

MĀORI EXPERT VIEWS OF ANTIMICROBIAL RESISTANCE USING A ONE HEALTH APPROACH: A QUALITATIVE STUDY

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Abstract

Māori experience disproportionately worse outcomes from infectious diseases compared to non-Māori, and antimicrobial resistance (AMR) contributes to these inequities. The aim of the study reported in this article was to gain insight into Māori experts' perspectives on AMR using a One Health approach, which incorporates understandings of human, animal and environmental health. Qualitative methods were applied and were guided by principles of Kaupapa Māori research. Four themes were identified: (1) the importance of AMR education for Māori, (2) the connection of mātauranga Māori and AMR, (3) colonisation and its negative impacts on hauora Māori and (4) collaboration across spheres of health as a priority for Māori. Overall, the findings show a need for greater recognition of an approach to AMR that is grounded in te ao Māori. This focus should be a priority for government agencies and healthcare providers across Aotearoa New Zealand in order to work towards health equity for Māori in tackling AMR.

Keywords

antimicrobial resistance, hauora Māori, One Health, qualitative methods, Kaupapa Māori

Introduction

Antimicrobial resistance (AMR) is an ever-increasing threat to public health internationally and in Aotearoa New Zealand that affects our ability to effectively and efficiently treat and prevent

infectious diseases (Das & Horton, 2016; World Health Organization [WHO], 2001). AMR occurs when bacteria, fungi, viruses and parasites survive exposure to drugs that would have usually killed them through the development of drug-resistant

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strains (Davies & Gibbens, 2013). In Aotearoa, Māori experience worse health outcomes and higher health burdens due to infectious diseases compared with non-Māori (Baker et al., 2012; McNicholas et al., 2000). For example, the 2009 H1N1 influenza pandemic hospitalisation rates were three times higher for Māori compared to non-Māori (Baker et al., 2012). Likewise, Māori are more likely to experience rheumatic fever and its long-term consequences compared to non-Māori, and current national awareness programmes have had limited success in tackling these inequities (Anderson & Spray, 2020).

Understanding AMR is crucial for addressing emerging and existing inequities in infectious diseases experienced by Māori. However, little research has been conducted to explore Māori views on AMR, and no research has applied a One Health approach to understand Māori experts' perspectives on AMR, despite the synergies of this approach with te ao Māori. One Health is a transdisciplinary, multisectoral approach working at local, regional, national and global levels, and the primary goal of One Health is to achieve optimal health outcomes recognising the interconnection between the health of humans, animals, plants and their shared environments (Harrison et al., 2020; Walsh, 2018; Wester et al., 2017). Efforts within just a single domain of One Health cannot prevent or eliminate the problem of AMR; therefore, a coordinated One Health approach to AMR is needed to achieve better public health outcomes (WHO, 2001).

Antimicrobials encompass a broad range of products that act on microbes such as viruses, bacteria, fungi and protozoa, whereas antibiotics specifically target bacteria and treat bacterial infections (Das & Horton, 2016; WHO, 2001). Since the discovery of penicillin in 1928, antibiotics have been considered the “magic bullet” for combatting infections such as tuberculosis and pneumonia (Royal Australasian College of Physicians, 2016). It was not until the mid-1940s that penicillin became readily available in public hospitals and in the community in Aotearoa (Macindoe, 2015; Royal Australasian College of Physicians, 2016).

Antibiotics changed the way infectious diseases were treated, leading to improved survival rates for many illnesses (Macindoe, 2015). However, infections with antimicrobial-resistant organisms usually require treatment with more expensive and potent antibiotics, and come with higher risk of poorer clinical outcomes and mortality (WHO, 2014). The rapid development and spread of bacterial resistance to antibiotics is particularly

concerning (Davies & Gibbens, 2013), with untreatable bacteria such as methicillin-resistant *Staphylococcus aureus*, Enterobacteriaceae, and strains of pneumococcus now being regularly reported globally (Das & Horton, 2016; Ministry of Health and Ministry for Primary Industries, 2017; Singer et al., 2003; Thomas et al., 2014), and worldwide mortality rates due to AMR infections are projected to be up to 10 million annually by the year 2050 (O'Neill, 2016; Pullon et al., 2016; Thomas et al., 2014).

Bacterial resistance to common antibiotics for a range of common infections is becoming a significant threat to the human and animal populations of Aotearoa (Alley et al., 2002; Heffernan et al., 2011; Rupp & Fey, 2003; Thomas et al., 2014). Morbidity and mortality from infectious diseases are increasing in Aotearoa, and the potential of limited antibiotic options for these is therefore of concern to all those dispensing, prescribing and requiring antibiotics (Thomas et al., 2014). Moreover, inequities exist in the prevalence of AMR infections, which are more common among Māori compared to non-Māori (Ellison-Loschmann & Pearce, 2006; Gerrard, 2018; Ritchie et al., 2011). It is important to acknowledge that a tension exists in the literature with prescribing rates, antibiotic use and health outcomes for Māori as higher prescribing rates and antibiotic use do not always necessarily mean better health outcomes (Das & Horton, 2016; Hikaka et al., 2021; Metcalfe et al., 2018).

A core principle of One Health is that human health is intrinsically related to the health of animals and the environment as three interconnected domains of health (as depicted in Figure 1). Taking a One Health approach also helps recognise that multidisciplinary collaborations at a range of scales are imperative to tackle problems such as AMR (Binot et al., 2015; Harbarth et al., 2015; Laxminarayan et al., 2016; Robinson et al., 2016; WHO, 2001). Furthermore, governments and researchers are realising the importance of understanding the elaborate networks that link AMR with human, animal and environmental health (Ministry of Health and Ministry for Primary Industries, 2017; Pullon et al., 2016; WHO, 2001).

Addressing AMR as a One Health issue recognises that the health of people in relation to antibiotic use is connected to the health of animals and the environment (Laidlaw et al., 2018; Robinson et al., 2016; Wester et al., 2017). Antibiotics are commonly used in animal production in subtherapeutic doses over long periods (Singer et al., 2003). This contributes to AMR

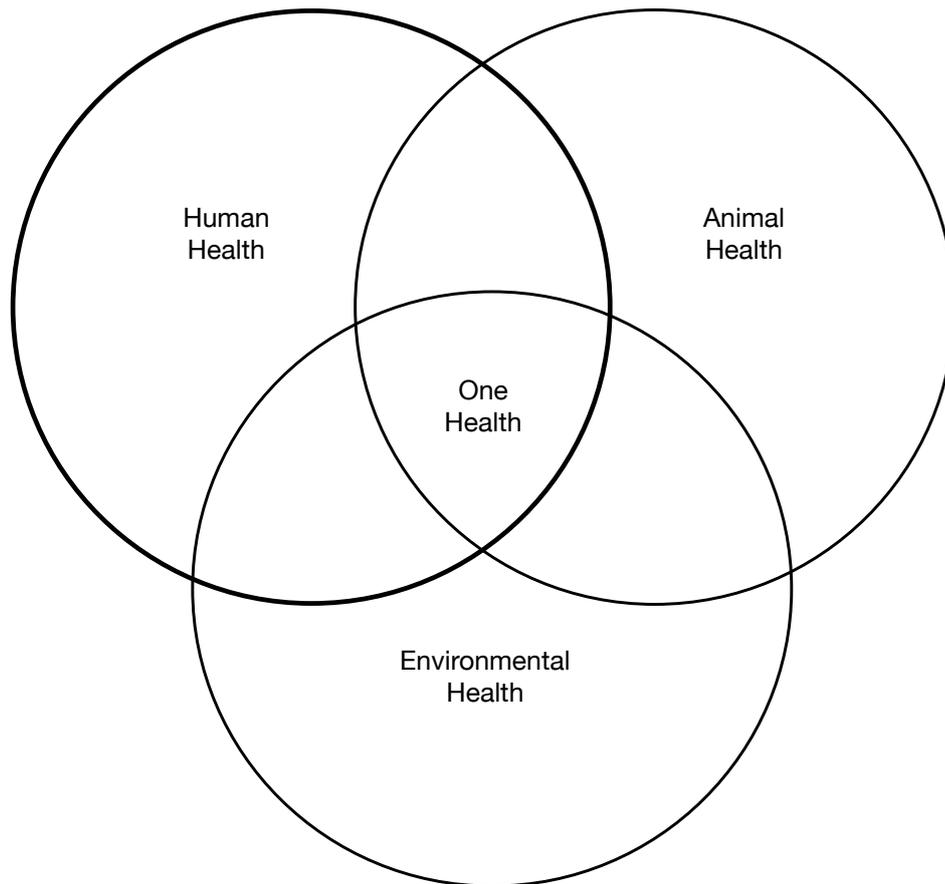


FIGURE 1 The One Health triad depicting the three interconnected domains of health (adapted from WHO (2001), with permission).

because these antibiotic use patterns create the ideal environment and conditions to select for bacteria with genes that confer resistance (Robinson et al., 2016; WHO, 2014). These genes can subsequently be transmitted to human-adapted pathogens, contaminated food or the environment (Harrison et al., 2020; WHO, 2001). Some antibiotics used in human and animal health are comprised of the same, or very similar, molecules and therefore their use could drive transmission of resistance between animals and humans, either directly or via the environment (Das & Horton, 2016; Singer et al., 2003). However, despite AMR being the quintessential One Health problem worldwide (Robinson et al., 2016), the relative contribution of human, animal and environmental domains in the creation and subsequent continuation of AMR infectious diseases is poorly understood (Binot et al., 2015).

A One Health approach has greatly contributed to our understanding of the spread and impact of widespread AMR infections on both human

and animal health across various community sectors, including hospitals, communities and aged care facilities (Walsh, 2018). The processing of human and animal waste is intrinsically related to the health of farmed animals (including fish) and the health of the environment (including rivers), as well as human health (Singer et al., 2003). Fortunately, Aotearoa raises a high proportion of farm animals on pasture, with the exception of the intensively housed poultry and pig industries, where antibiotics are still used in feed (Rossi & Garner, 2014; Sarmah et al., 2006). The level of antibiotic that remains in the animal must not exceed the maximum residue level set by the Ministry for Primary Industries (2023), which aims to ensure that any residues left in foods are at safe levels that are too low to contribute directly to AMR in human consumers. However, resistant organisms can still be passed to humans, and this is one of the main problems being tackled using a One Health approach.

The use of large amounts of antibiotics in animal farming can lead to environmental contamination through the application of contaminated waste on the land as fertiliser and the irrigation of crops with wastewater (Polianciuc et al., 2020). The types of antibiotics in food-producing animals and in human medicine are mostly the same, increasing the risk of emergence and spread of resistant bacteria causing infections in both humans and animals (Jechalke et al., 2014). Once in the environment, antibiotic residues can contaminate food and water and can lead to increasing the resistant bacteria (Polianciuc et al., 2020). Besides the risk of AMR in the environment, antibiotic residues can also be absorbed by plants, interfering with the physiological processes and causing potential toxicological effects (Küster & Adler, 2014). The role of the environment in the spread of AMR infections is also increasingly being recognised. Environmental scientists and regulators, such as the Environmental Protection Agency in Aotearoa and similar bodies internationally, monitor and control many of the pathways for the release of resistance-driving chemicals (like antibiotics) into the environment (Singer et al., 2016). Environmental scientists and regulators therefore also have a role in understanding and tackling AMR.

There has been surprisingly limited attention to AMR in research conducted in Aotearoa. However, two mixed-methods studies have explored different ethnic groups' understandings of, and reasons for the use of, antibiotics in the country (Norris et al., 2009; Norris et al., 2010). Norris et al.'s (2009) study aimed to examine the reported use of antibiotics amongst Samoan people, of whom there are approximately 130,000 in Aotearoa. Sixty per cent of these were born in Aotearoa (Norris et al., 2009). The study by Norris et al. (2009) also aimed to explore how the participants understood antibiotics, with one key finding being that antibiotics were often confused with paracetamol and other analgesics. In a subsequent study, Norris et al. (2010) found that interventions to improve the use of antibiotics needed to be pitched at a very basic level of knowledge, and a more targeted approach towards particular ethnic groups was needed, particularly for those whose home countries have antibiotics available without a prescription. In our literature search, we found only one Māori-specific study that explored Māori experiences and beliefs concerning antibiotics and AMR (Hika et al., 2022). However, it should be noted that this study was limited in scope, as it primarily focused on acute upper respiratory tract

symptoms and was conducted within a single clinic (Hika et al., 2022).

It is well established that major health inequities exist for Indigenous populations throughout the world (WHO, 2014). Māori experience many health inequities compared to non-Māori (Came et al., 2021; Ellison-Loschmann & Pearce, 2006; Rahiri et al., 2018; P. Reid & Robson, 2007), including many infectious diseases requiring a longer course and higher doses of antibiotics and other medicines to treat (Hika et al., 2022; Thomas et al., 2014). Data obtained from general practices and community pharmacies throughout Aotearoa in 2015 showed overall rates of community antibiotic dispensing were higher for Māori than for other ethnic groups (Whyler et al., 2018). This finding is in contrast with a 2011 study that found lower dispensing rates for Māori in a geographically isolated region (Norris et al., 2011). Antibiotic use and dispensing vary, with some studies reporting that Māori are less likely to receive a prescription for antibiotics and receive smaller quantities of antibiotics compared to non-Māori (Norris et al., 2011; Walls et al., 2015). Whyler et al. (2018) also found antibiotic dispensing rates to be higher for people living in more socioeconomically deprived areas, supporting the findings of two previous studies in Aotearoa (Hobbs et al., 2017; Walls et al., 2015).

Based on the above literature, there is a pressing need to hear from Māori experts in human, animal and environmental health about AMR through their lived professional and personal experiences. The aim of the study reported here was to develop insight into Māori experts' perspectives on AMR using a One Health approach to human, animal and environmental health within the current cultural and political context of Aotearoa. The study specifically explored how Māori experts view AMR in their line of work, their understandings of AMR, and their perspectives on how AMR affects not only them, but their whānau and wider communities.

Methods

A qualitative design was applied in order to explore Māori experts' views on AMR using a One Health approach guided by Kaupapa Māori methodology (Cram et al., 2018; Pihama et al., 2002; Walker et al., 2006). Māori participants who work in one of the three domains of One Health (human, animal or environmental health) were approached to share their perspectives of AMR through their lived experiences (both professional and personal). The research specifically

explored how Māori experts viewed AMR in their line of work, understandings of AMR, and how AMR affects not only the participants, but their whānau and the wider communities.

In addition to taking a One Health approach, this study was guided by principles of Kaupapa Māori research (Pihama et al., 2002; Smith, 2013; Walker et al., 2006). Kaupapa Māori research seeks to avoid deficit theories of health inequities or victim-blaming models of illness being applied to an already marginalised population (P. Reid & Robson, 2007). A Kaupapa Māori approach also ensured the research valued and respected te ao Māori and mātauranga Māori. Kaupapa Māori research has been defined broadly as research “by Māori, for Māori and with Māori” (Smith, 1999). This study was led by a Māori clinician (SC) whilst studying part time for a Master of Public Health qualification (Carrington, 2022), with a Māori primary supervisor (EW). Māori consultation was conducted through the University of Otago’s process via the Ngāi Tahu Research Consultation Committee providing advice on proposals. Ethical approval was received from the University of Otago Human Ethics Committee (Ref. D18/395).

As noted above, the Māori experts who were interviewed all worked in one of the domains of human, animal or environmental health. Nine participants agreed to participate and were interviewed. Eight interviews were conducted virtually, and one interview was conducted face-to-face at the participant’s workplace. Interviews lasted between 44 and 101 minutes. In keeping with a Kaupapa Māori approach (Pihama et al., 2002), all interviews began with whakawhanaungatanga and the option of having a karakia. The expertise of the nine participants covered the three domains of One Health, with five having expertise in human health, one in animal health and three in environmental health. Participants identified as belonging to various iwi and hapū throughout Aotearoa.

The study was conducted within a Kaupapa Māori framework (Pihama et al., 2002; Walker et al., 2006), with the underpinning aim to consider and preserve Māori values, attitudes and beliefs (for more information, see Carrington, 2022). A qualitative interview design was most congruent for this present study, due to the capacity of qualitative research to generate rich and detailed descriptions of meaning and experience (Denzin & Lincoln, 2011). A phenomenological qualitative research approach was taken as this is an effective way to understand participants’ experiences and to gain insights about people’s actions and motivations (Alase, 2017; Lester, 1999; Palmer et al.,

2010). Such an approach is also suitable for hearing about ways of challenging conventional wisdom and cutting through long-held assumptions about AMR (Alase, 2017; Lester, 1999; Ofahengaue Vakalahi & Taiapa, 2013). The audio-recorded interviews were transcribed verbatim and Braun and Clarke’s (2006) six-phase process of inductive thematic analysis was applied.

Results

Four themes were identified from the thematic analysis (Braun & Clarke, 2006) of the nine interviews with Māori experts: (1) the importance of AMR education for Māori, (2) the connection of mātauranga Māori and AMR, (3) colonisation and its negative impacts on hauora Māori, and (4) collaboration across spheres of health as a priority for Māori. These themes are discussed in further detail below, with a selection of supporting quotes from participants provided.

Theme 1: The importance of AMR education for Māori

The first theme addresses how the Māori experts raised the need for education about AMR and appropriate uses of antimicrobials that speaks to Māori. Participants commented that AMR is not really discussed as Māori often face health issues they consider higher priority than taking antibiotics for what might be thought to be minor infections:

I don’t think [Māori are] very aware of [AMR] at all . . . but actually from the Māori community in general [AMR is] not something that anyone ever talks about. Other concerns around health are bigger than taking antibiotics for an infection. (Expert 1, Human Domain)

There was concern among participants that the healthcare system and social structures of Aotearoa are contributing factors to a lack of education and knowledge about AMR infections and antibiotics for Māori, particularly with regard to making an informed decision about the medicines they should be prescribed and which are used to treat infections:

[P]oor people that are probably on an equal level have no understanding of [AMR] unless they’re exposed to it. And I don’t know that our health system does a good job on informing, well providing, information so that people can understand [AMR] and make an informed decision. (Expert 5, Environmental Domain)

Misinformation about medicines, particularly antibiotics, was raised as a concern by some participants. Relying on untrustworthy online sources of information about medicines was seen as having a detrimental effect on ensuring timely access to effective treatments for illnesses for Māori:

I think education probably has a big part to play, misinformation, so if you just look at the whole issue with the measles stuff and the vaccinations, you know. So people get their information from Facebook now, or misinformation from Facebook, and are less likely to read a medical journal article on the effectiveness of a particular, um, antibiotic, or the reasons why you would have an antibiotic. (Expert 8, Human Domain)

Theme 2: The connection between mātauranga Māori and AMR

The second theme addresses the connection between mātauranga Māori and disease management that was evident in participants' explanations of AMR. For example, one of the human health experts discussed in detail how they apply mātauranga Māori to their work, which enables them to create new concepts and ideas. They rejected the idea that mātauranga Māori is dated; rather, they saw it as a process of Māori applying knowledge they have from being Māori which enables them to make sense of their own world:

So we don't see that Māori knowledge [in the field of science], and it's just the way that Māori perceive everything and understand their world and comprehend their world and it could involve science, how Māori actually start to define that. That's what mātauranga Māori is and there's no . . . it's dynamic and it's evolving and there's no timeline so a lot of people get caught up with just talking about there is traditional knowledge and there is ancient knowledge, and then we've got historic Māori knowledge and then we're got contemporary knowledge too so Māori are adding to that knowledge base all the time. It hasn't stopped. And they will use that to make sense of their world, and it's a great effusion, amalgam of knowledge and ideas now [more] than it used to be, so it's come from the traditional into now. (Expert 4, Environmental Domain)

This "making sense" of knowledge that informs Māori ways of being and doing also includes making sense of AMR. Another participant described how a "scientific way of thinking" is increasingly aligned with mātauranga Māori:

[W]ell I think that, ah, what's happening is that the science is catching up to the mātauranga Māori way of thinking . . . in that through whakapapa, everything is connected, or maybe in the natural environment anyway. Things are connected. (Expert 8, Human Domain)

Mātauranga Māori was described by participants as Māori knowledge, Māori wisdom, Māori understanding and Māori skills. Participants noted that mātauranga Māori, in its simplest form, is about a Māori way of being and engaging in the world and uses kawa and tikanga to critique, examine, analyse and understand the world. Mātauranga Māori was also broadly defined by participants as being not only traditional knowledge but also contemporary knowledge; it is knowledge that changes and adapts with time. A common pattern was that mātauranga Māori has long involved knowledge relating to disease management, particularly relating to the dead and dying. One of the human health experts discussed how there were no Western medicines in Aotearoa before colonisation, so when someone had died and the body had been buried in the urupā, the washing of hands was done to cleanse away the tapu of the deceased and their tīpuna in the urupā. This participant noted that the washing of hands before and after entering the urupā is still a practice occurring today, with the origins of this practice related to sanitation purposes:

If I was working in an area where I knew there was a disease prevalent, have the potential to pass between one species and another, I might be a little bit more careful. Same as our ancestors would've been when they were burying people in the urupā. So whenever you come out of an urupā you always wash your hands to wash off the tapu, but I always look at that and think well actually the reason we're getting you to wash your hands is there were no medicines 200 years ago when you carried a dead person up and put them into the urupā and bury them . . . the likelihood of you picking up the disease or contamination or virus or whatever on that person is pretty high. (Expert 5, Environmental Domain)

Theme 3: Colonisation and its negative impacts on hauora Māori

The third theme addresses participants' explanations of how colonisation is one of the major drivers of health inequities for Māori in Aotearoa, including for AMR infections. Participants'

understanding of the ongoing impact of colonisation for Māori also helped frame discussions and thinking of ways in which to “break the negative cycle” for Māori within their own line of work. These ways include incorporating Māori perspectives at decision-making levels around health policy and Māori health initiatives to help face challenges like AMR. Some participants go above and beyond their job description to ensure that Māori understand and have better acceptance of medicines and healthcare services:

So I quite like to get involved a lot in the community aspect and actually get people’s perspectives on how they perceive medicines anyway, to try and encourage them and empower them to actually have them and why they’re important for their health overall. Or, if they’re not, or even if they don’t need them, yeah cos that happens too. (Expert 7, Human Domain)

Participants also discussed how colonisation has had long-lasting negative intergenerational health impacts for Māori in terms of spiritual, mental and physical hauora. They explained that not only does colonisation continue to contribute to poorer Māori health outcomes, including AMR infections, it also means loss of resources, loss of mana, and loss of dignity for Māori, even today:

[T]here it’s all about colonisation, loss of land, they just, it’s almost like it’s affected us so much that we find it hard to address other health issues cos we’re still going through this thing about what colonisation’s done to us. We’ve lost our land, we’ve lost our resources, we’ve lost our mana, lost our dignity. You get this going on . . . and it’s almost like it’s affecting our health all the time and it’s in the background. (Expert 4, Environmental Domain)

Theme 4: Collaboration across spheres of health as a priority for Māori

The fourth and final theme addresses participants’ arguments that ensuring collaboration using a One Health approach should be a priority for Māori. Some participants had prior knowledge of One Health and a One Health approach. One participant considered that a One Health approach was about encompassing more integration and collaboration across the three domains when it comes to the health and wellbeing of Māori:

So wellbeing is even wider and most Māori tend to talk about wellbeing rather than just health. We

see health as limited and, yeah, and that’s really where we’re coming from and where I see a One Health approach being really important, sort of almost like a movement towards more integration, collaboration. (Expert 4, Environmental Domain)

Participants considered having a One Health approach to AMR for Māori as a more holistic and collaborative way of interpreting health. They also noted that AMR is a complex and very real threat worldwide. They argued that utilising this kind of integrated approach will give a better understanding about the complexities of AMR, rather than it being understood as only a human issue:

You know in terms of One Health I think the approach is probably, yeah, it’s something that’s needed. Um . . . and I really kind of commend you know, people who are in this space, who are actually trying to develop a network, develop the thinking around, you know, holistic way of um looking at health . . . Cos I think it’s difficult to kind of have that integrated approach across all those three domains. Cos, ah, the kaupapa is huge. You know it’s bigger than all of us and so it probably needs a multidisciplinary approach, to do it, and someone to help co-ordinate it. Ah, cos you know the GPs can get kind of caught up in that stuff and environmental scientists just kind of doing our stuff and um, and kaitiaki might be doing their own thing and you know, this is all related, you know this antimicrobial stuff is related. (Expert 8, Human Domain)

Discussion

This study provides novel insights into Māori experts’ views about AMR grounded within a One Health approach to the domains of human, animal and environmental health. Integrated approaches like One Health are gaining more recognition globally (as well as in Aotearoa) as an effective way to approach and consider health issues at the human-environment interface, including zoonotic diseases like COVID-19 (Harrison et al., 2020). The findings show how experts across these domains are actively advocating for te ao Māori approaches to AMR across themes about the importance of AMR education for Māori, the connection of mātauranga Māori and AMR, colonisation and its negative impacts on hauora Māori, and collaboration across spheres of health as a priority for Māori. Overall, the findings show a need for greater recognition of an approach to AMR that is grounded in te ao Māori.

The Māori experts interviewed for this study who work as antibiotic prescribers and dispensers are looking after Māori patients using an approach that applies the concept of whānau ora in order to support the hauora of whānau and tackle inequities in infectious illnesses. In 2010, the Whānau Ora policy was created in Aotearoa in response to recognition by government that “standard ways” of delivering social and health services were not working, and outcomes, particularly for Māori, were not improving (Durie et al., 2010). A whānau ora approach to healthcare focuses on the whānau as a whole and addresses individual needs within the context of the whānau (Dormer, 2014; Kara et al., 2011; Kidd et al., 2010). A whānau ora approach to healthcare is becoming more established, particularly within the primary healthcare sector, with many healthcare providers employing specific Whānau Ora policy workers who work with individuals as well as the wider whānau (Kara et al., 2011; Kidd et al., 2010). The findings of this present study strongly support and reiterate that Māori need a more “Māori-centric” approach when it comes to tackling and eliminating AMR for Māori.

In Aotearoa, there is a persisting relationship between institutional racism and whether Māori receive good, quality and timely healthcare (Came et al., 2018; Graham & Masters–Awatere, 2020; Harris et al., 2019; Leitch et al., 2021; J. Reid et al., 2016; Shaio, 2021). The participants in this research who worked in the human health domain had observed institutional racism within the wider health system in Aotearoa and in their own personal lives, including their place of employment. They described how such incidents lead to inequitable health outcomes for Māori and that this is a by-product of the ongoing effects of colonisation.

All healthcare professionals in Aotearoa need to be culturally safe and culturally competent when treating Māori and whānau (Curtis et al., 2019; DeSouza, 2008; Ramsden & Whakaruruhau, 1993). There is growing recognition of the importance of cultural safety and cultural competency at the individual health practitioner and organisational levels to achieve equitable healthcare in Aotearoa (Curtis et al., 2019; DeSouza, 2008; Pitama et al., 2011). Health practitioners, healthcare organisations and health systems should be engaged in working towards cultural safety and critical consciousness to find solutions to health inequities (Curtis et al., 2019).

Based on the findings of this study, a One Health approach to AMR is a useful way for Māori and tauwiwi to better understand and grasp

the seriousness of AMR. Fostering a collaborative setting which brings together Māori health, Māori animal and Māori environmental experts to discuss and implement strategies which will tackle a serious health issue like AMR, while operating under a whānau ora approach, is long overdue. Ensuring that each of the One Health domains can contribute to the wider AMR solution could mean that AMR infections are detected and treated earlier. Mātauranga Māori relating to disease management and AMR needs greater recognition by the wider scientific community, decision makers and policy teams.

Conclusion

The findings from this qualitative study illustrate how culturally appropriate education about AMR is important for Māori as part of achieving health equity in Aotearoa. In addition, the findings suggest that clinical education is needed to help tauwiwi health practitioners develop the skills needed to be more culturally safe to enable better health outcomes for Māori, including reduced impact of AMR. Applying a Kaupapa Māori approach, like Whānau Ora, in parallel with a One Health approach to AMR, is needed to minimise the impact of AMR for Māori in Aotearoa. Overall, greater recognition of a One Health approach to AMR grounded in te ao Māori should be a priority for government and health organisations in Aotearoa.

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Glossary

atua	gods, deities
hapū	kinship group, subtribe
hauora Māori	Māori health
iwi	extended kinship group, tribe
kaitiaki	guardian, minder; custodian over natural resources
karakia	to recite ritual chants, prayer

kaupapa	topic, matter for discussion, agenda, subject	<i>Science & Medicine</i> , 247, Article 112798. https://doi.org/ghp4zs
Kaupapa Māori	Māori approach, Māori customary practice	Baker, M. G., Barnard, L. T., Kvalsvig, A., Verrall, A., Zhang, J., Keall, M., Wilson, N., Wall, T., & Howden-Chapman, P. (2012). Increasing incidence of serious infectious diseases and inequalities in New Zealand: A national epidemiological study. <i>The Lancet</i> , 379(9821), 1112–1119. https://doi.org/f2fr9t
kawa	rituals and customs, particularly for opening a new house	Binot, A., Duboz, R., Promburom, P., Phimpraphai, W., Cappelle, J., Lajaunie, C., Goutard, F. L., Pinyopummintr, T., Figuié, M., & Roger, F. L. (2015). A framework to promote collective action within the One Health community of practice: Using participatory modelling to enable interdisciplinary, cross-sectoral and multi-level integration. <i>One Health</i> , 1, 44–48. https://doi.org/gg2rfx
mana	prestige, authority, control, power, influence	Came, H., Doole, C., McKenna, B., & McCreanor, T. (2018). Institutional racism in public health contracting: Findings of a nationwide survey from New Zealand. <i>Social Science & Medicine</i> , 199, 132–139. https://doi.org/gdfspn
mātauranga Māori	Māori knowledge, originating from ancestors, Māori worldview and perspectives	Came, H., Herbert, S., & McCreanor, T. (2021). Representations of Māori in colonial health policy in Aotearoa from 2006–2016: A barrier to the pursuit of health equity. <i>Critical Public Health</i> , 31(3), 338–348. https://doi.org/ghrzsb
tapu	restrictions, under atua protection	Carrington, S. D. (2022). <i>Using a One Health approach to explore Māori experts views on antimicrobial resistance: A qualitative study</i> [Master's thesis, University of Otago]. OUR Archive. http://hdl.handle.net/10523/12844
tauīwi	outsider, foreigner, European, colonist, non-Māori	Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. <i>Qualitative Research in Psychology</i> , 3(2), 77–101. https://doi.org/fswdxc
te ao Māori	a Māori worldview	Cram, F., Pipi, K., & Paipa, K. (2018). Kaupapa Māori evaluation in Aotearoa New Zealand. <i>New Directions For Evaluation</i> , 2018(159), 63–77. https://doi.org/ghj2b6
tikanga	customary system of values and practices that have developed over time and are deeply embedded in the social context	Curtis, E., Jones, R., Tipene-Leach, D., Walker, C., Loring, B., Paine, S.-J., & Reid, P. (2019). Why cultural safety rather than cultural competency is required to achieve health equity: A literature review and recommended definition. <i>International Journal for Equity in Health</i> , 18(1), 1–17. https://doi.org/ghrzwg
tīpuna	ancestors	Das, P., & Horton, R. (2016). Antibiotics: Achieving the balance between access and excess. <i>The Lancet</i> , 387(10014), 102–104. https://doi.org/gjtb8d
whakapapa	genealogy, lineage, descent	Davies, S., & Gibbens, N. (2013). <i>UK Five Year Antimicrobial Resistance Strategy 2013 to 2018</i> . Department of Health. https://www.gov.uk/government/publications/uk-5-year-antimicrobial-resistance-strategy-2013-to-2018
whakawhanaungatanga	process of establishing relationships	Denzin, N. K., & Lincoln, Y. S. (2011). <i>The SAGE handbook of qualitative research</i> . SAGE.
whānau	family, including extended family	DeSouza, R. (2008). Wellness for all: The possibilities of cultural safety and cultural competence in New Zealand. <i>Journal of Research in Nursing</i> , 13(2), 125–135. https://doi.org/bb6vph
Whānau Ora	an official approach that places families at the centre of service delivery (capitalised to reflect the name of formal policy)	Dormer, R. (2014). Whānau Ora and the collaborative turn. <i>International Journal of Public</i>
urupā	burial ground	

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