Check for updates

Australian Journal of Rural Health

WILEY

AJRH National Rural Health Alliance

ORIGINAL RESEARCH OPEN ACCESS

A Cost Comparison From a Health Service Perspective of Three Allied Health Models of Care for Remote Australia: Student-Assisted Services, Fly-In Fly-Out Services and Services Provided by a Resident Clinician

Narelle Campbell[1] | Jackie Roseleur[2] | Jon Karnon[2] | Chris Hince[1] | Alice Cairns[3] | Kylie Stothers[4] | Chris Rissel[1]

[1]College of Medicine and Public Health, Flinders Health and Medical Research Institute, Flinders University, Darwin, Northern Territory, Australia | [2]College of Medicine and Public Health, Flinders Health and Medical Research Institute, Flinders University, Adelaide, South Australia, Australia | [3]James Cook University, Townsville, Queensland, Australia | [4]Indigenous Allied Health Australia, Northern Territory, Australia

Correspondence: Chris Rissel (chris.rissel@flinders.edu.au)

Received: 25 October 2023 | **Revised:** 27 August 2024 | **Accepted:** 4 February 2025

Funding: This study was funded by the Australian Government, Department of Health, through the Rural Health Multidisciplinary Training (RHMT) Program, Cooperative Research Centre for Developing Northern Australia (CRCNA).

Keywords: allied health | fly-in fly out (FIFO) | remote health | rural health | workforce training

ABSTRACT

Objectives: The objective of this paper is to compare the costs of an allied health student-assisted model of care with Fly-In-Fly-Out (FIFO) and resident clinician models of care from a health system perspective.

Methods: A descriptive cost analysis was conducted to understand the costs of an allied health student-assisted model of care. Scenarios were developed for the two remaining service models to determine their costs from a health service perspective.

Design: An observed and modelled costing study.

Setting: Northern Territory, Australia.

Participants: Allied health professionals and students.

Main Outcome Measure(s): The cost of providing a student-assisted model of care from a health service perspective.

Results: The students provided an average of 5 h of service time per client to 50 clients at a cost of $2363 per client. Three resident clinician and FIFO scenarios were modelled. The first scenario was based on time with clients across all three student cohorts. The second scenario applied the time spent with clients by the third cohort, reflecting the increase in time spent with clients as the program matured. In the third scenario, we increased the time in scenario 2 by 25% to account for the potential under-recording of client time. The resident clinician results for the three scenarios were $915, $987, and $1178, respectively. The FIFO results for the three scenarios were $1502, $1575, and $1922, respectively.

Conclusions: The student-assisted model was more expensive per client seen than the FIFO and resident clinician models, but significant intangible benefits were identified that positively impact both clients and students. These include training health professionals for remote communities in a culturally responsive model, greater cultural understanding, and increased care coordination provided by the students.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2025 The Author(s). *Australian Journal of Rural Health* published by John Wiley & Sons Australia, Ltd on behalf of National Rural Health Alliance Ltd.

Summary

- What is already known on this subject?
  - A shortage of health professionals in remote and rural areas means different service models are needed, including Fly-In Fly-Out services.
  - The Australian Government funds the Rural Health Multidisciplinary Training program to support students' clinical placements in remote and rural settings as a workforce development strategy.
  - A student-assisted service model can be feasibly implemented and is acceptable to remote communities.
  - A student-assisted model provides intangible benefits, including two-way cultural learning and a workforce pipeline for allied health recruitment.
- What this paper adds
  - Almost nothing is known about the costs of remote allied health models of care. Costs of three allied health models of care have been calculated, indicating that the student-assisted model costs more per client seen than the Fly-In Fly-Out model, but a resident clinician model is the least expensive. However, the intangible cultural learning and employment spillover effects of the student-assisted model may justify its higher cost per client seen.

1 | Introduction

Disability and rehabilitation services to address the consequences of chronic diseases are scarce in remote Australia due to community remoteness and the limited number and fluctuating availability of allied health professionals [1, 2]. Remote and rural communities have fewer health professionals, particularly allied health services like physiotherapy, speech pathology, and dentistry [3]. Relative to the populations in these areas, major cities had a greater number of working full-time equivalent (FTE) clinicians (2077 clinical FTE per 100 000 people in 2020) than each of the other remoteness areas (inner regional had 1890, outer regional areas had 1761, remote areas had 1959 and very remote areas had 1833 FTE per 100 000 people) [3]. Without available and adequate allied health services, large costs associated with avoidable hospital admissions and prolonged hospital lengths of stay are likely, and the premature death of remote residents is a known risk [4].

The National Strategic Framework for Rural and Remote Health recognises that 'health care planning, programs and service delivery models must be adapted to meet the widely differing health needs of remote and rural communities' [5]. Over the last two decades, many initiatives have attempted to increase and enhance the health workforce in rural and remote areas. These have included new teaching of health professionals about rural and remote health issues, including programs like the Northern Territory Medical Program which are designed to prepare doctors for work in rural and remote areas [6]. Training health professionals for rural and remote health settings is another initiative, with many professions such as medicine, nursing and allied health establishing Rural Generalist pathway programs [7, 8]. Various workforce incentive programs have also been implemented to help recruit and train health professionals. These have included bonded medical programs that have a return of service obligation to the jurisdiction, and financial incentives to take positions in remote areas [9].

Work integrated learning (WIL)/student placements are a major rural workforce development approach by the Australian Government [5].WIL placements have been implemented internationally since the early 1900s and are designed to incorporate various learning and teaching activities that integrate learning with its application in the workplace [10]. They have been successful in many settings, including rural and remote health [11]. While there is no current standardised definition of quality in the context of rural health placements [12], there is widespread agreement in the rural health context of positive impacts on interprofessional learning, and a relationship between rural placements, rural practice intention, and rural practice [13]. Good supervision and being involved in the community can contribute to a positive placement experience and increased rural practice intention [13].

The work integrated learning discussed in this paper is described below. It has the standard elements of interprofessional practice, supervision, and community engagement, but has an additional emphasis on Indigenous cultural safety and co-design of health activities.

1.1 | Models of Care

Three models of service delivery are the focus of this research. Two are common existing models: (1) The Fly-In Fly-Out (FIFO) model, and (2) full-time resident allied health professional; and one is relatively new: (3) a student-assisted model. The 'student-assisted model' is similar to the service-learning model, which has been used for some time [14]. The main difference is that the student-assisted model requires a greater level of responsibility from the student within the community context and culturally safe co-design of activities with Indigenous clients.

The FIFO model has a long history of being used by government health services and, more recently, private remote health service businesses to deliver health services in remote communities. Ideally, such a model involves a health professional who regularly visits (fly-in or drivein) the same communities over an extended time period. FIFO models have been described as 'second best' to a full-time resident health professional embedded in a remote community [15]. Drawbacks of the FIFO model include its potential to be an expensive way to provide services, that it requires regular and consistent contact to be sensitive to community needs, and that it is vulnerable to travel restrictions (e.g., COVID-19) [16]. The FIFO model does little for the economic and social development of communities as there is no further investment from the FIFO workforce in community groups, schools, and local business [16]. Finally, in a world where we recognise that health care provision can also contribute to climate change, the flying/driving requirements of the FIFO model may have a negative environmental impact. The FIFO model of care in our research was assumed to consist of a physiotherapist and speech pathologist visiting the community every 6 weeks.

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

'Resident clinicians' are allied health professionals working as part of a comprehensive primary or acute care multidisciplinary team, or as a private practitioner. This is usually the standard of care available in urban areas [17]. Although overall health expenditure in rural and remote areas is lower than in urban Australia [18], from an equity perspective, the standard of care available in urban areas should also be available to residents in rural and remote areas [2, 19]. The benefits of such a model include the trust developed when a clinician is locally available, provides continuity of care, and can be sensitive to community needs [20]. However, the ongoing shortage of allied health professionals [2] makes a resident allied health clinician model of care more difficult in remote communities. For the resident clinician model, it was assumed that a physiotherapist and speech pathologist would be permanently located in the community.

Student-assisted models of care (or student-learning models) have long been a critical aspect of health professional training whereby an individual student on clinical placement undertakes service provision while directly supervised by an appropriately qualified professional [21, 22]. The student-assisted model in our context requires the student to take on more responsibility in interactions with the client than in a student-learning situation. Most commonly, the supervisors are employed by a health service, and the student supervision and education are additional responsibilities for the health professional [23]. Potentially, a student-assisted service model in remote areas can become a pipeline into remote employment and thus may positively impact recruitment and retention while at the same time meeting student learning objectives and civic contributions [6].

A student-assisted service model, co-designed with community leaders, was successfully piloted for 8 weeks in 2019 in a very remote location (Nhulunbuy, Northern Territory (NT)), supported by the Northern Australian Research Network and two universities [21, 22]. The model was co-designed with the community using a pragmatic iterative process, based on participatory action research approaches. Co-design involved extensive dialogue and discussion with local cultural consultants, service users and their families, staff of community organisations, students, supervisors, placement coordinators, and a site administrator. The model was found to be sensitive to local need; it demonstrated cultural responsiveness and was accepted by the community [21, 22].

The 2019 pilot was expanded, and in 2022, a continuous 12-month service was delivered, supported through grant funding and universities through the Rural Health Multidisciplinary Training (RHMT) program, which supported travel and accommodation costs, enabling four students (two physiotherapists and two speech pathologists) at a time to work within the community. Three rounds of four students delivered services for 8 weeks each round in 2022. The students were supervised by an interprofessional team, including allied health professionals and Yolŋu cultural consultants. The Yolŋu supervisors were recognised as leaders in providing cultural education and supported the students in reciprocal community engagement, whereby the students learned about culture, language, and service provision by using a culturally responsive model of care [21, 22, 24].

A better understanding of the costs and benefits of different allied health service models is needed for state or federal governments and their agencies, including the National Disability Insurance Agency and community-controlled health services, to adequately allocate funds for ongoing services. Therefore, understanding the costs of delivering allied health services in a range of models is important. However, the literature on service model costs in low-resource settings such as remote Australia is scant [25, 26].

The aim of this study is to describe the costs, services provided, and other activities associated with a student-assisted service model and to model the costs of providing the same level of services via a FIFO service model and a resident clinician service model.

2 | Methods

The research design used was a descriptive analysis of a specific service model of care compared with two existing service models. Ethical approval for this research was obtained from the Human Research Ethics Committee of the Northern Territory Department of Health and Menzies School of Health Research (Reference Number: 2021-4103). Students maintained records of their daily activities and the services provided to the clients in MS Excel, which were reviewed by their on-site supervisor.

2.1 | Data Analysis

Descriptive analyses of the clients and student activities datasets were undertaken to describe the demographic and health characteristics, and frequencies of services received by clients and the time spent by students on different activities. The analysis of the student activity dataset quantifies the time spent on activities, including planning, service provision, including individual and group sessions, cultural education, travel, and time spent on other activities such as student assessments and self-directed learning.

To compare the services received by clients before the student-assisted service against services received during the intervention period, a clinician-researcher retrieved records of clients who consented for their health records to be reviewed ($n = 31$). Data collected included the number of allied health/primary care contacts (excluding phone calls) with local health service providers.

2.2 | Costs

To enable comparisons across the three models of care, we present the estimated cost of each model, adjusted to reflect the same level of care provided in the student-assisted model. Costs are estimated from a health system perspective, for example, excluding costs that would be borne by universities.

2.2.1 | Student-Assisted Service Model

The costs incurred for the student-assisted service model are shown in Table 1. Travel ($14400) and accommodation ($40000) for students are covered by the RHMT, funded by the

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 | Model inputs.

Model of care costs	Value	Source
Student-assisted service model costs		
Student supervisor salaries ($117 000/FTE × 0.5 FTE physiotherapist & 0.23 FTE speech pathologist)	$85 309	Intervention costs
Car travel (2 vehicles 65 km/per day for 120 days at 72c/km)[a]	$11 232	Australian Taxation Office [27]
Cultural governance and education	$20 000	Intervention costs
Additional costs (e.g., catering for sessions)	$1 600	Intervention costs
FIFO model		
Allied health professional salaries ($117 000/FTE)		Same salary rate as intervention
Scenario 1	$34 511	
Scenario 2	$38 131	
Scenario 3	$47 664	
Commercial flights: Darwin to Gove ($900/flight × 2 clinicians × 8 trips—all scenarios)	$14 400	Internet search
Accommodation ($315/night × 2 clinicians × 8 trips)		Internet search
Scenario 1 (3 nights per trip)	$15 120	
Scenario 2 (3 nights per trip)	$15 120	
Scenario 3 (4 nights per trip)	$20 160	
Car Hire ($145/day × 8 trips × 3 days/trip)		Internet search
Scenario 1 (4 days per trip)	$4 640	
Scenario 2 (4 days per trip)	$4 640	
Scenario 3 (5 days per trip)	$5 800	
Travel allowances ($101/day × 2 clinicians × 8 trips)		Northern Territory Government [16]
Scenario 1 (4 days per trip)	$6 451	
Scenario 2 (4 days per trip)	$6 451	
Scenario 3 (5 days per trip)	$8 064	
Resident clinician model		
Allied health professional salaries ($117 000/FTE)		Same salary rate as intervention
Scenario 1—all cohorts	$34 511	
Scenario 2—cohort 3	$38 131	
Scenario 3—cohort 3 plus 25%	$47 664	
Car travel (2 vehicles 65 km/per day for 120 days at 72c/km)[a]	$11 232	Australian Taxation Office [13]

[a]24 weeks of placement, 5 days per week.

Commonwealth of Australia. This program aims to improve the recruitment and retention of medical, nursing, dental, and allied health professionals in rural and remote Australia [28]. Therefore, these costs would not be borne by a local health service provider and have not been included in the economic evaluation.

Salary costs for the student supervisor include 25% on-costs for overhead costs such as superannuation, leave loading, long service leave levy, payroll taxes, and workers compensation. Payments to supervisors for placement were not factored in as this is uncommon in our remote region.

2.2.2 | Resident Clinician Model

As a comparator to the student-assisted model of care, we estimated costs associated with a resident clinician model. We based the cost estimate for the resident clinician model on the hours recorded by the students in the student-assisted service model, which included time spent providing health care to clients, service planning, care coordination, travel time, and other activities such as writing handovers. In addition, the car hire costs incurred by the student-assisted service model were included.

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

To account for the novelty of the student-assisted service model and the time required for its setup, we developed three scenarios. In the first scenario, we used the recorded time data from all students across the three cohorts. In the second scenario, we assumed that the data from cohort 3 provided a more accurate representation of the program's future performance as feedback from earlier cohorts were incorporated into the program. Hence, we extrapolated the time data from cohort 3 and applied those values to all three cohorts. In the third scenario, we incorporated an adjustment by increasing the reported time by 25% to account for potential under-recording of activities by the students. For each of the three scenarios, we assumed the same number of clients were seen ($n = 50$).

2.2.3 | Fly-In Fly-Out Model

As a second comparator to the student-assisted model of care, we estimated costs associated with a FIFO model, reflecting the three scenarios specified for the resident clinician model (Table 1). We assumed (based on information provided by the Department of Health—personal communication, senior allied health executive, NT Department of Health) that two clinicians (a physiotherapist and speech pathologist) allocated their time jointly, with a visit every 6 weeks. The specific number of days required varied by scenario. Costs include clinician salaries, including 25% on-costs, and travel costs. Travel costs including airfares, accommodation, meal, and incidental allowances were calculated using internet searches for flights, accommodation, and car hire and standard Northern Territory Health allowances for meal and incidental allowances [29].

3 | Results

Table 2 provides an overview of the demographic and health characteristics of the 50 clients who participated in the student-assisted service model. Approximately half of clients were female and most were Aboriginal and/or Torres Strait Islander. Data S1 displays the services received by clients who provided their consent to access their health systems' data, both before and during the implementation of the student-assisted service model ($n = 31$). In the period before the intervention, clients received an average of 4.9 services (standard deviation [SD] 5.5). However, during the intervention, the average number of services received per client increased to 6.3 (SD 5.1).

Figure 1 presents the average time spent per day by each cohort of students on planning, individual and group sessions, cultural education, travel, and other activities such as general education, briefings, student assessments, self-directed learning and presentations. Cohort 2 spent more time on cultural activities as they were present during the annual Garma festival (Australia's largest Indigenous gathering celebrating Yolŋu life and culture held in remote northeast Arnhem Land, approximately 30 km from Nhulunbuy) and participated in many of the events. Individual and group sessions included service provision to clients and care coordination.

Table 3 presents the distribution of hours allocated in the three scenarios. Most of the time was used to provide client services, followed by travel time.

TABLE 2 | Demographic and health characteristics of clients seen by the student-assisted service model.

Variables	Nhulunbuy[as]
Number of clients	50
Age, mean (sd)	59.5 (12.5)
Female	48.0%
Aboriginal and/or Torres Strait Islander	96.0%
Number of comorbidities, mean (sd) [range]	2.9 (1.3) [1–5]
Comorbidities	
Cardiovascular conditions and risk factors	66.0%
Respiratory conditions	58.0%
Renal conditions	44.0%
Musculoskeletal conditions add orthopaedic	30.0%
Endocrine conditions (Type 2 diabetes)	32.0%
Neurological conditions (including dementia)	22.0%
Other including dysphagia, malnutrition, deafness	20.0%
Frailty	14.0%
Psychological conditions	2.0%

[a]Removed clients with unknown conditions ($n = 7$) or deceased clients ($n = 4$).

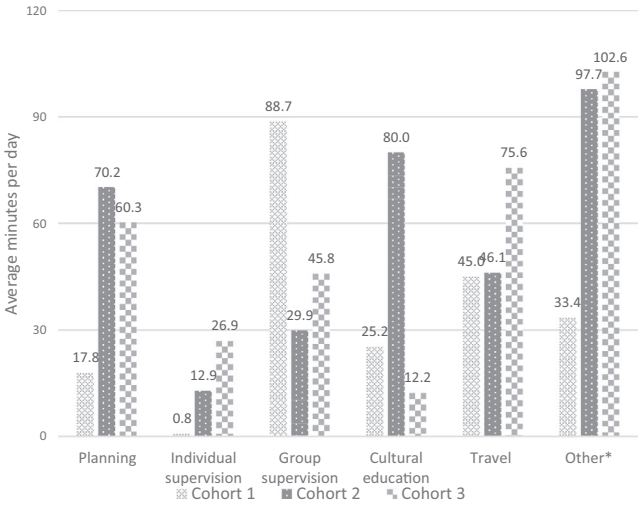

FIGURE 1 | Average time spent per day by each cohort of students *Other includes education received, briefings, student assessments, self-directed learning, and presentations.

Table 4 presents the observed costs of the student-assisted model and the estimated costs for the other two service models across three scenarios. In the first scenario, time data from all students across the three cohorts was used. The second scenario applied the data from cohort 3 to all cohorts, while the third scenario increased the reported time from scenario 2 by 25%. The total cost of the student-assisted service model was $118 141, resulting

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

in a cost per client of $2 363. For the resident clinician model, the total cost of the service for each of the scenarios was $45 743, $49 363 and $58 896, respectively, with corresponding costs per client of $915, $987, and $1 178, respectively. In the case of the FIFO model of care, the total costs were $75 123 for scenario 1, $78 743 for scenario $2 and $96 088 for scenario 3, with cost per client figures of $1 502, $1 575 and $1 922, respectively.

4 | Discussion

This economic analysis has shown that the costs to implement a student-assisted model are not insignificant. Educating 12 students in a very remote Aboriginal context and providing culturally responsive care to prevent avoidable hospitalisations was more expensive than a FIFO and a resident clinician model of care. With the current shortfall and maldistribution of allied health professionals in Australia [1, 2], much allied health service delivery has necessarily been a FIFO model [30–32]. The literature also shows that FIFO models can be less than desirable in terms of service user satisfaction [16, 33]. To deliver optimal services, FIFO models need a stable workforce and regular contact to build and maintain cultural connections. While our modelling has shown the model of care with the lowest cost to be the resident clinician, Australian allied health workforce supply and working conditions for allied health professionals in remote communities mean that recruiting resident clinicians to remote positions is very challenging. Further, it is known that allied health professionals in rural and remote areas have a high turnover rate and recruiting costs are a significant expense to services [34].

The student-assisted model requires the recruitment of clinician supervisors. Supervising students can incentivise clinicians, increasing job satisfaction and retention [35]. However, the insufficiency of workforce supply suggests that investment in student-assisted models in remote locations is a necessary upstream strategy to grow the remote workforce. Providing supported culturally responsive services via quality placement experiences could create a pool of graduate allied health professionals seeking to work and live in remote Australia [36, 37]. Thus, the additional costs required to co-design and deliver student-assisted models are an investment in both the career outcomes for allied health professionals and the health of remote Australia. Current Australian government policy via the RHMT program and its recent initiatives is a positive strategy, and without the funding support for travel and accommodation, the student-assisted models would be more costly for health services (or indeed may not occur) [27]. We contend that communities and their health services, public, private, and non-government, could consider collaborating with universities to create more student-assisted models of care, potentially allowing cost-sharing between the partners.

One of the critical factors to note in the costs of delivering the student-assisted model was the cost of cultural support to the students. While the employment of local Yolŋu people with cultural expertise increased the service cost, it also was a critical factor in the service success. It ensured that student clinical learning was underpinned by learning about Yolŋu culture and Indigenous health issues. By putting culture at the centre, the model applied a culturally responsive framework [21, 38–40]. Feedback from the students indicated that they had a much greater appreciation of culture, the impact of colonisation on communities, and would influence their advocacy for Aboriginal health when they returned to their cities of origin

TABLE 3 | Scenarios of service provision time in hours.

Category	Scenario 1—all cohorts	Scenario 2—cohort 3	Scenario 3—cohort 3 + 25%
Service time	252	235	294
Preparation time	113	169	211
Care coordination time	37	28	34
Other time	8	5	7
Travel time	148	179	224
Total	558	617	771

TABLE 4 | Costs and results for the student-assisted model and six modelled scenarios.

Parameter	Student-assisted model	FIFO scenario 1	FIFO scenario 2	FIFO scenario 3	Resident clinician scenario 1	Resident clinician scenario 2	Resident clinician scenario 3
Number of clients seen	50	50	50	50	50	50	50
Cost of intervention	$118 141	$75 123	$78 743	$96 088	$45 743	$49 363	$58 896
Salaries	$85 309	$34 511	$38 131	$47 664	$34 511	$38 131	$47 664
Travel	$11 232	$40 611	$40 611	$48 424	$11 232	$11 232	$11 232
Cultural	$21 600	$0	$0	$0	$0	$0	$0
Cost per client	$2 363	$1502	$1 575	$1 922	$915	$987	$1178

Note: Scenario 1: time data from all students across the three cohorts used. Scenario 2: time data from cohort 3 applied to all cohorts. Scenario 3: increased the reported time from scenario 2 by 25%.

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

[39]. Community members valued teaching the students because of the emerging two-way learning [22, 24].

As a national priority with policy recommendations, it is critical to include Aboriginal and Torres Strait Islander health perspectives into the health curriculum and develop health care services tailored to communities and the people they serve [5, 41]. The student-assisted service model incorporated cultural leaders and educators and local governance, potentially enhancing cultural safety for clients [22]. As students learned from the cultural educators and community, their quality of communication and cultural understanding developed. Such development is crucial for promoting trust and respect between the students and the clients, leading to a more inclusive and culturally appropriate healthcare environment. Again, a consortium of organisations, including influential and culturally appropriate community members, health services, and universities, could address both policy recommendations and health service gaps by working together to set up culturally responsive student-assisted services. The governance of such a consortium could ensure that client care coordination, including appropriate referrals, was managed in a way that prioritised the provision of culturally responsive services.

Using an economic lens based only on the cost per client to compare service delivery models assumes equal effectiveness of allied health services delivered by the alternative service models. Due to the dearth of information available on the effectiveness of allied health services in rural and remote regions, we could not undertake a cost-effectiveness analysis. Our study prioritised service provision, which limited the intrusiveness of the research methods and prevented us from collecting effectiveness data. Recent evidence from a similar student-assisted service model in Cape York, Queensland, which collected hospital admissions data, suggests that the provision of student-assisted allied health services in addition to usual care reduced potentially preventable hospital admissions (personal communication, A. Cairns). As further research emerges, calculating the cost-effectiveness of different models of care can be undertaken.

Furthermore, there is already a health-spend shortfall between urban and rural citizens of $6.55 billion, or $848.02 per capita (age-standardised) [18]. One way to offset this shortfall driven by expenditure in urban private hospitals and MBS availability is to utilise the emerging evidence of the benefits of locating university training programmes in remote and rural areas. The recent RHMT evaluation has shown that university training programmes in small remote locations have direct and indirect economic consequences, including that for every dollar invested, another dollar is created locally [42]. For example, the employment and additional social capital in the region as a consequence of people who migrate in or who already reside locally supervising, teaching into, and managing the programme contributes to the local economy. Those people consume goods and services locally and may bring other family members who also contribute to the region [43].

Finally, while not reported here, this study is consistent with others [21, 22] that identified a range of non-quantifiable beneficial consequences of the student-assisted service model, including the significance of a culturally responsive health service, community appreciation of the services, improvements in the quality of life associated with increased access to allied health services, and increases in the future allied health workforce with a desire to work in remote communities.

4.1 | Limitations

One limitation of this study is the possibility of error variance due to incomplete student records. To mitigate this, we conducted analyses based on data from the most recent student cohort, considered the most accurate, and performed sensitivity analyses to account for potential underreporting.

5 | Conclusion

In this study, we found that a resident clinician was the least expensive model of care in this remote setting. Resident clinicians are well placed to build strong relationships with the community and provide timely ongoing care. The student-assisted model was more expensive than the FIFO models. However, the student-assisted model represents an important investment in providing high-quality allied health care that supports the training of health professionals able to work in remote communities and implement culturally responsive care. Further research on the costs and benefits of providing culturally safe health services to remote Indigenous communities should be a priority.

Author Contributions

Narelle Campbell: conceptualization, funding acquisition, data curation, supervision, writing – review and editing. **Jackie Roseleur:** conceptualization, writing – review and editing, methodology, formal analysis, data curation. **Jon Karnon:** conceptualization, funding acquisition, methodology, writing – review and editing, data curation. **Chris Hince:** writing – review and editing, methodology, project administration, investigation, data curation. **Alice Cairns:** conceptualization, funding acquisition, writing – review and editing, methodology, project administration. **Kylie Stothers:** conceptualization, data curation, funding acquisition, writing – review and editing, methodology. **Chris Rissel:** conceptualization, writing – original draft, writing – review and editing, methodology, project administration, supervision.

Acknowledgements

Thanks to Renae Moore and Kim Clayworth (NT Health) for their technical input and the residents of Nhulunbuy, Gunyangara, Yirrkala, and Garrthalala who participated in this research. This study was funded by the Cooperative Research Centre for Developing Northern Australia (CRCNA). Open access publishing facilitated by Flinders University, as part of the Wiley - Flinders University agreement via the Council of Australian University Librarians.

Disclosure

Funding for this work was provided by the Cooperative Research Centre for Developing Northern Australia (CRCNA) and the Australian Government, Department of Health, through the Rural Health Multidisciplinary Training (RHMT) Programme. The work has not previously been published.

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Ethics Statement

Ethical approval for this research was obtained by the Human Research Ethics Committee of the Northern Territory Department of Health and Menzies School of Health Research (Reference Number: 2021-4103).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. A. G. J. Edelman, N. Moodley, S. Larkins, et al., *Northern Australia Health Service Delivery Situational Analysis* (Cooperative Research Centre for Developing Northern Australia, 2020).

2. J. Wakerman, J. Humphreys, D. Russell, et al., "Remote Health Workforce Turnover and Retention: What Are the Policy and Practice Priorities?," *Human Resources for Health* 17 (2019): 99.

3. Australian Institute of Health and Welfare, *Rural and Remote Health* (AIHW, 2022).

4. National Guideline Centre (UK), *Emergency and Acute Medical Care in Over 16s: Service Delivery and Organisation* (National Institute for Health and Care Excellence (NICE), 2018).

5. Australian Government Department of Health and Aged Care, *National Strategic Framework for Rural and Remote Health* (Australian Government Department of Health, 2016).

6. N. Campbell, E. Kennedy, C. Rissel, et al., "Workplace Locations of 2011-2017 Northern Territory Medical Program Graduates," *Rural and Remote Health* 21, no. 4 (2021): 6662, https://doi.org/10.22605/RRH6662.

7. Australian Government Department of Health and Aged Care, *National Rural Generalist Pathway* (Commonwealth of Australia, 2023).

8. Queensland Health, *Allied Health Rural Generalist Pathway* (State of Queensland, 2023).

9. Australian Government Department of Health and Aged Care, *Stronger Rural Health Strategy* (Commonwealth of Australia, 2021).

10. Universities Australia, Australian Chamber of Commerce and Industry, Australian Industry Group, Business Council of Australia, and Australian Collaborative Education Network, "National Strategy on Work Integrated Learning in University Education," 2015.

11. E. Green, *How Does Rural Work-Integrated Learning Prepare the Future Health Workforce for Practice?* (CSEdX Academic Program, 2022).

12. C. Quilliam, E. Green, R. L. Rasiah, et al., "University Staff Perspectives on Determinants of High-Quality Health Professions Student Placements in Regional, Rural and Remote Australia: Protocol for a Mixed-Method Study," *BMJ Open* 14 (2024): e077079.

13. S. M. Walsh, V. L. Versace, S. C. Thompson, et al., "Supporting Nursing and Allied Health Student Placements in Rural and Remote Australia: A Narrative Review of Publications by University Departments of Rural Health," *Medical Journal of Australia* 219, no. 3 (2023): S14–s19. S3, https://doi.org/10.5694/mja2.52032.

14. D. Jones, L. McAllister, R. Dyson, and D. Lyle, "Service-Learning Partnerships: Features That Promote Transformational and Sustainable Rural and Remote Health Partnerships and Services," *Australian Journal of Rural Health* 26 (2018): 80–85.

15. M. S. Fitts, J. Humphreys, T. Dunbar, et al., "Understanding and Responding to the Cost and Health Impact of Short-Term Health Staffing in Remote and Rural Aboriginal and Torres Strait Islander Community-Controlled Health Services: A Mixed Methods Study Protocol," *BMJ Open* 11 (2021): e043902.

16. R. Hussain, M. Maple, S. V. Hunter, V. Mapedzahama, and P. Reddy, "The Fly-In Fly-Out and Drive-In Drive-Out Model of Health Care Service Provision for Rural and Remote Australia: Benefits and Disadvantages," *Rural and Remote Health* 15 (2015): 3068.

17. Australian Government Department of Health and Aged Care, *Unleashing the Potential of Our Health Workforce—Scope of Practice Review* (Commonwealth of Australia, 2024).

18. Nous Group, "Evidence Base for Additional Investment in Rural Health in Australia. National Rural Health Alliance," 2023.

19. B. G. O'Sullivan and P. Worley, "Setting Priorities for Rural Allied Health in Australia: A Scoping Review," *Rural and Remote Health* 20 (2020): 5719.

20. Australian Government Department of Health and Aged Care, "Rural Health Workforce."

21. R. Barker, S. Witt, K. Bird, et al., "Co-Creation of a Student-Implemented Allied Health Service in a First Nations Remote Community of East Arnhem Land, Australia," *Australian Journal of Rural Health* 30, no. 6 (2022): 782–794, https://doi.org/10.1111/ajr.12938.

22. K. Bird, K. Stothers, E. Armstrong, et al., "Marŋgithirri guŋga'yunarawu Ga guŋga'yunyarawu marŋgithinyarawu Learning to Connect and Connecting to Learn: Preparing the Rural and Remote Allied Health Workforce Through a Co-Created Student-Implemented Service in East Arnhem, Australia," *Australian Journal of Rural Health* 30, no. 1 (2022): 75–86, https://doi.org/10.1111/ajr.12813.

23. A. Marlow and C. A. Mather, "Supervision of Nursing Students in Rural Environments," *Engaging Learning by Teaching the Teachers Australian and International Journal of Rural Education* 12 (2017): 271111253, https://doi.org/10.47381/aijre.v27i3.131.

24. E. Sarovich, D. Lowrie, L. Geia, S. Kris, and A. Cairns, "Different Meanings... What We Want in Our Lives... a Qualitative Exploration of the Experience of Aboriginal and/or Torres Strait Islander Peoples in a Co-Designed Community Rehabilitation Service," *Disability and Rehabilitation* 46 (2024): 354–361.

25. S. Howard-Wilsher, L. Irvine, H. Fan, et al., "Systematic Overview of Economic Evaluations of Health-Related Rehabilitation," *Disability and Health Journal* 9 (2016): 11–25.

26. P. Stanley-Davies, K. Battye, and E. Ashworth, *Economic Evaluation of an Outreach Allied Health Service: How Do You Measure 'Bangs for the Buck'* (8th National Rural Health Conference, 2005).

27. Australian Taxation Office, "Deductions for Motor Vehicle Expenses—Cents Per Kilometre Method," 2022.

28. Australian Government Department of Health and Aged Care, *Rural Health Multidisciplinary Training (RHMT) Program* (Commonwealth of Australia, 2023).

29. Northern Territory of Australia, *Public Sector Employment and Management Act 1993: Determination 1 of 2021* (Northern Territory of Australia, 2021).

30. T. A. Carey, D. Sirett, D. Russell, J. S. Humphreys, and J. Wakerman, "What Is the Overall Impact or Effectiveness of Visiting Primary Health Care Services in Rural and Remote Communities in High-Income Countries? A Systematic Review," *BMC Health Services Research* 18 (2018): 476.

31. M. Cottrell, P. Judd, T. Comans, P. Easton, and A. T. Chang, "Comparing Fly-In Fly-Out and Telehealth Models for Delivering Advanced-Practice Physiotherapy Services in Regional Queensland: An Audit of

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Outcomes and Costs," *Journal of Telemedicine and Telecare* 27 (2021): 32–38.

32. L. S. Fruhen, J. Gilbert, and S. K. Parker, "Fly-In-Fly-Out Work: A Review of the Impact of an Extreme Form of Work-Related Travel on Mental Health," *Organizational Psychology Review* 13 (2023): 177–204.

33. S. Duckett, "Fly-In, Fly-Out Heath Care Fails Remote Aboriginal Communities. Conversation," 2012.

34. M. Chisholm, D. Russell, and J. Humphreys, "Measuring Rural Allied Health Workforce Turnover and Retention: What Are the Patterns, Determinants and Costs?," *Australian Journal of Rural Health* 19 (2011): 81–88.

35. C. Rothwell, A. Kehoe, S. F. Farook, and J. Illing, "Enablers and Barriers to Effective Clinical Supervision in the Workplace: A Rapid Evidence Review," *BMJ Open* 11 (2021): e052929.

36. T. S. Davis, J. Guada, R. Reno, et al., "Integrated and Culturally Relevant Care: A Model to Prepare Social Workers for Primary Care Behavioral Health Practice," *Social Work in Health Care* 54 (2015): 909–938.

37. C. Minnican and G. O'Toole, "Exploring the Incidence of Culturally Responsive Communication in Australian Healthcare: The First Rapid Review on This Concept," *BMC Health Services Research* 20 (2020): 20.

38. A. Cairns, L. Geia, S. Kris, et al., "Developing a Community Rehabilitation and Lifestyle Service for a Remote Indigenous Community," *Disability and Rehabilitation* 44, no. 16 (2022): 4266–4274, https://doi.org/10.1080/09638288.2021.1900416.

39. A. H. C. Cairns, N. Campbell, R. N. Barker, et al., "Preparing Allied Health Students for Culturally Safe Interprofessional Practice in Remote Northern Australia," *Student Success* 16, no. 1 (2024): 27–37.

40. Indigenous Allied Health Australia, *Cultural Responsiveness in Action: An IAHA Framework* (IAHA, 2019).

41. Australian Health Professional Regulation Agency, "National Scheme's Aboriginal and Torres Strait Islander Health and Cultural Safety Strategy 2020-2025," 2020.

42. KBC Australia, *INdependent Evaluation of the Rural Health Multidisciplinary Training Program: Summary of Final Report to the Commonwealth Department of Health* (KBC Australia, 2020).

43. M. Prior, J. Farmer, D. J. Godden, and J. Taylor, "More Than Health: The Added Value of Health Services in Remote Scotland and Australia," *Health & Place* 16 (2010): 1136–1144.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.

14401584, 2025, 3, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/ajr.70012 by National Health And Medical Research Council, Wiley Online Library on [20/05/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License