinders MD3 OSCE being to assess safety and competence before entering the final year of their medical training rather than to necessarily identify the highest performing candidates. On examining individual domains and disciplines, we did identify variations in student performance between groups, which may highlight relative strengths and weaknesses in site-specific medical student teaching, particularly in regional areas. From a domain perspective, students in rural cohorts performed better in communication skills compared with metropolitan students. This may reflect better patient access, which is often considered a key advantage of the rural medical student experience [23]. In the Flinders MDRS and NT programmes, students participate heavily in parallel consulting throughout the year, where they independently see patients prior to their appointment with a general practitioner. This emphasis on one-on-one interactions with real patients likely contributed to the better communication skills seen in these cohorts.

Rural medical students are usually part of smaller healthcare teams, where they can receive greater individual support and supervision from clinicians, and are often encouraged to take a more integral role in patient care. Inclusivity and participation in care are heightened in smaller teams and are core aspects of clinical rotations highly valued by students [24]. In contrast, metropolitan-based teaching teams, particularly those in tertiary hospitals, are much larger, with rotating consultant staff, multiple junior doctors at various seniority levels and greater student numbers. Students typically report an inverse relationship between value in their clinical attachment and team size [25,26].

Of the five assessed domains, students in all regions performed better in history taking and physical examination than in problem formulation, management and communication skills. History and physical examination are core skills in medicine, and students receive considerable teaching and practice of these domains. In contrast, problem formulation is a more complex skill involving clinical reasoning that requires the integration of knowledge in order to build a differential diagnosis or management plan. This is an experiential skill that is

harder to teach and learn [27,28]. Although our marking rubric was pitched at the level expected for their level of training, students also found it harder to score well in the management domain. Management is often less emphasised in teaching curricula, particularly given its propensity to change with medical advances.

At a discipline level, we found students in rural South Australia did not perform as well as a group in Internal Medicine. It is unclear to what degree this is a result of less tertiary hospital exposure, with common medical conditions still being frequently encountered in primary and secondary care [29]. Interestingly, our NT cohort performed strongly in this discipline, however notably the NT regional programme also includes considerable time (20 weeks throughout the year for most students) on placement at the tertiary Royal Darwin Hospital. It is possible that in our SA rural stream, which leans more heavily on general practice-based teaching environments over larger hospital-based settings, students were less practised in cases which are managed under inpatient medical bedcards. This difference was not observed in other disciplines such as Surgery, Women's Health, or Child Health.

Examining discipline performance in all students, students obtained the lowest rate of perfect scores in Acute Care. One possible explanation for this is the benchmark in these cases (which typically involve resuscitation scenarios), was proportionally higher given even small oversights can have potentially life-threatening effects.

We have demonstrated that although the same Flinders University medical curriculum is implemented across all sites across a large geographic footprint, differences in performance on various domains and disciplines do exist. Nonetheless, our cross-sectional data support the findings of previous studies demonstrating that overall performance in clinical examinations of regional cohorts is not inferior compared to metropolitan students [21]. Indeed, students in regional cohorts may perform better in the majority of disciplines and domains overall. This evidence has reassuring implications for the future of regional medical training, where prospective students may otherwise feel disadvantaged by not being in a metropolitan training location. Extended rural training is strongly associated with building workforce capacity in these underserviced areas, with these students more likely to remain in rural practice following graduation [5].

Although our study focussed on the relationship between location of training and OSCE performance there is a clear need for further granularity beyond regional and metropolitan training settings. Comparing rural students in SA and NT revealed differences in discipline-level performance, supporting the view that various other factors (such as time spent in secondary hospital settings) may affect OSCE performance unrelated to whether training occurs in a metropolitan or rural area. Future research is required to look at how specific training exposures relate to clinical performance in specific areas. It is highly likely that core clinical skills such as communication or problem formulation transcend traditional medical disciplines. This perception is reflected in recent changes to internship training requirements in Australia where junior doctors no longer have to complete mandatory terms in Medicine, Surgery and Emergency Care but rather have terms where they must have exposure to Undifferentiated illness, Chronic illness, Critical illness and Peri-procedural Care.

There is a need for ongoing research to explore potential differences related to the type of longitudinal rural programme that students are immersed in, and to what extent this is influenced by different training exposures. New rural medical programmes, such as the Flinders South Australia Rural Medical Programme (SARM), involve students undertaking their entire postgraduate medical training in rural settings. This differs from the Flinders MDRS programme, where students undertook their first two years in metropolitan Adelaide before their 12-month immersion in a rural setting. Despite changes in the structure and delivery of the Flinders rural stream, a standardised OSCE across all locations remains part of the medical programme, and repeating this study in 2027 with inclusion of the first MD3 SARM cohort will be extremely informative.

We have examined a single student cohort of the Flinders MD programme and did not obtain information regarding the nature or demographics of medical students enrolled in our metropolitan compared to rural streams. Therefore, a limitation of our study is that we were unable to control for individual student factors (such as age, gender or type of undergraduate degree) when comparing rural and metropolitan cohorts. However, our principle finding – that overall performance of rural students is not different to those based in metropolitan areas – remains critically important to inform both community and policy makers that the quality of graduates from these programmes remains consistent regardless of location of training. Although we identified differences in discipline and domain level performance between rural and metropolitan students, we recognise that each discipline was only examined in a single station and is therefore not a complete representation of knowledge or performance of each area.

Another limitation is the relatively small size of the rural cohorts – while this is large compared to rural medical programmes in other countries, it does limit the generalisability of our findings, particularly as we have only included a single year's student cohort. Multiple comparisons were performed to interrogate any discipline and domain level differences, and while we corrected for this in the analysis, further exploration of these significant findings in subsequent rural cohorts is required. Finally, although all examiners are practising clinicians, and we conduct examiner training to ensure a standardised marking rubric is followed, examiners for morning and afternoon sessions over the two days of the Flinders OSCE often differed, introducing a degree of variability. This is particularly relevant as the NT cohort was examined over a single day in contrast to SA students, who due to the larger cohort size, were allocated to one of two separate examination days.

Nonetheless, a significant strength of our study is that an identical medical curriculum was implemented across all sites, and students underwent an OSCE with identical stations against a standardised assessment rubric at all locations. Given increasing emphasis on training medical students in rural environments, it is crucial that we continue to explore differences in student assessment outcomes and if these relate to variations in teaching and learning. Although our medical programme spans a large geographic footprint, we have a centralised Medical Programme Board, Assessment Team, Curriculum Advisory Group and funding model which strives to deliver an equitable educational experience regardless of student location. It is important to recognise that the success of regional medical training programmes must consider adequate resourcing of both staff and infrastructure (such as clinical attachments).

While our findings support the assertion that extended rural training produces graduates who overall are no different in OSCE performance to metropolitan students, we must continue to recognise the importance of broad training exposures including both primary care and tertiary hospital experience. Furthermore, we must consider how the benefits seen in rural cohorts that arise from greater supervisor-student and student–patient interactions can translate to metropolitan settings, where higher student numbers have a detrimental effect on patient access and training exposure.

Conclusion

Overall performance on written tests and standardised OSCE examinations did not differ between rural and metropolitan training locations but variations in domain and discipline-level performance were identified. Further research into how this variation relates to different training exposures is required.

Author contributions

CRediT: **Anthony Khoo:** Conceptualization, Formal analysis, Writing – original draft; **Peter Michelmore:** Writing – review & editing; **Sheela Joseph:** Writing – review & editing; **Michelle Szep:** Investigation; **Michal Wozniak:** Writing – review & editing; **Jonathan Gleadle:** Conceptualization, Writing – review & editing.

Disclosure statement

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Data availability statement

Data are available from the corresponding author upon reasonable request.

Ethical approval

This study was approved by the Flinders University Human Research Ethics Committee (Registration number HEL8244–2). As a low-risk study of a pre-existing dataset, the need for individual informed consent was waived.

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