Resurgence of rheumatic fever among Pacific peoples in Aotearoa New Zealand: A 2010–2023 analysis of hospitalisation data with implications for equity policy

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Abstract

Objective: The objective of this study was to assess ethnic, geographic and socioeconomic patterns in acute rheumatic fever and rheumatic heart disease hospitalisations in New Zealand (2010–2023), evaluate the impact of public health interventions and identify gaps in national surveillance.

Methods: National hospitalisation and mortality data were analysed by ethnicity, socioeconomic deprivation and geography, including Counties Manukau and the Ōtara-Papatoetoe Locality. Negative binomial models estimated adjusted risk differences across three time periods.

Results: Acute rheumatic fever was disproportionately concentrated among Māori and Pacific peoples in the most socioeconomically deprived areas, with Pacific populations—particularly in Counties Manukau—experiencing the highest burden. Acute rheumatic fever declined among Māori during the Rheumatic Fever Prevention Programme but not among Pacific peoples. A sharp, temporary decline in acute rheumatic fever and rheumatic heart disease hospitalisations occurred among Pacific populations during the COVID-19 pandemic, followed by resurgence by 2023.

Conclusions: Persistent ethnic and geographic inequities in acute rheumatic fever and rheumatic heart disease reflect ongoing surveillance gaps, inconsistent notification practices and uneven implementation of interventions. National targets remain unmet, and inequities are widening for some groups.

Implications for Public Health: Robust, standardised surveillance systems and equity-focused interventions—particularly for Pacific communities in Counties Manukau—are essential to reducing the preventable burden of acute rheumatic fever and rheumatic heart disease in Aotearoa New Zealand.

Key words: rheumatic fever, Pacific population, Aotearoa New Zealand, health disparities, COVID-19 impact, national surveillance

Introduction

Acute rheumatic fever (ARF) is a preventable autoimmune reaction to group A *Streptococcus* (GAS) infection, leading to carditis in 35–72% of cases and subclinical carditis in 18%.[1] While early secondary prophylaxis may reverse some cases, many develop into rheumatic heart disease (RHD), causing permanent heart valve damage.[2] Progression risk increases with recurrent ARF and is shaped by social factors like overcrowding, limited healthcare access and systemic inequities.[3]

Though rare in high-income countries, ARF remains a serious and inequitable health issue in New Zealand. National incidence is 14 times the Organisation for Economic Co-operation and Development

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(OECD) average and up to 44 times higher among Māori and Pacific children.[4] Between 2010 and 2016, RHD caused an average of 143 deaths annually (3.4 per 100,000 people aged under 70 years), with Māori and Pacific peoples facing mortality rate-rations of 12.3 and 11.2, respectively, compared to Europeans/others—reflecting deep structural inequities.[3,5] For comparison, cervical cancer—another preventable disease with a longstanding, targeted national screening programme— causes 53–81 deaths per year.[6]

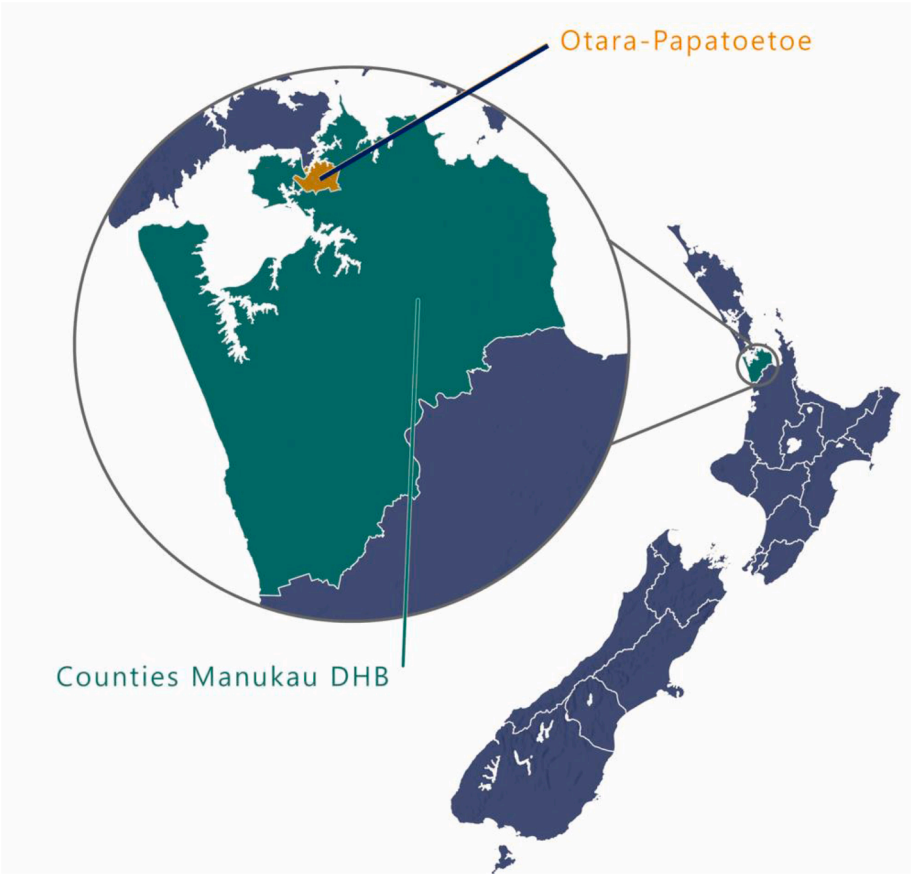
The NZ government launched the Rheumatic Fever Prevention Programme (RFPP) in 2011, investing NZD $65 million between 2012 and 2017 to support primordial and primary prevention of ARF in high-incidence areas.[4]

Implemented across 11 high-incidence District Health Boards (DHBs), the programme aimed to reduce ARF through three main strategies: reducing household crowding (linked to facilitating access to adequately sized housing for at-risk families), delivering timely treatment of GAS pharyngitis in individuals at a high risk for ARF[7] (mainly via school-based clinics) and increasing public awareness. The RFPP was part of the Better Public Services initiative, aiming to break down agency silos by promoting measurable outcomes and cross-sector collaboration, which set a target to reduce ARF incidence to 1.4 per 100,000 people by June 2017.[8]

By 2016, a 28% national decline in ARF incidence (from 4.0 to 2.9 per 100,000 in 2009–2011) was reported.[9] While this was attributed to "multiple interventions working in concert", the lack of built-in evaluation, national standard operating procedures and consistent implementation across DHBs limited clarity on which components drove the decline.[9] Although the RFPP officially ended in 2017, annual funding continued.[10] Nevertheless, this initial progress was not sustained. Long-term trends show persistent inequities: incidence declined among Europeans, remained stable for Māori and increased among Pacific peoples—particularly in South Auckland's Counties Manukau District, where socioeconomic deprivation is concentrated.[5] RHD mortality also declined overall but less so for Pacific populations, highlighting gaps in the programme's reach and effectiveness.[5]

The 2022 Pae Ora (Healthy Futures) Act restructured New Zealand's health system, disestablishing the 20 DHBs and consolidating services under Health New Zealand (HNZ) (Te Whatu Ora) and a new Public Health Agency within the Ministry of Health.[11] With a strong equity mandate, the reforms aim to align centralised planning and commissioning with locally responsive implementation through the creation of "localities"—defined geographic areas where HNZ works with iwi-Māori partnership boards and communities to develop long-term health plans. This integrated approach has the potential to strengthen rheumatic fever control through consistent national public health guideline implementation, improved surveillance and service delivery tailored to local needs. Localities such as Ōtara-Papatoetoe, one of 12 prototype Localities established in 2022 within the former Counties Manukau District (Figure 1) where ARF control is prioritised, offer a concrete opportunity to implement and evaluate how well-aligned central coordination and local action can improve health outcomes and equity.

Figure 1: Map of Aotearoa New Zealand with Counties Manukau District and Ōtara-Papatoetoe locality area.



DHB = District Health Board.

Table 1: Characteristics of patients with first episodes of acute rheumatic fever (ARF) in hospital discharge data 2010–2023 in three geographic areas: 1) New Zealand, 2) Counties Manukau district and 3) Ōtara-Papatoetoe locality for Aotearoa New Zealand residents and citizens.

	National hospitalisations N (%)	Counties Manukau hospitalisations N (%)	Ōtara-Papatoetoe hospitalisations N (%)
Total	1,997	681 (34)	165 (8)
Sex			
Female	876 (44)	326 (48)	80 (48)
Male	1,121 (56)	355 (52)	85 (52)
Age groups[a]			
0–3	0	0	0
4–19	1,585 (79)	532 (78)	128 (78)
3–35	1,908 (96)	667 (98)	163 (99)
>35	89 (4)	14 (2)	-[c]
Prioritised ethnicity[b]			
Pacific peoples	894 (45)	463 (68)	139 (84)
Samoan	465 (23)	255 (37)	76 (46)
Tongan	218 (11)	112 (16)	33 (20)
Cook Island Māori	109 (5)	67 (10)	24 (15)
Niuean	36 (2)	23 (3)	6 (4)
Tokelauan	19 (1)	6 (1)	
Fijian	13 (1)		
Pacific other	34 (2)		
Māori	967 (48)	196 (29)	24 (15)
Non-Māori/non-Pacific peoples	135 (7)	22 (3)	-[c]
Missing	-[c]	0	0
NZ deprivation index (quintiles)[d]			
Q1 (least deprived)	52 (3)	10 (1)	0
Q2	119 (6)	22 (3)	0
Q3	145 (7)	20 (3)	0
Q4	371 (19)	81 (12)	15 (9)
Q5 (most deprived)	1,304 (65)	548 (80)	150 (91)
Missing	6 (0)	0	0

Notes:
[a]Preventive sore throat management is focused on people aged 3–35 years, with an emphasis on children and adolescents 4–19 years old.[19]
[b]The priority order for ethnicity is Māori, Pacific peoples and non-Māori/non-Pacific peoples. The priority order within Pacific peoples is Tokelauan, Fijian, Niuean, Tongan, Cook Island Māori, Samoan, Other Pacific Island and Pacific Island (not further defined).
[c]Counts less than 4 are suppressed.
[d]NZDep has been assigned based on either the 2013 or 2018 census data depending on which is closer to the year of discharge.

To support this evolving public health landscape, we analysed national clinical data to assess how ARF and RHD outcomes can be monitored at the locality level. We examined hospitalisation and mortality patterns to evaluate how surveillance can inform equitable, locally responsive service planning under Pae Ora.

Methods

This descriptive study utilises routinely collected national hospitalisation and mortality data in accordance with the "Strengthening the Reporting of Observational Studies in Epidemiology" reporting guideline.[12]

First, we described the characteristics of patients registered with a first episode of ARF using hospital discharge data from 2010 to 2023, at the national level, in the Counties Manukau District and in the Ōtara-Papatoetoe Locality (Figure 1). As national clinical standards require that all cases of ARF be hospitalised for diagnostic confirmation and management, hospital discharge data provide a near-complete representation of ARF incidence.[13] Next, we plotted the rates of first hospitalisations for ARF and RHD from 2010 to 2023, as well as RHD mortality rates from 2010 to 2021, for New Zealand and Counties Manukau District. The Ōtara-Papatoetoe Locality was excluded from this analysis due to small numbers.

We analysed trends in ARF and RHD rates by comparing discharge counts across three time periods: 2010–2014, 2015–2019 and 2020–2023, both nationally and within Counties Manukau. Finally, we compared incidence rates of first ARF hospitalisations 2018–2023 between the three geographic areas.

Data and variables

Hospitalisations

Three datasets were obtained from HNZ. These included publicly and privately funded hospital discharge data for 1) ARF (390-392, ICD-9-AM) and 2) RHD (394-398, ICD-9-AM) cases from 1988 to 2023 and 3) mortality data for RHD cases (394-398, ICD-AM) from 1988 to 2018. This also included socio-demographic data and the domicile information of cases, which were used to assign cases to the Counties-Manukau District and/or the Ōtara-Papatoetoe Locality or otherwise. In addition, mortality counts for RHD for 2019–2021 were obtained from the HNZ mortality website, but these data were only available at the district level. [14]

Case selection

Cases were included if they had their first hospital discharge during the analysis period. An ARF case was included if there was no ARF discharge before 2010 and the event represented the first discharge after 2010. Cases with an RHD discharge more than three months before their first ARF discharge were excluded. Borderline cases were reviewed to determine whether the ARF and RHD events were part of the same hospital admission.

An RHD case was included if there was no prior RHD discharge before 2010, the first discharge occurred after 2010 and the individual was under 70 years of age at the time of discharge. We excluded RHD cases aged 70 years or older because ICD codes are considered less specific for RHD in older populations.[5]

Variables

Ethnicity was the main variable of interest. It was recorded as prioritised ethnicity at level 2, which assigns a unique ethnicity based on a predefined hierarchy. The level 1 prioritisation is Māori, Pacific peoples, Asian, Middle Eastern, Latin American and African, European New Zealanders and "Other".[15] For analysis, the latter four groups were combined due to small numbers. Within each level 1 ethnic group, there are more detailed subcategories (level 2). For Pacific peoples, these level 2 subcategories (e.g. Samoan, Tongan and Cook Islands Māori) were retained in the analysis, using the Ministry of Health's standard prioritisation rules. The New Zealand Deprivation index (NZDep), a census-derived measure applied to a small

geographical area,[16] was assigned to each case based on case's area of residence and the applicable census year (2013 or 2018), depending on the discharge year.

Population data

Population data from HNZ "best-available" population series were used to calculate rates for different geographic areas including Health Districts and Localities.[17] The series is based on the 2018 census and provides population estimates where data are available and projections where needed—for example, between censuses or in the years following the most recent census while data are not yet available.

The Counties-Manukau Health District refers to the area formerly covered by the Counties-Manukau DHB, which was responsible for delivering public health and health services in that region. Although DHBs have since been abolished, the Health Districts themselves remain important units for monitoring health outcomes. The Ōtara-Papatoetoe Locality was defined by HNZ using a combination of 2013 Census Area Units. Corresponding population data were based on a combination of "2018 Statistical Area 2" units (SA2s), as defined by Statistics New Zealand.[18] The latter method of defining the locality closely approximated the former version, with minor boundary differences. SA2-level data allowed for stratification by age and ethnicity, and each SA2 could be assigned a unique NZDep quintile.

Statistical methods

Incident counts and rates of ARF per 100,000 population were tabulated for 2010–2023. Incident counts and rates per 100,000 people aged under 70 years were tabulated for RHD discharges (2010–2023) and RHD mortality (2010–2021). Rates were plotted over time for New Zealand and the Counties-Manukau District.

Negative-binomial models with a log link and a population offset were used to compare ARF and RHD discharge counts across three periods: 2010–2014, 2015–2019 and 2020–2023, with the final period including the COVID-19 pandemic. A population offset was included in each model and was defined as the log of the relevant population multiplied by 100,000. Exponentiated coefficients were interpreted on the same scale as incident rates per 100,000 population.

Incident counts and rates of ARF were tabulated for the Ōtara-Papatoetoe Locality for 2018–2023, a restricted time frame due to population data availability. A Negative Binomial model with log link and population offset, as described previously, was used to compare ARF rates in the Ōtara-Papatoetoe Locality with 1) the rest of the Counties-Manukau District and 2) New Zealand outside Counties Manukau District. Prioritised ethnicity and NZDep quintiles were included as confounding variables. The outcome variable was the count of ARF events per area.

Results

ARF hospitalisations in New Zealand, Counties Manukau District and Ōtara-Papatoetoe Locality 2010–2023

Between 1 January 2010 and 31 December 2023, 2,182 cases with a first episode of ARF were recorded in hospitalisation discharge data, including 31 cases from private hospitals. Of these first-episode cases, 185 were non-residents/non-citizens, which included nearly all private hospital discharges. Of the 185 non-residents/non-citizens, 132 (71%) were Pacific and 43 (23%) were Māori. The remaining 1,997 cases are included in our analysis (Table 1). No cases were recorded in children under 3 years of age. The majority (80%) were aged 19 years or younger, and 96% were aged 3–35 years. Almost half (45%) of the cases were of Pacific ethnicity, 48% were Māori and 7% were of other ethnicities. Sixty-five percent lived in the lowest socio-economic areas of the country. Among cases over 35 years of age, ethnicity and deprivation were more evenly distributed (Supplementary Table 1).

A third (34%) of all cases were geographically located in the Counties Manukau District, and 165 (8 %) were from the Ōtara-Papatoetoe Locality. While the age distribution was similar across all three areas, the proportion of Pacific cases rose to 68 % in Counties Manukau and 84 % in Ōtara-Papatoetoe. The proportion living in the most socio-economic deprived areas increased from 65 % nationally to 80 % in Counties Manukau and 91 % in Ōtara-Papatoetoe.

The negative-binomial model found that ARF incidence rates in the Ōtara-Papatoetoe Locality did not differ from those in the Counties Manukau District outside Ōtara-Papatoetoe but were significantly higher than rates in New Zealand outside of Counties Manukau after adjusting for prioritised ethnicity and NZDep quintiles (Supplementary Table 2).

Incidence of ARF hospitalisation, RHD hospitalisation (2010–2023) and RHD mortality (2010–2021)

Between 1 January 2010 and 31 December 2023, 4,119 cases with a first episode of RHD (in individuals aged under 70 years) were recorded in hospitalisation discharge data, including 570 cases discharged from private hospitals. Of these, 520 were non-residents/non-citizens, including 309 discharged from private hospitals. Among the 520 non-residents/non-citizens, 421 (81%) were Pacific and 29 (6%) were Māori. After removing non-residents/non-citizens, 3,599 cases remained for analyses.

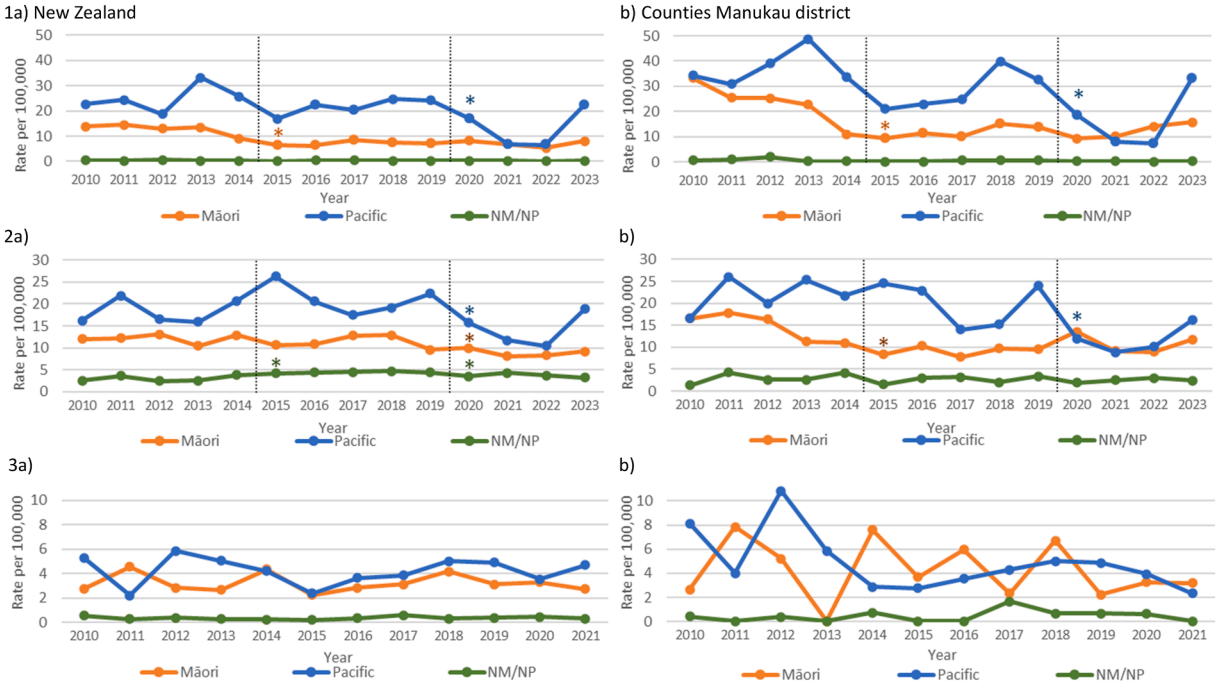
The incidence of first ARF and first RHD hospitalisations (2010–2023) in New Zealand and Counties Manukau is shown in **Figure 2**. Except for 2020 and 2021, during which strict COVID-19 measures were in place, ARF incidence among Pacific people remained consistently the highest of all ethnic groups, as did RHD hospitalisation in the Counties Manukau District. Observationally, ARF incidence for both Pacific and Māori populations in Counties Manukau was higher than national rates.

Both nationally and in Counties Manukau, the average ARF incidence for Māori decreased significantly between period 1 (2010–2014) and period 2 (2015–2019) and remained stable between periods 2 (2015–2019) and 3 (2020–2023) (Figure 2 and Supplementary Table 3). For Pacific peoples, incidence remained stable between periods 1 and 2 and declined significantly between periods 2 and 3.

Nationally, RHD hospitalisation incidence among Pacific and Māori populations remained stable between periods 1 and 2, followed by a significant decrease between periods 2 and 3. For non-Māori/non-Pacific groups, incidence increased significantly between periods 1 and 2, followed by a significant decrease in period 3. In Counties Manukau District, RHD incidence significantly decreased for Māori between periods 1 and 2 and for Pacific, between periods 2 and 3.

The notable decline among Pacific people coincided with the COVID-19 pandemic and was most pronounced in Counties Manukau, where both ARF and RHD rates for Pacific people fell below those for Māori.

Figure 2: Rates[a] of 1) first discharge from hospitalisation with acute rheumatic fever (ARF) per 100,000 people, 2010–2023, 2) first discharge from hospital with rheumatic heart disease (RHD) per 100,000 people under 70 years of age, 2010–2023 and 3) RHD Mortality per 100,000 people under 70 years of age, 2010–2021 in a) New Zealand and b) Counties Manukau district for New Zealand residents and citizens.



Notes: a) Population data are based on the Health New Zealand "best-available" population series. The series used was based on the 2018 census and provides population estimates where data are available and population projections otherwise, e.g. into the future or where data isn't collected between censuses. https://tewhatuora.shinyapps.io/populations-web-tool/.
An * indicated a significant change in mean level since the previous period.

These declines were followed by steep increases, returning to pre-pandemic levels by 2023.

Discussion

Between 2010 and 2023, individuals aged 3 to 35 years accounted for 96% of hospitalised ARF cases, with Māori and Pacific people making up almost all cases —48% and 45%, respectively. Nearly two-thirds (65%) of all cases lived in the most socioeconomically deprived areas (NZDep quintile 5), with this proportion rising notably across geographic areas: 80% in Counties Manukau and 91% in Ōtara-Papatoetoe. Pacific people represented an increasing proportion of cases from the national level (45%) to Counties Manukau (68%) and Ōtara-Papatoetoe (84%). These data highlight the disproportionate burden of ARF in Pacific and Māori populations, which increases progressively with greater socioeconomic disadvantage in urban areas.

This higher burden likely both reflects and reinforces higher infection pressure—or overall disease burden—in these areas (Supplementary Table 2), as evidenced by elevated ARF risk between 2018 and 2023 in Counties Manukau and Ōtara-Papatoetoe, independent of ethnicity or deprivation level.

Our findings confirm that the current throat-swabbing guidelines, which target high-risk individuals meeting at least two of the following criteria—identifying as Māori or Pacific, residing in low socioeconomic areas or being aged 3 to 35 years—remain accurate.[7]

Between 2010 and 2023, hospitalisation rates for both ARF and RHD remained consistently higher among Pacific people than any other group. While both Māori and Pacific peoples continue to experience a high burden of disease, we did observe differences in trends between the two groups over time. During the RFPP, a statistically significant decline in ARF hospitalisations was observed among Māori (2015–2019 *vs.* 2010–2014), whereas no comparable decline was seen in Pacific populations. Our study confirms the diverging Māori and Pacific trends first reported for 2000–2018, where Māori rates remained persistently high while Pacific rates rose over time and shows that these trajectories have continued through 2023.[5] These enduring differences suggest that the epidemiological patterns for Māori and Pacific peoples may differ and raise important questions about the reach, uptake, and equity of interventions, highlighting and confirming the need for improved surveillance and further examination of how policies are designed and implemented across communities.[19]

Several contextual factors may help explain these differing trends during the RFPP period. Pacific populations in areas like Ōtara-Papatoetoe often reside in neighbourhoods of even greater socioeconomic deprivation than other high-risk communities (Table 1), which may amplify exposure to GAS (Supplementary Table 2) and reduce the effectiveness of interventions. Differences in housing conditions, timely healthcare access, and levels of community engagement with health services may also contribute. In addition, variation in implementation or uptake of interventions could be relevant; for example, school-based throat-swabbing programmes may have had lower coverage in schools with a higher proportion of Pacific students than in those with more Māori students.

Other factors may help explain the temporary decline in Pacific ARF incidence during the pandemic. One possibility is that extended school closures in Auckland—lasting four months longer than elsewhere—reduced GAS transmission among Pacific students, who make up a large proportion of the school-aged population in the affected districts. Among those aged 5–19 years, 63% of Pacific youth lived in the three Auckland health districts subject to prolonged lockdowns, compared with 21% of Māori.[20]

New Zealand's closed international borders may also have contributed by limiting travel from Pacific Island nations and reducing the introduction of new GAS strains.[21] This is notable given the strong transnational ties between Pacific communities in New Zealand and their countries of origin. In our study, a significant proportion of ARF and RHD hospitalisations involved non-residents or non-citizens. Among those, most were Pacific (ARF: 71% and RHD: 81%). Whether these individuals were already living in New Zealand or had travelled for care is unclear, but their presence suggests a potential transmission pathway that may have been interrupted during the pandemic.

While reduced healthcare access during the COVID-19 pandemic may also have influenced hospitalisation trends, this seems unlikely to fully explain the observed patterns, given the severity of ARF and RHD. If access barriers did play a role, their disproportionate impact on Pacific—rather than Māori—populations is difficult to reconcile without better data.

Compounding these uncertainties is the longstanding lack of robust national surveillance of ARF and RHD.[19,22] Although ARF has been notifiable under the Health Act since 1986,[23] national systems have failed to produce reliable, standardised data to evaluate intervention effectiveness or track equity in outcomes.[19] In 2014, surveillance processes were purposefully adjusted during the RFPP, including the introduction of revised case report forms.[24] However, inconsistent implementation and incomplete compliance with notification requirements under the Health Act contributed to ongoing data gaps—undermining efforts to evaluate the effectiveness of RFPP interventions across different populations.[9,19]

Together, these observations highlight the dynamic, context-specific nature of ARF and RHD epidemiology and underscore the urgent need for improved surveillance and equity-focused evaluation capable of identifying and responding to the distinct and evolving drivers of disease burden across high-risk communities.

Data limitations and impacts on surveillance accuracy

Several data quality issues may have impacted the results of this study. First, miscoding and misdiagnoses in hospital records have previously led to overcounts of ARF cases by 25–33%.[22] Although some research and regional surveillance initiatives attempt to correct for this by cross-referencing hospitalisation data with notifications and other sources,[19,22,25] these corrections are not reflected in the national datasets, allowing inaccuracies to persist across national-level data extracts.

Second, a notable spike in ARF incidence was observed in 2013, particularly among Pacific populations. This may have resulted from increased awareness following the launch of the RFPP, which in turn may have contributed to the (non-significant) decline in subsequent years.[9] Remarkably, this peak was not observed in the Māori population, suggesting possible differences in either underlying epidemiology or patterns of surveillance response. If this spike was due to heightened surveillance or awareness rather than a true increase in disease, it could obscure real differences in programme impact across groups.

Third, our comparisons of RHD and RHD mortality rely on crude rates, whereas other comparative studies[5] additionally reported age-adjusted rate ratios for these outcomes, offering a clearer assessment of ethnic differences.

Finally, the population projections used to calculate incidence rates are prone to inaccuracy, especially for Pacific populations in Counties Manukau.[26] These projections often underestimate Pacific population size, leading to an overestimation of disease rates. Ongoing adjustments to these projections further complicate accurate trend analysis, particularly in high-risk subpopulations. These inaccuracies have differing effects across ethnic groups,[27] further obscuring the true extent of disparities.

Unrealised reforms and continuing gaps in national leadership

A 2021 Cabinet paper, released in advance of the 2022 health reforms, emphasised the need for improved surveillance to strengthen public health efforts.[28] While the *Pae Ora (Healthy Futures) Act 2022*[11] formally assigned responsibilities for data monitoring and response—particularly for high-risk populations—these have yet to be implemented in practice.[29] In the absence of robust systems for surveillance, accountability and equity-focused planning, efforts to control ARF and RHD will continue to be undermined by fragmented data, persistent uncertainty and unaddressed inequities.[30]

Conclusion

While declines in incidence were observed at certain points—among Māori during the RFPP and among Pacific peoples during the COVID-19 pandemic—only the former appears to have been sustained. However, the government's target incidence rate of 1.4 per 100,000 has still not been met. Despite over NZD $100 million invested in control efforts, persistent gaps in surveillance and coordination continue to hinder evaluation and progress. Stronger national leadership, systematic data collection and equity-focused action are urgently needed to drive measurable progress and eliminate preventable inequities, which remain overwhelmingly concentrated in New Zealand's most underserved communities.

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Conflicts of interest

The authors have no competing interests to declare.

Ethics

This study was approved by the Aotearoa Research Ethics Committee (AREC25_05).

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Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2025.100301.