RHEUMATIC FEVER IN NEW ZEALAND ANNUAL REPORT JULY 2014 TO JUNE 2015

Authors:

Yvonne Galloway

Susan Jack

Tammy Hambling

PREPARED FOR: Ministry of Health

CLIENT REPORT No: FW16053

PREPARED BY: Health Intelligence Team, Health Group

PUBLISHED: 27 September 2017

This report is available at www.surv.esr.cri.nz

Published: 27 September 2017

Suggested citation:

Institute of Environmental Science and Research Ltd (ESR).
Rheumatic Fever in New Zealand: Annual Report July 2014 to June 2015. Porirua: ESR; 2017.

Client Report: FW16053

ACKNOWLEDGEMENTS

This report was prepared as part of a Ministry of Health contract for scientific services.

Thanks to the clinicians and public health unit staff for provision of data and to Tomasz Kiedrzynski, Niki Stefanogiannis and Janine Ryland, Ministry of Health, and Catherine Jackson, Auckland Regional Public Health, for peer review.

DISCLAIMER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

Abbreviation	Description
anti-DNase B	Anti-deoxyribonuclease B
ASO	Anti-streptolysin O
BPS	Better Public Service
CRP	C-reactive protein
DHB	District health board
ECG	Electrocardiogram
ESR	Institute of Environmental Science and Research Ltd.
ESR	Erythrocyte sedimentation rate
GAS	Group A streptococcal or group A streptococcus
ICD-9-CM-A	Australian Version of the International Classification of Diseases, Ninth Revision, Clinical Modification
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
IU/mL	International units per millilitre
NHI	National Health Index
NZDep2013	New Zealand index of deprivation 2013
RHD	Rheumatic heart disease
RFPP	Rheumatic Fever Prevention Programme
ULN	Upper limit of normal

SUMMARY

Acute rheumatic fever is a serious condition that can lead to rheumatic heart disease. Rheumatic fever in New Zealand predominantly affects Māori and Pacific young people aged 5–14 years from socioeconomically deprived areas. This first annual report on the epidemiology of rheumatic fever in New Zealand is based on notifiable disease data and presents summary information on rheumatic fever notifications with an onset date in the period 1 July 2014 to 30 June 2015.

A total of 117 confirmed or probable first episode rheumatic fever cases with onset from July 2014 to June 2015 were reported, giving a rate of 2.6 per 100,000 population. This compares with 178 cases with onset from July 2013 to June 2014. If this trend continues, the Better Public Service target of reducing first episode rheumatic fever hospitalisation rates by two thirds, from 4.0 in 2012 to 1.4 per 100,000 population by 2017, appears to be on track. Nevertheless, with a national rate of 2.6 per 100,000, New Zealand's rate is amongst the highest in industrialised countries [1].

There is a steep social gradient for rheumatic fever, with most (71%) cases occurring in people from the most socioeconomically deprived areas. The highest rates of first episode rheumatic fever were for Pacific peoples aged 5–14 years (77.3 per 100,000), followed by Māori aged 5–14 years (31.7 per 100,000). This compares to a rate of 0.5 per 100,000 for European or Other ethnicity in the 5–14 years age group.

Most cases occurred in the upper North Island district health board (DHB) regions, with almost half (48%, 56 cases) of first episode rheumatic fever cases from the Auckland region. Tairāwhiti DHB had the highest rate (14.9 per 100,000) followed by Northland DHB (7.8 per 100,000). Rheumatic fever is rare in the South Island.

Almost all cases with rheumatic fever were hospitalised, in accordance with national guidelines.

Just under half of confirmed or probable first episode rheumatic fever cases did not report having a sore throat in the four weeks prior to admission, underlining the need for a comprehensive approach to preventing rheumatic fever that includes more than sore throat management.

There were four recurrent episodes of rheumatic fever during this reporting period. Recurrences represent a failure of secondary prevention and should be reviewed to identify issues that could be addressed in order to prevent further rheumatic fever episodes.

This report highlights areas that may need strengthening in primary care including awareness of sore throats and of symptoms and signs of rheumatic fever among high-risk populations, enabling timely admission to hospital and appropriate hospital investigations to be undertaken.

Timely and complete notification of all cases would enhance national monitoring and surveillance. Only 59% of cases were notified within seven days of hospitalisation as is recommended by the Ministry of Health.

Strengthening comprehensive follow-up after discharge, including use of a register for appropriate and timely delivery of secondary prophylaxis, should ensure no recurrent cases of rheumatic fever. A national register should be considered to ensure continued follow-up of cases when they move to other regions.

INTRODUCTION

Rheumatic fever and its sequel rheumatic heart disease (RHD) are serious illnesses triggered by an autoimmune response to group A streptococcal (GAS) pharyngitis. In New Zealand, rheumatic fever predominantly affects Māori and Pacific children and young adults, aged 5–19 years. RHD is a cause of premature death in New Zealand with an average of 159 RHD deaths per year, giving an annual mortality rate of 4.4 per 100,000, for the period 2000–2007. The age-adjusted mortality for RHD was 5–10 times higher for Māori and Pacific peoples than for non-Māori/non-Pacific [2].

The Government has identified reducing the incidence of rheumatic fever as one of its priorities, and began implementing the Rheumatic Fever Prevention Programme (RFPP) in 2011. The RFPP focuses on: increasing awareness of rheumatic fever; improving access to timely treatment of GAS throat infections among priority populations; and supporting mechanisms to address housing and household crowding among priority populations. In 2012, reducing the incidence of rheumatic fever by two-thirds to 1.4 cases per 100,000 population by 2017 became one of the 10 cross-government Better Public Service (BPS) targets. The Ministry of Health is the lead government agency responsible for achieving this target.

This report is part of a larger body of work that brings together various sources of information on rheumatic fever and invasive GAS infection, allowing for more consistent monitoring of the incidence, burden and severity of GAS infections. The analysis and reporting of rheumatic fever surveillance data will inform Ministry of Health-led interventions and outcomes.

This is the first annual report on the epidemiology of rheumatic fever in New Zealand. The report is based on notifiable disease data and presents summary information on rheumatic fever notifications with an onset date in the period 1 July 2014 to 30 June 2015.

METHODS

SURVEILLANCE METHODS

Notifications

Rheumatic fever is a notifiable disease in New Zealand. Rheumatic fever can be classified as first episode (no known past history of rheumatic fever), or recurrent episode (an episode in a person with a known past history of rheumatic fever or previously diagnosed RHD). Cases are recorded in the national notifiable disease database, EpiSurv.

The diagnosis of rheumatic fever relies on clinicians being aware of the diagnostic features of the condition. Diagnosis is clinical and largely based on the Jones criteria, which are divided into major and minor manifestations (Table 1). The New Zealand modification of the Jones criteria allows echocardiographic evidence of carditis and aseptic monoarthritis as major criteria. The case classification for both first and recurrent episodes is shown in (Table 2) [3]. Clinicians are required to notify suspected cases of rheumatic fever to their local Medical Officer of Health.

Table 1. Jones criteria for rheumatic fever

Manifestation	Criteria
Major manifestations modified from Jones 1992	Carditis (including evidence of subclinical rheumatic valve disease on echocardiogram)[1] Polyarthritis[2] (or aseptic monoarthritis) Chorea (can be stand-alone for confirmed initial or recurrent rheumatic fever diagnosis) Erythema marginatum Subcutaneous nodules
Minor manifestations	Fever Raised ESR or CRP[3] Polyarthralgia Prolonged PR interval on ECG[4]

[1] When carditis is present as a major manifestation (clinical and/or echocardiographic), a prolonged PR interval cannot be considered an additional minor manifestation in the same person.

[2] Other causes of arthritis/arthralgia should be carefully excluded, particularly in the case of monoarthritis, eg, septic arthritis (including disseminated gonococcal infection), infective or reactive arthritis and auto-immune arthropathy (eg, juvenile chronic arthritis, inflammatory bowel disease, systemic lupus erythematosus, systemic vasculitis and sarcoidosis). Note that if polyarthritis is present as a major manifestation, polyarthralgia cannot be considered an additional minor manifestation in the same person.

[3] ESR = erythrocyte sedimentation rate; CRP = C-reactive protein

[4] ECG = electrocardiogram

Table 2. New Zealand Communicable Disease Control Manual case classification and diagnostic criteria for rheumatic fever

Case classification	Diagnostic criteria
Confirmed	• Serological evidence of preceding group A streptococcal infection[1] • Two major, **or** one major and two minor, manifestations in the Jones criteria (Table 1) are present **Or** • Chorea (other major manifestations or evidence of group A streptococcal infection not required)
Probable	• Evidence of preceding group A streptococcal infection from positive throat culture or rapid antigen test • Two major, **or** one major and two minor, manifestations in the Jones criteria (Table 1) **Or** • Serological evidence of a preceding group A streptococcal infection • One major and one minor manifestation in the Jones criteria
Suspect	• Strong clinical suspicion of rheumatic fever • Insufficient signs and symptoms to fulfil diagnosis of confirmed or probable rheumatic fever

[1] Elevated or rising streptococcal antibody titres are essential for confirming preceding GAS infection. Other laboratory tests, including culture and rapid antigen test, cannot distinguish between infection and carriage.

While elevated or rising antibody titres are essential for confirming preceding GAS infection, there is no definition of what constitutes 'rising' titre levels. Therefore, in order to establish whether serological evidence of preceding GAS infection was present or not, we examined the titre fields in EpiSurv and if the upper limit of normal (ULN) (ASO titre of ≥480 IU/mL or anti-DNase B titre of ≥680 IU/mL) titre levels were exceeded the case was deemed to have serological evidence. For cases where the ULN was not exceeded, we compared the first and second titres to see if any rise in titres had occurred. Since the dates are not recorded in EpiSurv, we were unable to determine the length of time between the first and second samples.

Case report form

Since July 2014, a revised rheumatic fever case report form has been used for notifications. Changes from the form used prior to July 2014 cover information on:

- presence of sore throat in the four weeks prior to the onset of rheumatic fever;
- presentation to a health professional for assessment of that sore throat;
- appropriate management of the sore throat by the health professional;
- antibiotic adherence to treatment by the case;
- number of presentations to a health professional with symptoms of rheumatic fever prior to hospital admission;
- secondary prevention of rheumatic fever.

A copy of the current case report form can be found at https://surv.esr.cri.nz/episurv/CaseReportForms/Rheumatic-Jul2014.pdf

Hospitalisations

The Ministry of Health collates national data on public and private hospital discharges. This data is stored as part of the National Minimum Dataset. In order to identify first episode rheumatic fever hospitalisations, records with a principal diagnosis of acute rheumatic fever (ICD-10-AM diagnosis codes: I00, I01, I02 and ICD-9-CM-A diagnosis codes: 390, 391, 392) were extracted. Records were excluded if there was a previous acute rheumatic fever or chronic RHD diagnosis since 1988 or if the case was a New Zealand non-resident. The Ministry of Health definition for first episode rheumatic fever hospitalisations is given in Table 3.

Hospitalisation data was used to supplement EpiSurv data where the date of hospitalisation was not recorded in EpiSurv but a corresponding hospital discharge was recorded in the Ministry of Health dataset.

Table 3. Ministry of Health definition for first episode rheumatic fever hospitalisations

ICD codes used:	ICD-10-AM diagnosis codes: I00, I01, I02 (acute rheumatic fever)
	ICD-9-CM-A diagnosis codes: 390, 391, 392 (acute rheumatic fever)
	ICD-10-AM diagnosis codes: I05–I09 (chronic rheumatic heart disease)
	ICD-9-CM-A diagnosis codes: 393–398 (chronic rheumatic heart disease)
Inclusions:	Principal diagnoses (acute rheumatic fever) only
	Overnight admissions
	Day-case admissions
Exclusions:	Previous acute rheumatic fever diagnosis (principal and additional) from 1988
	Previous chronic rheumatic heart disease diagnosis (principal and additional) from 1988
	New Zealand non-residents
Transfers:	Transfers with a principal diagnosis of acute rheumatic fever are counted as one acute rheumatic fever hospitalisation episode

Mortality data

In order to identify any deaths from rheumatic fever, information on notified cases was matched with the Mortality Collection using the National Health Index (NHI) number. The Ministry of Health maintains the Mortality Collection which classifies the underlying cause of death for all deaths registered in New Zealand using the ICD-10-AM 6th Edition and the World Health Organization Rules and Guidelines for Mortality Coding. The dataset is updated monthly with data from Births, Deaths, and Marriages on death registrations and stillbirths. Data on the cause of death is not available until two years after the end of the calendar year, but other details, including the date of death, are available sooner.

ANALYTICAL METHODS

Dates

Information presented in this report is based on data recorded in EpiSurv as at 25 February 2016. Any changes made to EpiSurv data after this date are not reflected in this report.

Case numbers are reported according to the onset date where provided, or hospitalisation date. If neither date was provided then the report date has been used.

Population rate calculations

The denominators used to determine all disease rates, except the rates for ethnic groups and deprivation, were from the 2014 mid-year population estimates published by Statistics New Zealand. All rates are presented as the number of cases per 100,000 population. Rates are not given where there were fewer than five cases in any category since such rates are considered unreliable.

Ethnicity

Multiple ethnicities can be recorded for a single case in EpiSurv. Ethnicity is prioritised in the following order: Māori, Pacific peoples, and European/Other ethnicity. For more detail on classification refer to Ministry of Health ethnicity data protocols [4]. The denominator data used to determine disease rates for ethnic groups was based on the proportion of people in each ethnic group from the usually resident 2013 census population applied to the 2014 mid-year population estimates.

New Zealand index of deprivation

Socio-economic deprivation is based on the New Zealand index of deprivation 2013 (NZDep2013). The index, measuring relative socioeconomic deprivation, is derived from a weighted combination of nine variables from the 2013 census, each reflecting a different aspect of material and social deprivation. The deprivation score is calculated for each geographical meshblock in New Zealand [5]. Deprivation scores are grouped into deciles 1 to 10, where decile 1 represents the least deprived areas and decile 10 the most deprived areas [5]. The denominator data used to determine disease rates for NZDep2013 categories is based on the proportion of people in each NZDep2013 category from the usually resident 2013 census population applied to the 2014 mid-year population estimates.

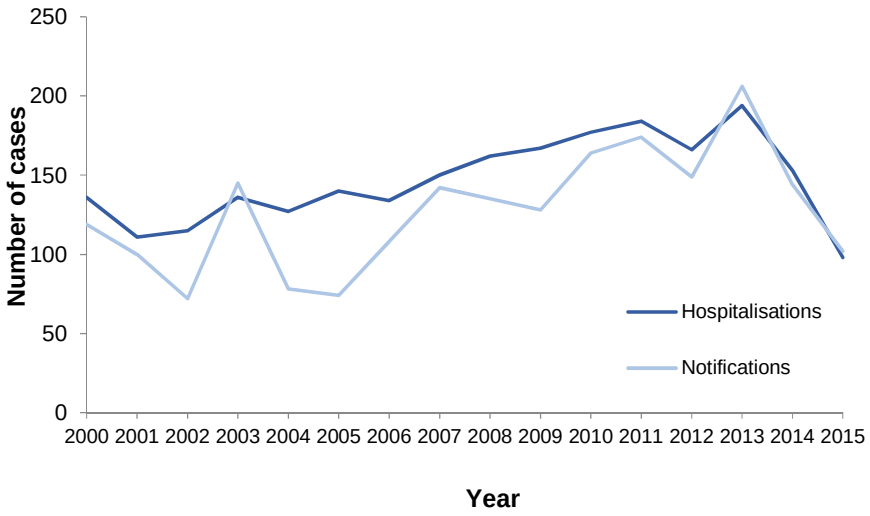
NOTIFICATION DATA QUALITY

In New Zealand there are three major systems used for the surveillance of rheumatic fever: hospitalisation data; notification data; and regional patient registers. Under-reporting has been documented for rheumatic fever notification data [6, 7] and register data [8, 9] in some regions. Miscoding and misdiagnoses affect hospitalisation data, which may overcount cases by 25–33% [7]. Although rheumatic fever registers have been shown in many regions to provide the best source of local data [7], they do not provide consistent national data.

Rheumatic fever became a notifiable disease in 1986. However, due to under-notification and delays in notification, hospitalisations have been used by the Ministry of Health to monitor the incidence of initial episodes of rheumatic fever since 2010.

Since 2013, the numbers of rheumatic fever cases as determined by hospitalisation or by notification have become more closely aligned (Figure 1).

Figure 1. Comparison of first episode rheumatic fever notifications and hospitalisations, by year, 2000–2015



Notifications are based on date of onset. Hospitalisations are based on date of discharge.

Completeness

The Ministry of Health Guidance for Public Health Units annual planning priorities for 2016/17 [10] included the following measures regarding completeness of rheumatic fever notification data:

- ensure that all cases of acute and recurrent acute rheumatic fever are notified with complete case information to the medical officer of health within seven days of hospital admission;
- work with the reporting medical practitioner to ensure that all fields in the rheumatic fever case report form are reported and completed accurately;
- undertake remedial work on any incomplete rheumatic fever notifications from July 2014 using the new notification form.

A total of 128 cases of rheumatic fever with onset from 1 July 2014 to 30 June 2015 were notified, with 124 first episodes and four recurrences. Table 4 shows the completeness of information recorded on EpiSurv for these cases. The table follows the sections on the case report form and, for each subsection, shows the number of records with each field completed and the number with one or more fields with missing or unknown data. The basis of diagnosis section is generally well completed, apart from the section on evidence of preceding GAS infection, while the case management and contact management sections are not well completed.

Table 4. Completeness of case information for rheumatic fever notifications, July 2014 to June 2015 onset

Case report form section	All fields complete	Missing / unknown	Percent complete
Basis of diagnosis			
Major manifestations	111	17	86.7
Minor manifestations	101	27	78.9
Evidence of GAS infection	77	51	60.2
Titres (at least one recorded)	123	5	96.1
Classification	128	0	100.0
Previous history (recurrences only, n=4)	0	4	0.0
Clinical course			
Clinical course and outcome	112	16	87.5
Onset date	124	4	96.9
Hospitalisation date	121	7	96.8
Risk factors			
Recent sore throat (initial episodes only, n=124)	117	7	94.4
If yes, saw a health professional (initial episodes only)	40	24	62.5
Throat swabs prior to admission (initial episodes only)	116	8	93.5
Antibiotics prior to admission(initial episodes only)	88	36	71.0
Clinical diagnosis	75	53	58.6
Family history (initial episodes)	89	35	71.8
Housing referral (initial episodes)	86	38	69.4
Protective factors			
RF register/prophylaxis (recurrences only)	2	2	50.0
Management			
Case management	18	110	14.1
Contact management	81	47	63.3

Timeliness

Of the 128 rheumatic fever cases with onset between July 2014 and June 2015, 126 were admitted to hospital. The hospitalisation date was known for all of the 126 cases (five hospitalisation dates were missing from EpiSurv but available in the hospitalisation dataset), with 58.7% (74/126 cases) notified within seven days of hospitalisation. This increased to 78.6% (99/126 cases) notified within 14 days of hospitalisation (Table 5). Table 18 in the appendix shows a breakdown of the length of time between hospitalisation and notification by district health board (DHB).

Table 5. Length of time between hospitalisation and notification for rheumatic fever cases, July 2014 to June 2015 onset

Time between hospitalisation and notification date (days)	Number of cases				Cumulative proportion (%)
	First episode	Recurrent episode	Total	Cumulative total	
≤7	73	1	74	74	58.7
8–14	24	1	25	99	78.6
15+	25	2	27	126	100.0
Total[1]	**122**	**4**	**126**		

[1] Two first episode cases were not hospitalised.

Case classification

The rheumatic fever section of the Communicable Disease Control Manual was updated in December 2014 and the case definition was changed to largely align with the National Heart Foundation Guidelines [11]. This definition was included in the instructions for completing the EpiSurv case report form from July 2014, even though the National Heart Foundation Guidelines and the Communicable Disease Control Manual update had not been released at that stage. As noted in the Methods section (page 6), although the ULN titre levels for anti-streptococcal antibodies are clearly stated in the National Heart Foundation Guidelines, it is not clear what constitutes 'rising' titre levels. Therefore clinical judgement is required for case classification that may not strictly accord with the Communicable Disease Control Manual or other accepted definitions such as a two-fold, or 0.2 $\log_{10}$, rise in antibody titre levels [12].

Table 6 compares the case classification, as recorded in the status field in EpiSurv, with the Communicable Disease Control Manual definition based on the supporting evidence documented in the Basis of Diagnosis section in EpiSurv. The EpiSurv and Communicable Disease Control Manual case classifications were the same for 94/128 (73.4%) cases. However, 18 cases that were classified as confirmed in EpiSurv, did not meet the case definition for a confirmed case based on supporting evidence, with seven meeting the definition for a probable case, and 11 meeting the definition for a suspect case. Eight cases classified as probable in EpiSurv actually met the definition for a confirmed case and six only met the definition for a suspect case. All seven cases classified as suspect in EpiSurv remained as suspect cases when the Communicable Disease Control Manual definitions were applied.

Table 6. Classification of rheumatic fever cases in EpiSurv compared with the Communicable Disease Control Manual definition, July 2014 to June 2015 onset

EpiSurv-reported case classification	Communicable disease control manual definition			
	Confirmed	Probable	Suspect	Total
First episode				
Confirmed	73	7	11	91
Probable	8	12	6	26
Suspect	0	0	7	7
Total first episode	**81**	**19**	**24**	**124**
Recurrent episode				
Confirmed	2	1	1	4
Total	**83**	**20**	**25**	**128**

The results section describes notifications as reported in EpiSurv without adjustment for notifications that may have been misclassified according to the Communicable Disease Control Manual case definitions.

RESULTS

There were 128 notifications for rheumatic fever with an onset date between 1 July 2014 and 30 June 2015, giving a rate of 2.8 per 100,000 population. Of these, 124 were recorded as first episodes and four were recurrent episodes. This section reports on first episodes and recurrent episodes separately.

Of the 128 notifications, there were seven cases with an EpiSurv case classification of “suspect” (insufficient signs and symptoms to fulfil diagnosis of confirmed or probable rheumatic fever). All seven suspect cases were first episodes. These seven cases have been excluded from the following analyses and only cases reported in EpiSurv as confirmed or probable have been included.

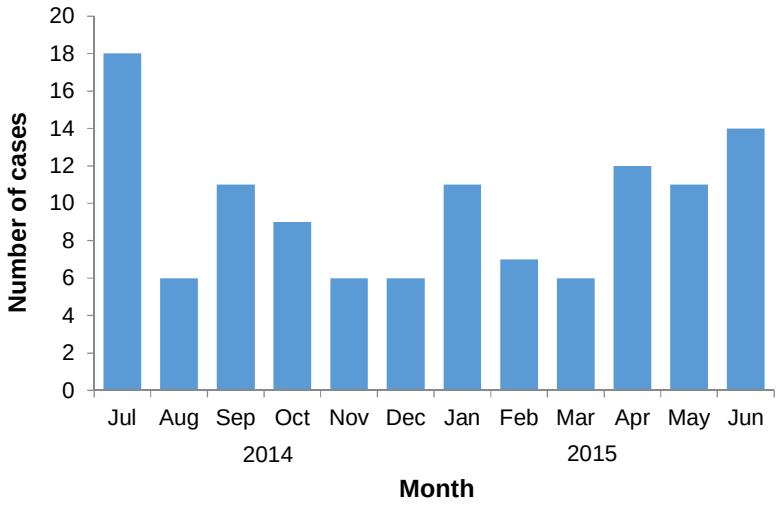
FIRST EPISODE RHEUMATIC FEVER

A total of 117 confirmed or probable first episode rheumatic fever cases with onset from July 2014 to June 2015 were notified. This gives a rate of 2.6 per 100,000 population.

Disease incidence by month

The number of first episode rheumatic fever notifications by month of onset from July 2014 to June 2015 is shown in Figure 2. This shows some seasonal variation with the highest number of cases in July 2014 (18 cases) and June 2015 (14 cases).

Figure 2. Number of first episode rheumatic fever cases by month of onset, July 2014 to June 2015



Confirmed and probable cases only

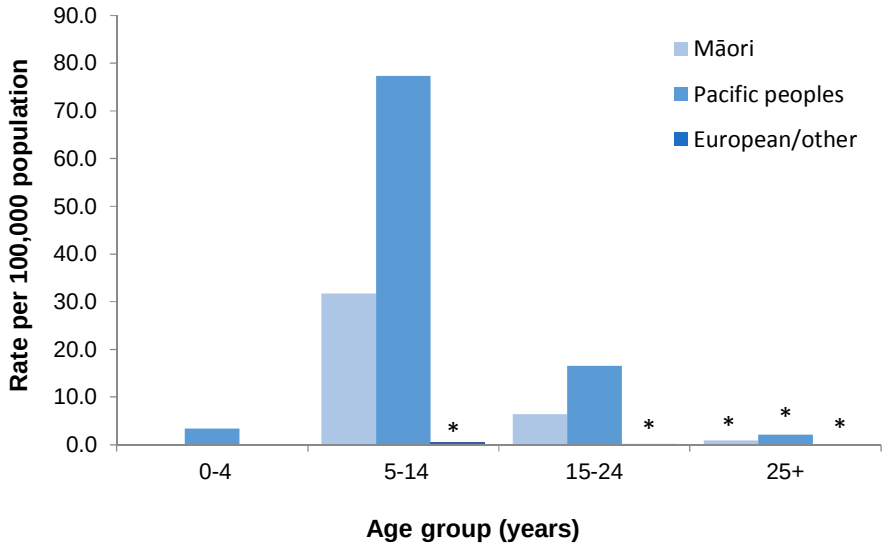
Disease incidence by age and ethnicity

Age and ethnicity were recorded for all cases of first episode rheumatic fever. The majority (78%) of first episode rheumatic fever cases occurred in the 5–14 years age group, with 91 cases and a rate of 15.1 per 100,000 population. A further 18 cases were aged 15–24 years (2.8 per 100,000 population), seven were aged 25 years and over (0.2 per 100,000) and one was aged 4 years (see Table 19 in the appendix).

While Māori and Pacific peoples had a similar number of cases of first episode rheumatic fever notified (57 and 56 respectively), the rate for Pacific peoples was 20.1 per 100,000 compared with 8.5 per 100,000 for Māori. Four cases were of European or Other ethnicity (see Table 20 in the appendix).

Figure 3 shows the age-specific ethnic rates for first episode rheumatic fever cases with onset from July 2014 to June 2015. The highest rates of first episode rheumatic fever were for Pacific peoples aged 5–14 years (77.3 per 100,000, 43 cases), followed by Māori aged 5–14 years (31.7 per 100,000, 46 cases). This compares to two cases for European or Other ethnicity in the 5–14 years age group. The third highest rate was for Pacific peoples aged 15–24 years (16.6 per 100,000, 9 cases). The number of cases and rates for age groups targeted by current initiatives are shown in Table 20 in the appendix.

Figure 3. First episode rheumatic fever rates by age group and prioritised ethnicity, July 2014 to June 2015 onset



Confirmed and probable cases only
* Rate based on fewer than five cases.

Disease incidence by district health board

District health board (DHB) was recorded for all cases of first episode rheumatic fever. The distribution of cases with onset from July 2014 to June 2015 along with rates per 100,000 population is presented Table 7. Rates were not calculated for seven DHBs due to the small number of cases. Five DHBs reported no cases.

Almost half (47.9%, 56/117 cases) of first episode rheumatic fever cases were from the Auckland region. Tairāwhiti DHB had the highest rate (14.9 per 100,000) followed by Northland DHB (7.8 per 100,000).

Most cases (99/117, 84.6%) were Māori and Pacific peoples aged 5–19 years. The highest rates seen in this group were also from Tairāwhiti and Northland DHB, with rates of 93.6 and 60.0 per 100,000 respectively.

Table 7. Number of cases and rate per 100,000 population of rheumatic fever by DHB, July 2014 to June 2015 onset

District health board	All ages		Maori and Pacific 5-19 years	
	Cases	Rate[1]	Cases	Rate[1]
Northland	13	7.8	11	60.0
Waitemata	8	1.4	6	20.7
Auckland	12	2.5	11	43.7
Counties Manukau	36	7.1	29	48.0
Waikato	12	3.1	11	36.2
Lakes	7	6.8	6	50.3
Bay of Plenty	5	2.3	5	27.2
Tairāwhiti	7	14.9	7	93.6
Taranaki	1	-	0	0.0
Hawke's Bay	2	-	2	-
Whanganui	0	0.0	0	0.0
MidCentral	3	-	3	-
Hutt Valley	3	-	3	-
Capital & Coast	4	-	2	-
Wairarapa	2	-	1	-
Nelson Marlborough	0	0.0	0	0.0
West Coast	0	0.0	0	0.0
Canterbury	2	-	2	-
South Canterbury	0	0.0	0	0.0
Southern	0	0.0	0	0.0
Total	**117**	**2.6**	**99**	**32.4**

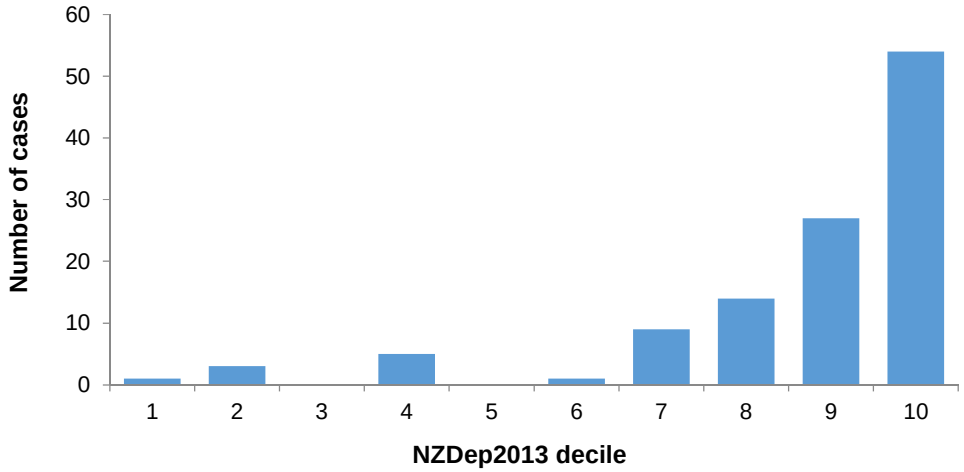
Confirmed and probable cases only

[1] Rate per 100,000 population. Where there were fewer than five cases in any category a rate has not been calculated.

Disease incidence by deprivation

A deprivation index decile could be assigned for 114 (97.4%) cases of first episode rheumatic fever. The distribution of cases with onset from July 2014 to June 2015 is presented in Figure 4 and Table 21 in the appendix. The majority (71.1%, 81/114) were from the most deprived areas (NZDep2013 deciles 9 and 10).

Figure 4. Number of first episode rheumatic fever cases by NZDep2013, July 2014 to June 2015 onset



Confirmed and probable cases only
New Zealand index of deprivation (1 = least deprived and 10 = most deprived).

Basis of diagnosis

Rheumatic fever is a clinical diagnosis requiring fulfilment of the modified Jones criteria along with evidence of a preceding GAS infection as described in Table 2 in the Methods section.

Jones criteria

Table 8 shows the numbers of first episode rheumatic fever cases with each clinical manifestation recorded. Polyarthritis and polyarthralgia cannot be considered both major and minor criteria in the same person and therefore cases reporting both have been included as a “Yes” for polyarthritis and a “No” for polyarthralgia. Similarly carditis and a prolonged PR interval on ECG cannot be included as both major and minor criteria in the same person and cases reporting both have been included as a “Yes” for carditis and a “No” for prolonged PR interval. The most common major manifestations recorded were carditis (91/115, 79.1%) and polyarthritis or aseptic monoarthritis (74/111, 66.7%). The most common minor manifestations were raised ESR or CRP (108/117, 92.3%), and fever (61/108, 56.5%). Cases with chorea do not require any other major or minor manifestations to be diagnosed as rheumatic fever, although only 3/16 (18.8%) chorea cases had no other major or minor manifestations recorded.

The number of major and minor manifestations for rheumatic fever cases is shown in Table 22 in the appendix.

Table 8. Clinical manifestations associated with first episode rheumatic fever cases, July 2014 to June 2015 onset

Jones criteria	Yes	No	Unknown	Percent Yes (%)[1]
Major manifestations				
Carditis	91	24	2	79.1
Polyarthritis or aseptic monoarthritis	74	37	6	66.7
Chorea	16	91	10	15.0
Erythema marginatum	16	90	11	15.1
Subcutaneous nodules	0	108	9	0.0
Minor manifestations				
Raised ESR or CRP[2]	108	9	0	92.3
Fever	61	47	9	56.5
Polyarthralgia (except where polyarthritis or monarthritis is present as a major manifestation)	25	83	9	23.1
Prolonged PR interval on ECG[3] (except where carditis is present as a major manifestation)	6	98	13	5.8

Confirmed and probable cases only
Cases had more than one manifestation recorded.
[1] Percent refers to the number of cases for which information was known.
[2] ESR = Erythrocyte sedimentation rate; CRP = C-reactive protein
[3] ECG = electrocardiogram

Supporting laboratory criteria

The case definition for rheumatic fever requires serological evidence of preceding GAS infection for a confirmed case, with the exception of cases presenting with chorea. If a case only had a positive throat culture or rapid antigen test then they are classified as a probable or suspect case (Table 2). Table 9 shows the level of supporting laboratory evidence for a preceding GAS infection using a hierarchical system where each case is represented only once, starting with elevated titres, followed by a throat culture and then an antigen test.

There were 16 cases with chorea and therefore laboratory evidence of preceding GAS infection was not needed for the diagnosis of confirmed rheumatic fever. These have been excluded from Table 9.

The majority of cases (71.3%, 72 cases) of first episode rheumatic fever had elevated antibody titres, while 14.9% (15 cases) had a positive throat culture. No cases had a rapid antigen test as the method of confirmation. Fourteen (13.9%) cases had no evidence recorded or the evidence was unknown.

Table 9. Laboratory evidence of preceding or current GAS infection for first episode rheumatic fever cases, July 2014 to June 2015 onset

Laboratory criteria	Number	Percent (%)[1]
Elevated streptococcal antibody titre[2]	72	71.3
Positive throat culture for group A streptococcus	15	14.9
Positive rapid streptococcal antigen test	0	0.0
Total with possible evidence of preceding or current GAS infection	**87**	**86.1**
Unknown	12	11.9
No evidence	2	2.0
Total[3]	**101**	**100.0**

Confirmed and probable cases only

Each case is only presented once in the table

[1] Percent refers to the number of cases for which information was known

[2] Elevated or rising streptococcal antibody titres are essential for confirming preceding GAS infection. Other laboratory tests, including culture and rapid antigen test, cannot distinguish between infection and carriage

[3] Excludes cases of chorea as evidence of preceding GAS infection is not required

For those cases without chorea who did not fulfil the titre cut-off criteria and had a second titre recorded (n=17), 15/17 (88.2%) demonstrated any rise or fall in either/or ASO and anti-DNase B titres: 14/15 had a rise of <100% and one demonstrated a one-fold (100%) rise.

Clinical course and outcomes

Sore throat

Just under half of first episode rheumatic fever cases (47.3%, 53/112 cases) reported that they did not have a sore throat in the four weeks prior to hospital admission, and therefore their rheumatic fever could not have been prevented through sore throat management. Table 10 shows the 59 cases that did report a sore throat in the four weeks prior to admission and whether they sought care and received appropriate management through throat swabbing, antibiotic prescribing and completion of their prescribed antibiotic course. Of those with a sore throat, less than two-thirds (61.4%) sought care, and even fewer had a throat swab taken (42.9%). Some patients were prescribed antibiotics empirically or on the basis of GAS detected on their throat swab (38.9%), although not all prescriptions followed recommended guidelines for appropriate antibiotic, dose and duration as per the GAS sore throat management guidelines [13].

Table 10. Sore throat treatment prior to hospital admission for first episode rheumatic fever cases, July 2014 to June 2015 onset

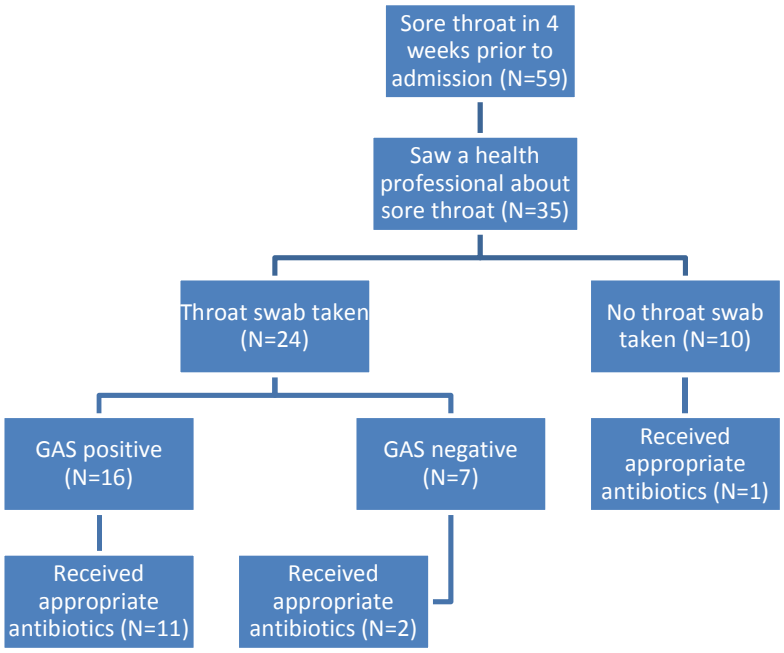
Description	Yes	No	Unknown	Percent (%)[1] of cases with a sore throat
Number of cases who reported a sore throat in the four weeks prior to admission/health care	**59**			100.0
Number of cases who reported a sore throat and sought health care	35	22	2	61.4
Number of cases who reported a sore throat, sought health care and had a throat swab taken	24	32	3	42.9
Number of cases who reported a sore throat, sought health care and had a throat swab that was GAS positive	16	39	4	29.1
Number of cases who reported a sore throat, sought health care and were prescribed antibiotics	21	33	5	38.9
Number of cases who reported a sore throat, sought health care and were prescribed **appropriate** antibiotics	14	36	5	28.0
Number of cases who reported a sore throat, sought health care, were given appropriate antibiotics and reported completing a full course	10	37	12	21.3

Confirmed and probable cases only

[1] Percent refers to the number of cases for which information was known

Figure 5 shows a flow diagram for the 59 cases who reported having a sore throat in the four weeks prior to hospital admission and whether they had a GAS positive throat swab prior to receiving appropriate antibiotics. Eleven cases with a GAS-positive throat swab received appropriate antibiotics and three cases with GAS-negative or no throat swab also received appropriate antibiotics.

Figure 5. Sore throat treatment flow diagram for first episode rheumatic fever cases, July 2014 to June 2015 onset



Almost two thirds 64.2% (34/55 cases) of Māori and 40.0% (22/56 cases) of Pacific cases reported having a sore throat in the four weeks prior to hospital admission, Pacific peoples were more likely to be prescribed appropriate antibiotics (36.8% compared with 17.9% for Māori) and more likely to report completing the full course (31.6% compared with 11.5% for Māori) (Table 11).

Table 11. Sore throat treatment prior to hospital admission for first episode rheumatic fever cases, Māori and Pacific peoples, July 2014 to June 2015 onset

Description	Māori				Pacific peoples			
	Yes	No	Unknown	Percent (%)[1] of cases with a sore throat	Yes	No	Unknown	Percent (%)[1] of cases with a sore throat
Number of cases who reported a sore throat in the four weeks prior to admission/health care	**34**			100.0	**22**			100.0
Number of cases who reported a sore throat and sought health care	20	13	1	60.6	12	9	1	57.1
Number of cases who reported a sore throat, sought health care and had a throat swab taken	11	21	2	34.4	11	10	1	52.4
Number of cases who reported a sore throat, sought health care and had a throat swab that was GAS positive	7	25	2	21.9	7	13	2	35.0
Number of cases who reported a sore throat, sought health care and were prescribed antibiotics	11	20	3	35.5	8	12	2	40.0
Number of cases who reported a sore throat, sought health care and were prescribed **appropriate** antibiotics	5	23	6	17.9	7	12	3	36.8
Number of cases who reported a sore throat, sought health care, were given appropriate antibiotics and reported completing a full course	3	23	8	11.5	6	13	3	31.6

Confirmed and probable cases only

[1] Percent refers to the number of cases for which information was known

Hospitalisations

Hospitalisation status was recorded for all notified cases of first episode rheumatic fever. Of these, 99.1% (116/117 cases) were hospitalised. The case that was not admitted to hospital was aged over 25 years and was seen in the emergency department and diagnosed by a hospital clinician.

Time between onset date to hospitalisation date

Information on the time between onset of illness and the date of hospitalisation was known for 113 (96.6%) first episode rheumatic fever cases. One case was not admitted to hospital and the date of onset was unknown for three cases. Table 12 shows the time between onset of illness and the date of hospitalisation by demographic factors and location. The majority of cases (80/113, 70.8%) were admitted to hospital within two weeks of onset of symptoms. Seven cases (6.2%) were admitted to hospital over four weeks after onset of symptoms, with the longest interval reported as 82 days (just under 12 weeks).

Of the 15 DHBs with admissions for first episode rheumatic fever, six DHBs admitted all cases within two weeks of onset of symptoms. In one DHB, one third of cases were admitted within two weeks and a quarter of cases admitted over four weeks after onset of symptoms.

Thirteen cases were seen by a doctor two or more times in the three months prior to admission. Of these, seven were admitted within two weeks of onset of symptoms, four in two to four weeks, and one was admitted eight weeks after the onset of symptoms. One case had no onset date recorded.

Table 12. Time between onset of illness and hospitalisation date for first episode rheumatic fever cases by age group, ethnic group and DHB, July 2014 to June 2015 onset

Demographic factor	Time between onset of illness and hospitalisation (n=116)					Percentage (%)[1] of cases hospitalised within specific time periods			
	<2 weeks	2–<3 weeks	3–<4 weeks	Over 4 weeks	Unknown	<2 weeks	2–<3 weeks	3–<4 weeks	Over 4 weeks
Total	**80**	**19**	**7**	**7**	**3**	**70.8**	**16.8**	**6.2**	**6.2**
Age group (years)									
0–4	1	0	0	0	0	100.0	0.0	0.0	0.0
5–14	62	13	7	6	3	70.5	14.8	8.0	6.8
15–24	13	4	0	1	0	72.2	22.2	0.0	5.6
25+	4	2	0	0	0	66.7	33.3	0.0	0.0
Ethnic group									
Māori	36	9	5	5	1	65.5	16.4	9.1	9.1
Pacific peoples	42	9	2	2	1	76.4	16.4	3.6	3.6
European/other	2	1	0	0	1	66.7	33.3	0.0	0.0
District health board									
Northland	6	2	1	1	2	60.0	20.0	10.0	10.0
Waitemata	8	0	0	0	0	100.0	0.0	0.0	0.0
Auckland	11	1	0	0	0	91.7	8.3	0.0	0.0
Counties Manukau	23	9	2	2	0	63.9	25.0	5.6	5.6
Waikato	4	2	3	3	0	33.3	16.4	25.0	25.0
Lakes	5	1	0	0	1	83.3	16.7	0.0	0.0
Bay of Plenty	5	0	0	0	0	100.0	0.0	0.0	0.0
Tairāwhiti	6	0	0	1	0	85.7	0.0	0.0	14.3
Taranaki	1	0	0	0	0	100.0	0.0	0.0	0.0
Hawke's Bay	1	1	0	0	0	50.0	50.0	0.0	0.0
Whanganui	0	0	0	0	0	0.0	0.0	0.0	0.0
MidCentral	0	2	1	0	0	0.0	66.7	33.3	0.0
Hutt Valley	2	1	0	0	0	66.7	33.3	0.0	0.0
Capital & Coast	4	0	0	0	0	100.0	0.0	0.0	0.0
Wairarapa	2	0	0	0	0	100.0	0.0	0.0	0.0
Nelson Marlborough	0	0	0	0	0	0.0	0.0	0.0	0.0
West Coast	0	0	0	0	0	0.0	0.0	0.0	0.0
Canterbury	2	0	0	0	0	100.0	0.0	0.0	0.0
South Canterbury	0	0	0	0	0	0.0	0.0	0.0	0.0
Southern	0	0	0	0	0	0.0	0.0	0.0	0.0
Status									
Confirmed	61	16	6	6	1	68.5	18.0	6.7	6.7
Probable	19	3	1	1	2	79.2	12.5	4.2	4.2

Confirmed and probable cases only

[1] Percent refers to the number of cases for which information was known.

Investigations in hospital

EpiSurv only records information on some of the investigations that are required whilst the case is in hospital. These investigations, except for taking throat swabs, were conducted for almost all of the 116 first episode rheumatic fever cases that were hospitalised as presented in Table 13 below. Of the 35 cases that did not have throat swabs taken in the week after admission, 17 (48.6%) had throat swabs taken in the four weeks prior to admission. Information is not collected in EpiSurv for the remaining investigations recommended for all cases: white blood cell count; blood cultures; or chest X-ray.

Table 13. Investigations carried out in hospital for first episode rheumatic fever cases, July 2014 to June 2015 onset

Description	Done	Not done	Unknown	Percentage (%) where test was carried out
Throat swabs taken in the week after admission	77	35	4	68.8
ESR	112	4	0	96.6
CRP	111	1	4	99.1
PR interval (proxy for ECG)	104	5	7	95.4
Carditis (proxy for echocardiogram)	114	1	1	99.1
Antistreptococcal antibody titres	113	0	3	100.0

Confirmed and probable cases only

Of the cases where a throat swab was taken in the week after admission, 35.1% (27/77) were positive for group A streptococcus. The *emm* type [cluster pattern] was recorded for nine cases and was as follows: 41 [D4] (two cases), 42 [E6], 53 [D4], 86 [D4], 89 [E4] (one case each), 90 [E2] (two cases) and 91 [D4] (one case). Only one isolate reported (*emm* type 89) would be covered by the proposed 30-valent GAS vaccine, and two further isolates may be covered through opsonisation or cross protection (*emm* types 42 and 53) [14]. The remaining isolate *emm* types (41, 86, 90 and 91) have not been determined if they would be covered through opsonisation.

Deaths

No deaths from rheumatic fever were reported in EpiSurv or in the Mortality Collection. EpiSurv does not record information on deaths from RHD.

Family history of rheumatic fever

Family history of rheumatic fever was recorded for 89 (76.0%) first episode rheumatic fever cases. Over a third (32/89, 36.0%) of cases reported a family history of rheumatic fever (Table 14). Three cases reported a family history in more than one relationship category and only the closest relationship has been included in the following table. The most common relationship reported was a grandparent/cousin/aunt/uncle (48.1%) followed by a parent or sibling (40.7%) and then second cousin/great aunt/great uncle (11.1%).

Table 14. Family relationship for first episode rheumatic fever cases reporting a family history

Relationship to case	Number	Percent (%)[1]
Parent or sibling	11	40.7
Cousin, uncle, aunt or grandparent	13	48.1
Great uncle, great aunt, 2nd cousin	3	11.1
Not stated / unclear	5	-
Total[2]	**32**	**100.0**

Confirmed and probable cases only.
[1] Percent refers to the number of cases for which information was known
[2] Total includes three cases that reported a family history in more than one relationship category

Case follow up and contact management

Information on case follow-up for first episode rheumatic fever cases is shown in Table 15. Almost two thirds (63.8%, 67/105) of families of first episode rheumatic fever cases were referred to a local housing service. The number of cases referred in each DHB is shown in Table 23 in the appendix. Some families were not eligible for referral (e.g. adult rheumatic fever case with no children in the household), and some families declined referrals. Only one Pacific case (in Auckland or Wellington) was reported as having contact with a Pacific community worker, although this information was unknown for 41 cases.

Most cases (109/112, 97.3%) were placed on a rheumatic fever register. For the three who were not, one was planned to be added, one had a possible penicillin allergy given as the reason for not being added to the register, and no reason was given for the other case. Arrangements were made for delivery of prophylaxis in all cases where the information was known.

Table 15. Case follow up for first episode rheumatic fever cases, July 2014 to June 2015 onset

Case follow up and contact management (n=117)	Yes	No	Unknown	Percent (%)[1]
Case or household referred to a local health service to assess overcrowding or housing	67	38	12	63.8
Case's household has ever had contact with a Pacific engagement strategy community worker (Pacific people in Auckland or Wellington only) (n=50)	1	8	41	11.1
Case was placed on rheumatic fever or secondary prevention management system	109	3	5	97.3
Arrangements made for delivery of prophylaxis	112	0	5	100.0

Confirmed and probable cases only
[1] Percent refers to the number of cases for which information was known

Information on throat swabbing of household contacts was provided for 106 (90.5%) cases. A total of 84/106 (79.2%) cases had their household contacts throat swabbed, with 38/84 (45%) contacts having GAS positive throat swabs, however only 15/38 (39.5%) swabs had an *emm* type reported.

Information on the *emm* type of both the case and contact(s) was available for only three cases. Of these, one case had the same *emm* type reported as the contact.

RECURRENT EPISODE RHEUMATIC FEVER

A total of four recurrent episode rheumatic fever cases with onset from July 2014 to June 2015 were reported. All four were reported as confirmed cases.

Two cases were aged 5–14 years and both were in the Māori ethnic group. The other two cases were aged 15–24 years and were Pacific peoples. Cases were from Counties Manukau (2 cases), Auckland and Bay of Plenty DHBs (1 case each).

Basis of diagnosis

The Communicable Disease Control Manual case definition for recurrent episode rheumatic fever cases is the same as for initial episodes (Table 2) with the added requirement of a known past history of rheumatic fever or previously diagnosed RHD. Cases can be classified as suspect, probable and confirmed.

All four recurrent episode rheumatic fever cases were recorded in EpiSurv as confirmed. However, after reviewing the information on all four recurrent episodes, two met the confirmed definition, one was probable and one was suspect (Table 16). All four cases met the clinical (Jones) criteria for rheumatic fever; but the level of evidence of preceding GAS infection was sufficient for confirmation in only one case. One case had chorea and therefore evidence of preceding GAS infection was not required.

Table 16. Case criteria for recurrent episode rheumatic fever cases, July 2014 to June 2015 onset

Case No.	Age group (years)	Number of previous attacks	Previous RHD	Jones Criteria	Serological evidence of preceding GAS	Other evidence of preceding GAS	Classification[1]
Case 1	15–24	3	Yes	2 major and 2 minor	Yes	None	Confirmed
Case 2	5–14	1	Yes	chorea	No	None	Confirmed
Case 3	15–24	2	Yes	2 major and 1minor	No	None	Suspect
Case 4	5–14	1	Not stated	1 major and 2 minor	Unknown	Culture positive	Probable

[1] Applying the Communicable Disease Control Manual definition

Protective factors

Information on whether the recurrent episode rheumatic fever cases were already on a rheumatic fever register at the time of their recurrence was provided for all four cases, and all were on a register.

Three recurrent episode cases were receiving antibiotic prophylaxis prior to their recurrence and one was not. The case that was not receiving antibiotic prophylaxis was on a rheumatic fever register but reported as non-compliant, transient, and self-discharged from hospital. All three cases receiving antibiotic prophylaxis were on benzathine penicillin prior to their recurrence, with two cases taking it every 28 days as prescribed and one case reported as taking it irregularly (Table 17). Only one case

had the date of the last two doses recorded, and the last dose for this case was received 10 days prior to the recurrent episode.

Table 17. Antibiotic prophylaxis regime for recurrent episode rheumatic fever cases, July 2014 to June 2015 onset

Case No.	Age group (years)	On rheumatic fever register	Receiving antibiotic prophylaxis	Name of antibiotic	Prescribed frequency	Regularity
Case 1	15–24	Yes	Yes	benzathine penicillin	Unknown	Irregularly
Case 2	5–14	Yes	Yes	benzathine penicillin	28 days	Regularly
Case 3	15–24	Yes	No	N/A	N/A	N/A
Case 4	5–14	Yes	Yes	benzathine penicillin	28 days	Regularly

Clinical course and management

All four recurrent episode rheumatic fever cases were hospitalised. Two cases had throat swabs taken in the week after admission and neither were positive for GAS.

One case reported that they had not seen a doctor for rheumatic fever symptoms in the three months prior to hospital admission. No information was available for the other three cases.

Arrangements for ongoing prophylaxis were made for three cases – one case was unable to be contacted (the non-compliant case above).

There were no deaths reported amongst the recurrent cases.

Contact management

Only one recurrent episode rheumatic fever case had household contacts that were throat swabbed. Five contacts had a throat swab taken and one was positive for GAS but no *emm* type was recorded.

DISCUSSION

Rheumatic fever trends and prevention approaches

This report describes cases of rheumatic fever with an onset date between July 2014 and June 2015. A total of 117 confirmed or probable first episode rheumatic fever cases with onset from July 2014 to June 2015 were reported giving a rate of 2.6 per 100,000. This compares with 178 confirmed or probable first episode rheumatic fever cases reported with onset from the previous year, July 2013 to June 2014. There has been a 34% decline in the number of notified cases between these two time periods, coinciding with the implementation of the RFPP. The BPS target of reducing first episode rheumatic fever hospitalisations by two thirds from 4.0 to 1.4 per 100,000 population by 2017 appears to be on track. Nevertheless, with a national rate of 2.6 per 100,000, New Zealand's rate is amongst the highest in industrialised countries [1], and is yet to reach the lower rates that occurred in the early 2000s.

The RFPP was set up in 2011 to combat New Zealand's high rates of rheumatic fever. The programme includes strategies to increase awareness of rheumatic fever and how to prevent it, reduce household crowding and improve access to effective treatment for GAS sore throat infections. Many initiatives were not fully implemented until 2014 and therefore their impact may yet be seen.

Quality and completeness of data

Case note reviews were not undertaken for any of the notified cases. Consequently, data reported is based solely on the notification information available which may miss some details, particularly the sequence of events in cases that were difficult to diagnose.

We rely on accurate recording of dates, clinical diagnostic criteria, course and outcome, and risk factors for rheumatic fever on the case report form. Most sections of the case report form were completed reasonably well, including basis of diagnosis, clinical course and risk factors. However, specific details regarding the evidence of GAS infection, seeking health professional care, antibiotic treatment prior to admission, and family history were less than adequately completed. In addition, information on housing referral, rheumatic fever register/prophylaxis for recurrences, case management/follow up details, and contact management was not well completed.

On careful review of the information reported in the basis of diagnosis section, we note that the stated classification only matched the Communicable Disease Control Manual definitions for 94/128 (73.4%) of all rheumatic fever cases. This suggests that there is some confusion around applying the case definition accurately, and more regular review of case classification data may be required. The quality of the basis of diagnosis information for rheumatic fever cases in EpiSurv needs to be strengthened to ensure all cases are correctly identified and classified

Ethnic disparities, awareness raising and education

Ethnic disparities are very concerning, with 43 first episode rheumatic fever cases in Pacific peoples aged 5–14 years (77.3 per 100,000 population) and 46 in Māori aged 5–14 years (31.7 per 100,000) compared with two cases for European or Other aged 5–14 years. Although rheumatic fever rates for both Māori and Pacific peoples are declining, the decline is greater amongst Māori. For Māori, 64% of

cases reported a sore throat in the four weeks prior to admission compared with 40% of Pacific cases. A strong focus on awareness raising and ensuring health education around sore throat care seeking, and access to rapid assessment and treatment of sore throats for high risk Māori and Pacific families should continue.

Diagnostic criteria

The New Zealand guidelines for the diagnosis of rheumatic fever were updated in 2014 [11] and are largely aligned to the Ministry of Health Communicable Disease Control Manual guidelines [3], with the exception of indolent carditis (carditis of insidious onset and slow progression with evidence of inflammatory disease as distinguished from chronic RHD) as the only manifestation of rheumatic fever.

The serological evidence of preceding GAS infection required to make a confirmed or probable diagnosis of rheumatic fever needs to be reviewed. The New Zealand rheumatic fever guidelines have relatively high ULN cut-offs for antistreptococcal serology (ASO and anti-DNase B titres) compared with Australia and other countries. They are also higher than those recommended in early modifications of the Jones criteria (ASO >333 IU/mL for children >5 years, and >250 IU/mL for adults) [15]. The New Zealand cut-offs may be higher than necessary to support a confirmed or probable diagnosis of rheumatic fever. Global rheumatic fever experts recommend using age-specific streptococcal antibody serology titres. New Zealand could adopt the age-specific titres used in Australia [16], or conduct their own study to develop accurate New Zealand age-specific titre cut-offs.

In addition, clarifying what constitutes a rise in anti-streptococcal titre levels needs to be addressed. The WHO and other experts recommend a two-fold rise between acute and convalescent titre levels as indicative of a true GAS infection [12]. As most rheumatic fever cases do not have GAS serology at the time of the acute GAS throat infection, documenting the date or dates of GAS serology should be added to the case report form to enable better interpretation of titre levels.

Quality of case and contact management

The New Zealand guidelines recommend that all those with suspected rheumatic fever should be hospitalised as soon as possible after the onset of symptoms [11]. Although most suspected rheumatic fever cases were hospitalised within two weeks of the onset of symptoms, a quarter of cases in 2014/15 were not. Hospital admission allows appropriate investigations to be performed to confirm the diagnosis. It also provides opportunity for education to the patient and family on rheumatic fever, secondary prophylaxis, and RHD. Awareness raising among primary care practitioners on the New Zealand guideline recommendations for timely admission to hospital may be needed in certain regions (Table 12). Some delay may be due to delayed care seeking. Seven cases were admitted over four weeks after the onset of symptoms with one case not admitted for almost 12 weeks. Education to families and communities may help and health professionals need to be especially alert to possible rheumatic fever in high-risk populations, particularly those with a family history of rheumatic fever.

All cases should have a throat swab taken on admission and *emm* typing conducted on all GAS positive swabs. In addition, family contacts should have throat swabs taken with *emm* typing carried out if GAS is detected. Data presented in this report show that this is either not currently routine practice, or is not being reported.

Adherence

Support for adherence to antimicrobial treatment to complete a 10-day course of appropriate antibiotics, as per the National Heart Foundation guidelines, for the treatment of GAS pharyngitis is critical to prevent rheumatic fever. Although 21 cases were prescribed antibiotics, 10 reported taking the full course and six did not (five unknown), giving 62.5% adherence for the known cases. Improved adherence education and support is needed as, despite seeking care and having their sore throat appropriately managed, almost 38% of this group were at risk of rheumatic fever through not completing the full course of prescribed antibiotics.

Family history and referral to a housing service

The high proportion of notified cases with a family history of rheumatic fever suggests that families or households who have a member with a history of rheumatic fever or RHD are at increased risk of another family member contracting rheumatic fever. Identifying these high-risk families and ensuring they have ready access to free or affordable rapid health care, and are prioritised for housing assessments, may augment existing prevention strategies.

Almost two thirds of first episode rheumatic fever cases were referred to a local housing service. Notably Northland DHB only had a referral to a local housing service rate of 18.2% and Tairāwhiti DHB's referral rate was 28.6%, however this may reflect the fact that the service was still being implemented in 2014.

Secondary prophylaxis and recurrent cases

Secondary prophylaxis is routinely implemented for all cases of rheumatic fever to prevent recurrences and reduce the likelihood of RHD. There were four recurrent cases of rheumatic fever during the report period (3% of total cases), with all reported as being on a rheumatic fever register. However, only one case had the date of the last two doses of IM benzathine penicillin recorded. In addition, there were three first episode rheumatic fever cases who were discharged from hospital without being placed on a rheumatic fever register. The regular schedule for secondary prophylaxis is IM benzathine penicillin G given every 28 days. For those with a recurrence on a 28-day schedule, a 21-day schedule is recommended. One recurrent case in this reporting period was noted as having prophylaxis irregularly.

Rheumatic fever registers are critical to the ongoing prevention of rheumatic fever and RHD. A review of the effectiveness of existing registers and implementing required improvements may support prevention strategies. A national rheumatic fever register should be considered to ensure consistent, timely and responsive management of high-risk individuals.

Possible contribution of GAS skin infections to developing rheumatic fever

We have limited information on *emm* types from rheumatic fever cases during this report period. However, it is notable that, of those reported, over half of the GAS throat isolates were of typical skin *emm* types (*emm* pattern D) and the remaining were of skin/pharyngeal *emm* types (*emm* pattern E) [17]. There were no GAS isolates reported that belonged to the typical throat *emm* type pattern [A–C]. This finding is in keeping with Williamson et al's analysis of a larger group of 74 GAS isolates temporally associated with rheumatic fever in New Zealand between 2006–2014, where 36/74 (49%) of strains were of the skin *emm* pattern D [18].

Conclusion

Considerable progress has been made in the primary prevention of rheumatic fever in New Zealand in recent years, coinciding with a decline in overall rheumatic fever rates. However, accurate diagnosis of rheumatic fever, referral timeliness, and management, including appropriate referral to rheumatic fever registers and for housing assessments, require strengthening. Ongoing surveillance will be essential to monitor rheumatic fever trends in New Zealand.

REFERENCES

1. Steer AC. 2015. Historical aspects of rheumatic fever. *J Paediatr Child Health* 51(1): 21-7.

2. Milne RJ, Lennon D, Stewart JM, et al. 2012. Mortality and hospitalisation costs of rheumatic fever and rheumatic heart disease in New Zealand. *J Paediatr Child Health* 48(8): 692-7.

3. Ministry of Health New Zealand. 2014 *Communicable Disease Control Manual. Rheumatic Fever chapter update.* Wellington. http://www.health.govt.nz/system/files/documents/publications/cd-manual-rheumatic-fever-v2-dec-2014.pdf

4. Ministry of Health, New Zealand. 2004. *Ethnicity Data Protocols for the Health and Disability Sector.* Wellington. https://www.health.govt.nz/system/files/documents/publications/ethnicitydataprotocols.pdf

5. Atkinson J, Salmond, C., Crampton, P. 2014. *NZDep2013 Index of Deprivation.* University of Otago, Wellington. http://www.health.govt.nz/publication/nzdep2013-index-deprivation

6. Loring B. 2008. *Rheumatic Fever in the Bay of Plenty and Lakes District Health Boards. A review of the evidence and recommendations for action*. Toi te Ora Public Health. http://www.toiteorapublichealth.govt.nz/vdb/document/150

7. Oliver J, Pierse N, Baker M. 2014. Estimating rheumatic fever incidence in New Zealand using multiple data sources. *Epidemiol Infect*: 1-11.

8. Jackson C, Lennon D. 2009. *Rheumatic Fever Register Scoping the Development of a National Web-Based Rheumatic Fever Register.* Ministry of Health, Auckland.

9. Yap M. 2012. *Review: Rheumatic Fever Registers as a component of Secondary Prevention Programmes.* Ministry of Health, Wellington .

10. Ministry of Health, New Zealand. 2016. *Annual Plan Guidance for Public Health Units 2016/17. Appendix 1 Strategic Priorities.* Wellington. http://nsfl.health.govt.nz/dhb-planning-package/201617-planning-package-and-review-plans/phu-guidance

11. National Heart Foundation of New Zealand. 2014. *New Zealand Guidelines for Rheumatic fever: Diagnosis, Management and Secondary Prevention of Acute Rheumatic Fever and Rheumatic Heart Disease: 2014 Update. https://www.heartfoundation.org.nz/uploads/HF2227A_Rheumatic_Fever_Guideline_v3.pdf*

12. Parks T, Smeesters PR, Curtis N, et al. 2015. ASO titer or not? When to use streptococcal serology: a guide for clinicians. *Eur J Clin Microbiol Infect Dis* 34(5): 845-9.

13. National Heart Foundation of New Zealand. 2014. *Group A Streptococcal Sore Throat Management Guideline. 2014 Update.* Auckland. http://assets.heartfoundation.org.nz/shop/heart-healthcare/non-stock-resources/gas-sore-throat-rheumatic-fever-guideline.pdf

14. Dale JB, Penfound TA, Tamboura B, et al. 2013. Potential coverage of a multivalent M protein-based group A streptococcal vaccine. *Vaccine* 31(12): 1576-81.

15. Stollerman G, Markowitz, M., Tar5anta, A., Wannamaker, LW., Whittemore, R. 1965. Jones criteria (revised) for guidance in the diagnosis of rheumatic fever. *Circulation* 32(4): 664-8.

16. RHDAustralia. National Heart Foundation of Australia, and the Cardiac Society of Australia and New Zealand. 2012. *Australian guideline for prevention, diagnosis and management of acute rheumatic fever and rheumatic heart disease (2nd edition).* Menzies School of Health Research.

17. Bessen DE, Sotir CM, Readdy TL, et al. 1996. Genetic correlates of throat and skin isolates of group A streptococci. *J Infect Dis* 173(4): 896-900.

18. Williamson DA, Smeesters PR, Steer AC, et al. 2015. M-Protein Analysis of Streptococcus pyogenes Isolates Associated with Acute Rheumatic Fever in New Zealand. *J Clin Microbiol* 53(11): 3618-20.

APPENDIX

Table 18. Length of time between hospitalisation and notification for rheumatic fever cases by DHB, July 2014 to June 2015 onset

District health board	Time between hospitalisation and notification date (days)				Percentage (%)[1] of cases notified within specified number of days of hospitalisation		
	≤7	8–14	15+	N/A[2]	≤7	8–14	15+
Northland	9	2	1	1	75.0	16.7	8.3
Waitemata	5	2	2	0	55.6	22.2	22.2
Auckland	9	0	5	0	64.3	0.0	35.7
Counties Manukau	20	11	9	0	50.0	27.5	22.5
Waikato	10	2	0	0	83.3	16.7	0.0
Lakes	2	2	4	1	25.0	25.0	50.0
Bay of Plenty	2	1	3	0	33.3	16.7	50.0
Tairāwhiti	4	3	0	0	57.1	42.9	0.0
Taranaki	0	1	0	0	0.0	100.0	0.0
Hawke's Bay	3	0	0	0	100.0	0.0	0.0
Whanganui	0	0	0	0	0.0	0.0	0.0
MidCentral	2	0	1	0	66.7	0.0	33.3
Hutt Valley	3	0	0	0	100.0	0.0	0.0
Capital & Coast	3	0	1	0	75.0	0.0	25.0
Wairarapa	0	1	1	0	0.0	50.0	50.0
Nelson Marlborough	0	0	0	0	0.0	0.0	0.0
West Coast	0	0	0	0	0.0	0.0	0.0
Canterbury	2	0	0	0	100.0	0.0	0.0
South Canterbury	0	0	0	0	0.0	0.0	0.0
Southern	0	0	0	0	0.0	0.0	0.0
Total	**74**	**25**	**27**	**2**	**58.7**	**19.8**	**21.4**

[1] Percent refers to the number of cases for which information was known

[2] Two cases were not hospitalised

Table 19. Number of cases and rate per 100,000 population of first episode rheumatic fever by age group and sex, July 2014 to June 2015 onset

Age group (years)	Female		Male		Total	
	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]
0–4	0	-	1	-	1	-
5–14	43	14.6	48	15.6	91	15.1
15–24	10	3.2	8	2.4	18	2.8
25+	4	-	3	-	7	0.2
Total	**57**	**2.5**	**62**	**2.7**	**117**	**2.6**

Confirmed and probable cases only

[1] Rate per 100,000 population. Where there were fewer than five cases in any category, a rate has not been calculated.

Table 20. Number of cases and rate per 100,000 of first episode rheumatic fever by age group and prioritised ethnicity, July 2014 to June 2015 onset

Age group (years)	Māori		Pacific peoples		European/other	
	Cases	Rate[1]	Cases	Rate[1]	Cases	Rate[1]
0–4	0	-	1	-	0	-
5–14	46	31.7	43	77.3	2	-
15–24	8	6.4	9	16.6	1	-
25+	3	-	3	-	1	-
Total	**55**	**8.5**	**56**	**20.1**	**4**	**-**
Age groups (years) targeted by current initiatives						
5–12	37	31.6	34	76.1	1	-
4–19	51	22.5	49	54.8	3	-

Confirmed and probable cases only

[1] Rate per 100,000 population. Where there were fewer than five cases in any category, a rate has not been calculated.

Table 21. Number of cases and rate per 100,000 population of first episode rheumatic fever by deprivation, July 2014 to June 2015

NZDep2013 decile[1]	Cases	Rate[2]
1	1	-
2	3	-
3	0	0.0
4	5	1.1
5	0	0.0
6	1	-
7	9	2.0
8	14	3.2
9	27	6.1
10	54	12.3
Unknown	3	-
Total	**117**	**2.6**

Confirmed and probable cases only

[1] New Zealand index of deprivation (1 = least deprived and 10 = most deprived).

[2] Rate per 100,000 population. Where there were fewer than five cases in any category, a rate has not been calculated.

Table 22. Number of major and minor clinical manifestations for rheumatic fever cases, July 2014 to June 2015 onset

Number of major manifestations	Number of minor manifestations				
	0	1	2	3	Total
First episode					
0	0	0	0	1	**1**
1	1	14	25	13	**48**
2	3	22	31	3	**59**
3	1	3	7	0	**11**
Recurrent episode					
1	0	0	1	0	**1**
2	0	1	2	1	**3**
Total	**5**	**40**	**66**	**17**	**128**

Table 23. Number of cases first episode rheumatic fever cases referred to a local housing service by DHB, July 2014 to June 2015 onset

District Health Board	Yes	No	Unknown	Percent (%)[1]
Northland	2	9	2	18.2
Waitemata	5	2	1	71.4
Auckland	7	3	2	70.0
Counties Manukau	25	6	5	80.6
Waikato	10	2	0	83.3
Lakes	3	4	0	42.9
Bay of Plenty	2	2	1	50.0
Tairāwhiti	2	5	0	28.6
Taranaki	1	0	0	100.0
Hawke's Bay	1	0	1	100.0
Whanganui	0	0	0	0.0
MidCentral	0	3	0	0.0
Hutt Valley	3	0	0	100.0
Capital & Coast	4	0	0	100.0
Wairarapa	2	0	0	100.0
Nelson Marlborough	0	0	0	0.0
West Coast	0	0	0	0.0
Canterbury	0	2	0	0.0
South Canterbury	0	0	0	0.0
Southern	0	0	0	0.0
Total	**67**	**38**	**12**	**63.8**

Confirmed and probable cases only

[1] Percent refers to the number of cases for which information was known

INSTITUTE OF ENVIRONMENTAL SCIENCE AND RESEARCH LIMITED

Kenepuru Science Centre
34 Kenepuru Drive, Kenepuru, Porirua 5022
PO Box 50348, Porirua 5240
New Zealand
T: +64 4 914 0700 **F:** +64 4 914 0770

Mt Albert Science Centre
120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142
New Zealand
T: +64 9 815 3670 **F:** +64 9 849 6046

NCBID – Wallaceville
66 Ward Street, Wallaceville, Upper Hutt 5018
PO Box 40158, Upper Hutt 5140
New Zealand
T: +64 4 529 0600 **F:** +64 4 529 0601

Christchurch Science Centre
27 Creyke Road, Ilam, Christchurch 8041
PO Box 29181, Christchurch 8540
New Zealand
T: +64 3 351 6019 **F:** +64 3 351 0010

www.esr.cri.nz