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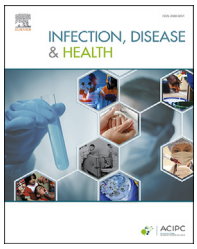

Research paper

Capacity building to address antimicrobial resistance in remote Australia: The inaugural HOT NORTH Antimicrobial Academy

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Abstract *Background:* Rates of antimicrobial resistance (AMR) for some pathogens in Australia are considerably higher in rural and remote compared to urban regions. The inaugural Hot North Antimicrobial Academy was a 9-month educational programme aimed to build workforce knowledge and capacity in antimicrobial use, audit, stewardship, surveillance and drug resistance in remote primary health care.
Methods: The Academy was advertised to Aboriginal and Torres Strait Islander, regional and remote healthcare workers. Participants were Aboriginal health practitioners, nurses, pharmacists and doctors from Queensland, Northern Territory, South Australia and Western Australia working in remote primary health care with a focus on Indigenous health. Due to COVID-19 restrictions, the Academy ran virtually from February—November 2021 using Microsoft Teams. The Academy was evaluated using surveys and yarning circles to assess impact and knowledge gain.
Results: Participants and faculty from across Australia attended 19 lectures and mentorship sessions. Eleven participants commenced and eight (73%) completed the Academy. The Academy raised participants awareness of AMR guidelines, governance and generating change; built confidence in advocacy; grew knowledge about drug resistant infections; and created a community of AMR champions in Indigenous health.

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Conclusion: The evaluation confirmed the Academy met the needs of participants, provided opportunities to move stewardship from tertiary hospitals into Indigenous and remote clinics and developed skills in research, audit, stewardship and advocacy for all involved. All sessions were recorded for future use, with facilitation by the National Aboriginal Community Controlled Health Organisation (NACCHO) in future years.

Highlights

- The known: The remote Indigenous primary health care (PHC) sector is not mentioned in Australia's National AMR strategies.
- The new: An inaugural Antimicrobial Academy operated in 2021 for remote Indigenous PHC staff to build workforce capacity.
- The implications: A mixed-methods evaluation showed knowledge gain was strong and the Academy well received.

Introduction

The National Australian Antimicrobial Resistance (AMR) Strategy, 2020 and beyond, endorsed by the Council of the Australian Governments, seeks to curtail drug resistance and sustain the use of beneficial antimicrobials for future generations [1]. This follows on from Australia's first National AMR Strategy 2015—2019 [2]. Regrettably, despite the heavy burden of AMR in remote Australia [3] inequitably affecting Aboriginal and Torres Strait Islander Peoples (hereafter respectfully referred to as Indigenous), there is no mention of remote or Indigenous populations in the first or second strategy [4]. One possibility for this oversight is the lack of a Voice to advocate on behalf of Indigenous, rural and remote communities. Alongside this is the need for capacity building of the remote and Indigenous workforce to enable transfer of skills and knowledge in AMR from urban, tertiary hospitals where these skills have been centred for several decades, to Indigenous primary health care — especially in rural and remote settings - where advocacy and Voice may shift this oversight [4]. A shift to community-controlled antimicrobial stewardship (AMS) strategies is consistent with the Priority Reform 2 of the National Agreement on Closing the Gap strategy [5]. High antimicrobial use in the remote north of Australia is well established but to date, infrequently documented in the medical literature [6,7]. This however is changing [8,9] with greater attention to the challenges of AMS in remote hospital and primary health care sectors [10,11]. Understanding antibiotic selection pressures when new evidence is incorporated into guidelines is critical to inform ongoing treatment recommendations. One such example is the Skin Sore Trial which found oral cotrimoxazole was just as effective as intramuscular benzathine penicillin G for impetigo treatment [12]. This regimen was quickly incorporated aligned with publication of the evidence into regional and national guidelines in 2014 [13—15]. Understanding whether clinicians were using this new regimen and what impact this might have on drug resistance was needed [16,17].

To address this gap, the Coordinated Remote AntiMicrobial Stewardship (CRAMS) research began in 2018 across northern Western Australia (WA), Northern Territory (NT) and Queensland (QLD) to assess antimicrobial usage in remote northern Australia [6]. This was the first audit of antimicrobial use in remote Australia and demonstrated a heavy burden of infectious diseases with less appropriate prescribing, limited clinician awareness of antimicrobial stewardship (AMS) or understanding of AMR. Alongside this were the gaps in training opportunities on AMR amongst Indigenous clinicians and remote Aboriginal Community Controlled Health Organisations (ACCHOs). The HOT NORTH Antimicrobial Academy was developed as a research translation and capacity building activity to address these gaps. HOT NORTH [18] was an NHMRC funded Centre for Research Excellence, coordinated by the Menzies School of Health Research, with the aim of building capacity for health research in the tropical north. The Academy was designed to train a cohort of Indigenous and remote primary health care clinicians in antimicrobial stewardship. It sought to democratise the language and learning of AMR and antimicrobial stewardship, to understand the participants' role in preventing AMR and the confidence to advocate for inclusion in future national strategies.

We aimed to evaluate the inaugural Academy to assess whether these aims were met and to inform future training needs across remote and Indigenous primary health care in Australia.

Methods

Setting and study design

Following successful application for funding to run the inaugural Academy, the lead investigators sought broader input from key stakeholders including the National Aboriginal Community Controlled Health Organisation (NACCHO), National Association of Aboriginal and Torres Strait Islander Health Workers and Practitioners (NAATSIHWP) and the

statewide Queensland Antimicrobial Stewardship program (QSAMSP). The QSAMSP team coordinated the Academy with support from the Academy Leadership Team which included three tertiary infectious diseases physicians (one paediatrician and two adult physicians all with longstanding clinical and research experience in northern Australia), one Indigenous medical director of a remote ACCHO and one pharmacist from NACCHO. Additional lectures were provided by Indigenous and non-Indigenous experts working in the AMR and AMS space across northern Australia (the faculty).

An initial planning meeting with key stakeholders and Leadership Team was held on 11 March 2020. The agreed intention from this meeting was to run a predominantly face-to-face Academy commencing with a 2-day face to face workshop to build rapport, trust and confidence. Following this, occasional lectures were planned to be delivered via Microsoft (MS) Teams once relationships and rapport had been established. The workshop members recommended >1 participant per site would be beneficial and the strong embedding of cultural governance throughout the program to ensure cultural security for participants. Shortly after this in response to the growing threat of COVID-19, Australia closed its national border and the BioSecurities Act prohibited travel to remote locations across Australia [19]. State and Territory border closures due to COVID-19 and restrictions on the movement of clinicians during this time delayed the start of the Academy in 2020, and shifted from the planned hybrid model to online delivery using MS Teams. These changes delayed the commencement of the Academy until March 2021 and included the pivot to conduct the Academy as a completely online curriculum.

The Academy was advertised through Aboriginal health peak bodies (NACCHO and NATSIHWA), ACCHOs, state government health departments, the HOT NORTH website and through national forums such as Antimicrobial Awareness Week (2020). To participate, applicants submitted a brief resume and a simple, streamlined application form that drew out previous experience with antimicrobials, and reasons for application. In addition, a letter of support from the participant's organisation and line manager was requested to ensure that the participant had the organisational support to progress. A nominated on-site support person for the participant was also included. This application process as described was recommended by the Aboriginal health peak bodies represented at the workshop in March 2020.

The Academy Leadership Team met together via MS Teams to evaluate and select applicants that were clinicians working in remote communities, preferentially identified as Indigenous, and welcomed multidisciplinary participation from Aboriginal Health Practitioners, nurses, pharmacists and medical officers. All initial applicants were deemed eligible and enrolled in the first cohort as participants.

The Academy ran from March—November 2021 as an entirely virtual training program using the MS Teams platform. Monthly lectures were supplemented by 2 half day intensive online sessions and concluded with a 2-day hybrid meeting in Darwin in which participants presented their projects and attended the final HOT NORTH research meeting.

The Academy curriculum covered four main themes in AMR and AMS: (i) skin health and common skin infections as the most common infection seen across remote Australia [6]; (ii) surveillance techniques and tools; (iii) available stewardship and clinical resources; and (iv) communication, media skills and advocacy. The hybrid in-person and video conferencing delivery mode spanned nine months with 90-min and half day presentations held monthly. Fellows undertook an AMS project of their choice, utilising skills learnt through the Academy, and presented this to the Academy.

A mixed-methods evaluation was planned. Participants completed an anonymous pre- and post-knowledge, attitude and practice (KAP) survey before commencing in March 2021 and upon conclusion of the Academy in December 2021 using MS Teams. Ordinal data were collected using a Likert scale for each question to assess change in KAP. There were 6 questions on skin health, three questions on surveillance techniques, and one question each on available resources and media. In addition to the survey data, qualitative data was collected using the Indigenous methodology of yarning [20] circles, placing an emphasis on two-way sharing of knowledge and ideas. The yarning circle occurred at the hybrid final Academy session held in Darwin in November 2021. Qualitative data was recorded on MS Teams and thematically analysed by BS and checked by AB. Both KAP surveys and qualitative data from the yarning circles contributed to the evaluation to capture the experiences and impressions of the participants, and evaluate gains in knowledge, skills and confidence.

Results

The Academy commenced in March 2021 with 11 participants comprising Aboriginal health practitioners (AHP), nurses, pharmacists and medical officers from WA, South Australia (SA), NT, QLD and Victoria (VIC). Ten participants (91%) were female, and 6/11 (55%) aged between 20 and 35 years, with the remainder aged between 36 and 50 years. Five (45%) participants were from the ACCHO sector. The Leadership Team and lecturers comprised >20 Indigenous and non-Indigenous health professionals from WA, QLD, Tasmania (TAS), VIC, Australian Capital Territory (ACT) and NT who generously shared their knowledge in antimicrobials. Across the nine months from February to November 2021, 19 lectures and workshops were delivered, with mentoring sessions conducted in addition. Participation involved support from the health service to attend the monthly lectures, half day intensives and completing a project about antimicrobials.

All 11 Academy participants completed the baseline survey, and eight (73%) completed the Academy and survey. Three healthcare workers were unable to complete the Academy due to changes in job responsibilities and pressures of COVID-19. Table 1 shows the summarised findings from the pre- and post- KAP surveys. These indicate a self-reported significant improvement in knowledge in three of the four themes of the Academy. The theme of communication, media skills and advocacy had only minimal improvement. Each participant declared they had achieved a good level of confidence in using surveillance tools and

Table 1 Pre and post KAP survey response summaries.

Theme	Specific	Pre	Post	Change
Skin Health	Impetigo, scabies, tinea, head lice, cellulitis	Reasonable but patchy knowledge	Good-Excellent Knowledge	Improved
Surveillance techniques and tools	Antibiograms	Good knowledge	Good-Excellent knowledge Confident in using antibiograms	Improved
	HOTSpots tool [21]	Limited knowledge	Good-Excellent knowledge	Improved
	Facility audits/audit tools	Low awareness of and low experience	Excellent Knowledge of audits. Good confidence to conduct audits.	Improved
Available stewardship and clinical resources	Guidelines	Some awareness	Good-Excellent knowledge	Improved
Communication, media skills and advocacy		Some knowledge but no experience	Some self-reported improvement	Minimal change

techniques. There was high satisfaction with the Academy with all participants reporting it exceeded their expectations.

Qualitative evaluation themes drawn from yarning circles

Theme 1: The online format worked but with suggestions for future Academies

The online format using MS Teams was regarded as easy to participate in. For some participants it was their first experience of this platform and a session on navigating it was recommended at the outset of future Academies. High and increasing workload associated with the pandemic were barriers to participation reported by all. Involvement in the COVID-19 response affected the participants and the availability of some lecturers and the Leadership Team. The format of entirely virtual participation until the last hybrid session was acceptable to participants as it gave them greater flexibility to participate, and scheduling lectures during their workday meant that their organisation was supportive of their participation. However, the relational and cultural safety aspects of gathering face to face were lost with this methodology and participants suggested organising regional hubs for future Academy participants to be able to connect. Online fatigue was also raised, with the optimal duration of online learning identified as 90 min for future Academy sessions. The addition of an online coffee and chat session with the Leadership Team in the interval between the monthly lectures was also valued by the participants. Matching future participants with a doctor or nurse with a detailed understanding of the governance at their respective health service was also recommended to improve the quality of projects completed and local knowledge generation.

The participants all indicated they heard about the Academy by word of mouth and email. They found the streamlined application process easy. They perceived the quality of the lectures and the break-out groups to be good or excellent and made a recommendation to introduce the research or audit project earlier in the curriculum for future Academies. The participants were uniformly very satisfied with the Academy, indicating it exceeded expectations.

> '*This helped me develop my knowledge around AMS. I enjoyed it as a new learning curve for me, another avenue in my practice*'

The faculty appreciated the flexibility and efficiency of online delivery, ability to participate despite busy schedules and enough scope for participants to ask questions at the end of lectures. Whilst face to face was raised as preferable, the ability to connect across remote Australia and run future Academies at low cost via an online modality outweighed the need to travel.

Theme 2: A networked community from which to draw strength, support and connection

Participants and Faculty created a networked community of like-minded individuals learning together and each reported great strength was drawn from this. This interconnectedness of purpose was identified as the greatest benefit of participating in the Academy. Participants reported that being the first in an organisation to attempt an antimicrobial audit and the needed governance changes was daunting. Through the collaboration and collegiality of the Academy, they overcame this limitation and completed practice changing audits in skin and soft tissue infection, and urinary tract infection antimicrobial audits and the use of traditional bush medicines in combination with antimicrobials. In the Academy, they found like-minded people who became peers and AMR champions.

Theme 3: Racism within healthcare

Through their projects, the participants were able to identify strengths and challenges in the health care system. One example that arose through sharing stories was that racism in healthcare had been identified embedded in guidelines and behaviours. An example involved local hospital guidelines and their interpretation that provide antimicrobial advice based on ethnicity, without an understanding of the true ethnicity-based disease risk.

Careful attention to local epidemiology and antibiograms to better inform guidelines, before labelling Indigenous Australians as universally at high risk for methicillin resistant *Staphylococcus aureus* (MRSA) is needed. The sense of collegiality to address this was strong. The Academy format created space for concerns to be raised and participants recognised that they were 'not alone'.

> *"We are not alone in striving to improve systems and combat systemic racism"*

The projects generated broad ranging discussions on topics including cultural security, examples of systemic racism with its profound and personal impacts, and bush medicines implemented alongside antimicrobials to achieve reconciliation in health care and walking together.

Theme 4: Tailoring AMR messages to achieve organisational change

Participants identified that they had learnt how to tailor drug resistance messages specifically for patients, doctors and their executive which could lead to organisational change. Hard conversations were bravely progressed by some participants following the knowledge gained through being a member of the inaugural Academy. Participants embraced sessions in which new insights were achieved in health care governance. Similarly, identifying the strengths already operational within remote health care settings e.g. Guidelines and Standard Drug Lists that preceded tertiary hospitals in implementation, was a highlight.

> *"Understanding the history, purpose relevance and importance of guidelines and protocols, e.g. CARPA [22], is likely to increase adherence to the protocols."*

Theme 5: Embracing the next steps in drug resistance for indigenous communities and in regional and remote Australia

All participants identified that the Academy is a stepping-stone to having a breadth of voices including Indigenous Australians and those working in remote primary health care to inform the National AMR strategy discussions and revisions. Participants were able to place the importance of AMR within the politics of health and recognise that jurisdictional and national changes were possible with advocacy. It is hoped that this Academy and newly skilled voices to advocate will lead to inclusion of these topics in Australia's next National AMR Strategy. Knowledge gained about the global and one health perspective on AMR in later lectures broadened the scope of participants experience, to understand where this important topic fits more broadly for Indigenous peoples across the world.

Discussion

To our knowledge, the inaugural HOT NORTH Antimicrobial Academy is the first virtual training program, developed, delivered and evaluated, to address the unmet needs for training in antimicrobial stewardship and AMR in remote Australian health care. The key findings of the evaluation were that the Academy was feasible, effective and somewhat unexpectedly participants preferred the use of the virtual format, albeit due to COVID restrictions there was no comparison to the in-person experience. Participants reported feeling connected by their shared purpose and once collectively identified, united in their desire to address evidence of structural and systemic racism in antimicrobial guidelines and policies. The qualitative data highlighted overall impressions of the Academy's utility, including significant self-reported improvement in knowledge. It also highlighted areas for future improvement or adjustment.

Virtual learning in the COVID-era has become common place with most adult learners now choosing virtual or hybrid options for increased convenience, decreased cost and the reduced environmental impact of not travelling long distances for educational opportunities [23]. In Australia, throughout much of 2021, state and national borders remained closed which restricted opportunities for travel [19,24]. This also reduced the widespread impact of COVID-19 infections in the vast majority of remote Aboriginal and Torres Strait Islander communities throughout 2021 [25]. However, all of the participants and Academy Leadership Team were involved in many aspects of the COVID response from national committees through to immunisation delivery, providing complex competing demands on their time and sadly limited the final completion for one quarter of participants. Despite these challenges, the virtual Academy created new opportunities for connection around a shared purpose.

Working in antimicrobial stewardship provides opportunities for shared purpose, collaboration, and collective learning as it is a relatively new field in healthcare [26]. This was also the experience for the participants in the inaugural Academy as they were being trained to fill a gap in education and implementation of stewardship in remote Australia. Despite the heavy burden of AMR in this context [3], very little to date had been done to address the knowledge and service gaps. However, the strong history since the early 1990s of guideline-based healthcare for infectious diseases to support a transient and isolated workforce preceded many stewardship guidelines elsewhere in Australia [27]. Addressing AMR globally will take individual and population, local and national solutions [28], and the Academy is another example of attending to this need.

The Academy participants were united in their discussions of the importance of identifying and calling out structural racism in health care. This is inherent in AMR policy in Australia at the highest levels with the exclusion of Aboriginal and Torres Strait Islander health from both the first [2] and second [1] editions of Australia's National AMR strategy. A key tenant of stewardship is knowing the local patterns of antimicrobial resistance to inform guidelines, and highlighted by participants, there are areas for improvement.

The evaluation of the inaugural Academy evaluation was limited by the small sample size. We were also unable to consider how a face-to-face Academy may have compared, as due to COVID-19 restrictions, it was effectively conducted online — which participants ultimately thought was preferable due to their ability to fit it into their work flows on a regular basis. However, all participants who completed the Academy also provided pre- and post- KAP surveys and contributed to yarning circles to strengthen these findings.

The inaugural HOT NORTH Antimicrobial Academy filled a training, leadership and capacity building gap for clinicians working in Indigenous primary health care in regional and remote Australia. Pivoting to an entirely online format to continue despite the challenges of the COVID-19 pandemic have provided a low-cost opportunity to continue to run the Academy in future years in partnership with NACCHO. Participants and faculty developed a network of collegiality, support and sense of community needed to champion the next steps in regional, remote, and Indigenous inclusion in future National AMR Strategies.

Ethics

The Academy activities and evaluation were deemed a Quality Assurance project and received exemption by the Metro North Health Service Ethics and Research committee (Ref No: LNR/2021/QRBW/73799) and the Menzies School of Health Research human research ethics committee (HREC 2021—3963).

Authorship statement

ACB: Conceptualisation, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing — Original draft, Writing — Review and editing, Visualisation, Supervision, Funding acquisition. BS: Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing — Original draft, Writing — Review and editing, Visualisation, Supervision, Project Administration, Funding acquisition. DK: Methodology, Investigation, Writing — Review and editing, Visualisation. LE: Methodology, Investigation, Writing — Review and editing, Visualisation. AH: Methodology, Investigation, Writing — Review and editing, Visualisation. TM: Methodology, Investigation, Writing — Review and editing, Visualisation. RS: Methodology, Investigation, Writing — Review and editing, Visualisation. KVR: Methodology, Investigation, Writing — Review and editing, Visualisation. LA: Methodology, Investigation, Writing — Original draft, Writing — Review and editing, Visualisation, Supervision, Funding acquisition. MS: Methodology, Validation, Writing — Review and editing, Visualisation, Supervision, Funding acquisition. SYCT: Conceptualisation, Methodology, Formal analysis, Investigation, Writing — Review and editing, Visualisation, Supervision, Funding acquisition. TY: Conceptualisation, Methodology, Formal analysis, Investigation, Writing — Review and editing, Visualisation, Supervision, Funding acquisition.

Conflict of interest

The authors confirm there are no conflicts of interest to declare.

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