

# Modifiable risk factors for ARF: results from NZ case-control study

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# NZ RF Risk Factors Study

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# Outline

**Note – All results are provisional and will change in final published version**

- Goal & aims
- Risk factors under investigation
- Methods
- Proximal risk factors
- Distal risk factors
- Multivariate analysis
- Implications

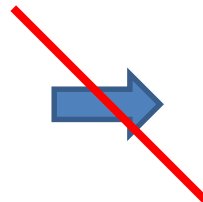




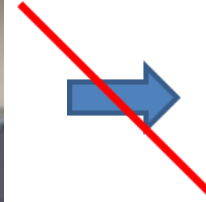
# Goal of research

To identify **modifiable risk factors** for acute rheumatic fever to inform prevention policy & interventions

Distal risks  
factors /  
Determinants



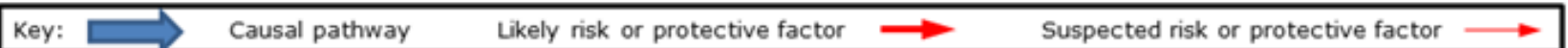
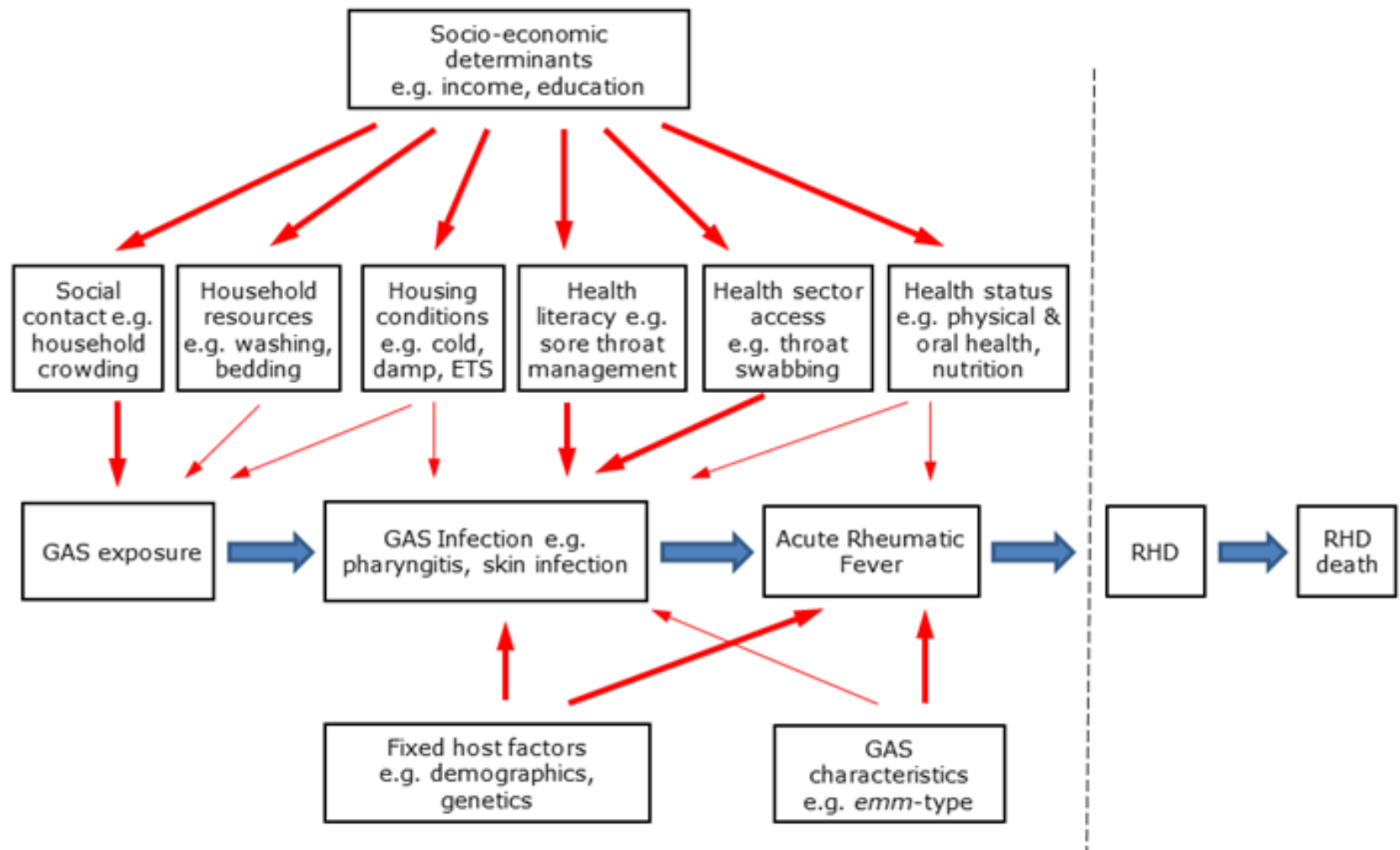
Proximal risk  
factors



ARF/RHD



# Risk Factors under investigation



# **Which of following factors are associated with an increased risk of ARF?**

## **Proximal risk factors**

- Throat infection
- Skin infection
- Scabies infection

## **Distal risks factors / Determinants**

- Family history of RF
- Household crowding
- Bed sharing
- Poor quality housing eg cold, damp, mould
- Lack of hot water for showering/bathing
- Barriers to primary healthcare
- Poor nutrition (eg high intake sugar sweetened drinks)
- Poor dental health
- Tobacco smoke exposure



# Methods

## Case-control study

- 119 ARF cases (definite & probable) after excluding 19 cases that didn't meet case definition

Compared with:

- 357 closely matched controls (time, age, ethnicity, deprivation, DHB, gender) ie 3 per case



# Methods

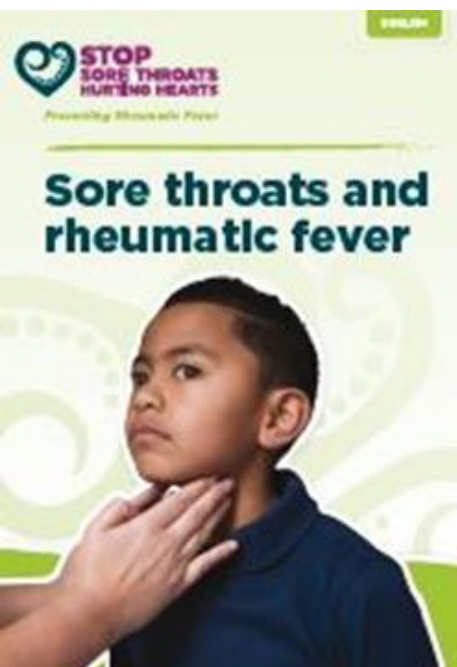
## Data collection

- Questionnaire completed in a face-to-face interview by Māori and Pacific interviewers
- A subset of cases and controls also provided blood for additional testing, including ferritin, vitamin D, immunological markers, genetics; hair nicotine
- Linked data on dental health, previous hospitalisations, housing, schools attended
- Height, weight, BMI from clinical records (cases) or NZHS records (controls)

# Results: Proximal exposures

**Sore throat in  
previous 4 weeks**

	Case		Control	
	n	%	n	%
Yes	59	49.5	101	28.3
No	55	46.2	253	70.9
Don't Know	5	4.2	3	0.8
		UCL	LCL	p
Conditional aOR	2.52	1.60	3.99	<0.0001



**Conditional = analysis of case with 3  
matched controls**

**aOR = adjusted Odds Ratio,  
adjusted for matching variables of  
age, sex, ethnicity, deprivation, DHB**

# Results: Proximal exposures

## Skin infection in previous 4 weeks

Skin abscess



School sore



Skin abscess



Cellulitis



School sore



	Case		Control	
	n	%	n	%
Yes	25	21.0	36	10.1
No	93	78.2	321	89.9
Don't Know	1	0.8	0	0.0
		UCL	LCL	p
Conditional aOR	2.30	1.30	4.07	0.004

Skin infection without throat infection		UCL	LCL	p
Conditional aOR	1.25	0.50	3.09	0.631
Skin infection with throat infection		UCL	LCL	p
Conditional aOR	13.13	2.88	59.96	0.009

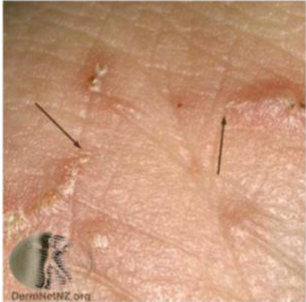
# Results: Proximal exposures

## Scabies in previous 4 weeks

	Case		Control	
	n	%	n	%
Yes	7	5.8	5	1.4
No	112	94.1	349	97.8
Don't Know	0	0	3	0.8
		UCL	LCL	p
Conditional aOR	5.44	1.62	18.24	0.006

Scabies

Burrows (arrows point to mites) Scabies on hand



Scabies between fingers

Scabies on hand



# Results: Household crowding

**Bedroom deficit  
of one or more  
(Canadian  
National  
Occupancy  
Standard / CNOS)**

	Case		Control	
	n	%	n	%
0 bedroom deficit	86	72.4	320	89.7
1 Bedroom deficit	22	18.5	22	6.2
2 Bedroom deficit	7	5.9	13	3.6
3 or more Bedroom deficit	4	3.4	2	0.6
		UCL	LCL	p
Conditional aOR	3.78	2.13	6.72	<0.0001

ARF association with all measures of household crowding:

- Occupancy (people / house)
- Density (people / room)
- Crowding indices (CNOS)
- Self-assessed crowding



# Results: Bed sharing

Usually share a bed in the last 4 weeks?

	Case		Control	
	n	%	n	%
Yes	64	53.8	137	38.4
No	55	46.2	218	61.1
Don't Know			2	0.6
		UCL	LCL	p
Conditional aOR	2.31	1.44	3.69	0.001

Does anyone sleep in case/control's bed when they aren't using it ('hot bedding')?

	Case		Control	
	n	%	n	%
Yes	21	17.6	17	4.8
No	98	82.4	338	94.7
Don't Know				
		UCL	LCL	p
Conditional aOR	4.40	2.15	9.03	<0.0001

# Results: Housing tenure & quality

**Housing tenure –**  
proportion living in  
rental housing

	Case		Control	
	n	%	n	%
Rental	93	78.2	225	63.0
Owned by occupant	16	13.5	100	28
Don't now	10	8.4	32	9
		UCL	LCL	p
Conditional aOR	3.65	1.81	7.02	0.002

**Housing quality –**  
Association with  
“poor or very  
poor” vs. average  
or better based on  
self-rating on 5-  
point scale

	Case		Control	
	n	%	n	%
Poor, Very poor	31	26.0	24	6.7
Average or better	88	73.9	332	93
Don't Know			1	0.3
		UCL	LCL	p
Conditional aOR	5.17	2.70	9.90	<0.0001

# Results: Household damp & mould

**Household damp & mould** based on 3 questions:

- **Mould on the walls or ceilings** in bedrooms or living rooms in the last 12 months
- **Damp walls or ceilings** in bedrooms or living rooms the last 12 months?
- **Damp or musty smell** in bedrooms or living rooms over the last 12 months?

	Case		Control	
	n	%	n	%
1 or more indicators	75	63.0	135	37.8
No indicators	44	37.0	221	61.9
Don't Know				
		UCL	LCL	p
Conditional aOR	3.57	2.15	5.93	<0.0001

# Results: Household cold

**Household cold** based on sum of 4 questions:

- In winter, is your home **colder than you would like?**
- In winter, do you put up with **feeling cold inside to save on heating costs?**
- Did case/control need to **share a sleeping room just to stay warm** in the last 4 weeks?
- Has your house been so cold that you **shivered** in the last 4 weeks?

	Case		Control	
	n	%	n	%
1 or more indicators	90	75.6	221	62.0
No indicators	29	24.4	134	37.5
Don't Know			2	0.6
		UCL	LCL	p
Conditional aOR	2.16	1.3	3.57	0.003

# Results: Tobacco smoker exposure

## Smokers living in house

	Case		Control	
	n	%	n	%
Yes	71	59.7	173	48.5
No	48	40.3	184	51.5
Don't Know				
		UCL	LCL	p
Conditional aOR	1.79	1.12	2.85	0.014

## Hair nicotine levels measured for 94 cases & 109 controls

	Case		Control	
	n	%	n	%
≥0.2ng	36	38.3	24	22.0
<0.2ng	58	61.7	85	78.0
Don't Know				
		UCL	LCL	p
OR	2.20	1.19	4.07	0.012

# Results: Household washing resources

Composite measure based on 2 questions:

- Does case/control sometimes have a **cold or lukewarm bath/shower** because there is not enough hot water? (shown here)
- Does case/control sometimes have to **put off having a bath/shower** because there is not enough hot water?

	Case		Control	
	n	%	n	%
Yes	30	25.2	40	11.2
No	89	74.8	315	88.2
Don't Know			2	0.6
		UCL	LCL	p
Conditional aOR	2.97	1.58	5.59	<0.0007



# Results: Nutrition

**Sugar sweetened drinks** -How many sugar-sweetened drinks (including fruit juice), but not including diet drinks, does case/control normally drink per day?

	Case		Control	
	n	%	n	%
1 or more	70	58.7	131	36.9
None	49	41.2	220	61.6
Don't Know				
		UCL	LCL	p
Conditional aOR	2.43	1.55	3.81	<0.0001

# Results: Nutrition - BMI

**BMI** – based  
on measured  
height and  
weight

BMI	Case		Control	
	n	%	n	%
<18.5	12	10.1	94	26.3
18.5-24.9	34	28.6	150	42.0
25-29.9	31	26.1	54	15.1
30+	29	24.4	37	10.4
		UCL	LCL	p
aOR of BMI 30+	2.95	1.68	5.19	<0.0002

# Results: Health service access

## Barriers to primary health care access:

- Unable to be seen within 24 hrs
- Didn't visit because of cost
- Didn't visit because of transport
- Didn't visit because of childcare
- Didn't fill prescription because of cost

	Case		Control	
	n	%	n	%
2-5 barriers	27	22.6	51	14.3
0 or 1 barrier	92	77.3	306	85.8
		UCL	LCL	p
Conditional aOR	1.73	1.00	2.98	0.050

# Results: Health service access

**Current school has a throat swabbing programme for rheumatic fever (self report)?**

	Case		Control	
	n	%	n	%
Yes	59	49.6	138	38.7
No	37	31.1	144	40.3
Don't Know/ missing	23	18.5	75	21
		UCL	LCL	p
Conditional aOR	2.47	1.34	4.53	0.004

**Linked records**

		UCL	LCL	p
Conditional aOR	2.06	1.12	3.81	0.021

# Results: Family History of RF

**Relatives ever diagnosed with RF or RHD?**

	Case		Control	
	n	%	n	%
1 or more	60	52.2	76	21.7
none	55	47.8	274	78.3
Don't Know	4	3.4	7	2.0
		UCL	LCL	p
Conditional aOR	4.22	2.57	6.94	<0.0001

**Māori and Pacific ancestry** - Number of grandparents with any NZ Māori or Pacific ethnicity

	Case		Control	
	n	%	n	%
3 or more	114	95.8	278	77.9
2 or fewer	5	4.2	79	22.1
Don't Know	0		0	
		UCL	LCL	p
Conditional aOR	7.22	2.76	18.89	<0.0001

# Results: Multivariate

Significant relationship with risk of ARF in multivariate analysis:

- Family History RF
- Household Crowding
- Mould & Damp Score
- Limited hot water
- Sugar Sweetened Beverages



# Results: Multivariate

No significant relationship with risk of ARF in multivariate analysis:

- NZiDep
- Contacts outside home
- Functional Crowding
- Bed sharing
- Living with smoker
- Housing tenure
- Feeling Cold
- Oral Health (DMFT/dmft)
- School sore throat management programme
- Barriers to healthcare

# Implications for reducing RF

## 1. Revise the population approach to GAS infection management - Could include:

- More intensive, targeted approach based on family history of rheumatic fever, ethnicity/ancestry, age
- Treatment of both sore throats and skin infections
- Use of injectable penicillin and potentially prophylactic treatment
- Systematic scabies treatment

# Implications for reducing RF

## 2. Sustained improvement in the home environment of children

- **Reduced bed sharing by children** – a ‘bed for every child’.
- **Reduced household crowding** - adequate supply of affordable, suitable housing eg construction of social housing and increase security of tenure
- **Sustained improvement in housing quality** - reduce damp and mould, adequate insulation and heating, housing warrant of fitness
- **Addressing fuel poverty** – to improve energy efficiency, reduce costs of home and water heating
- **Reducing exposure to tobacco smoke** in homes and cars, and reducing respiratory infections more generally.

# Future implications for reducing RF

## 3. Improved diet for children – Eg

- Reducing consumption of sugar sweetened beverages
- Attention to micronutrient deficiencies

# Future research & evaluation

- GAS infection study in Auckland (HRC) – Focus on role of skin infection & effectiveness of oral antibiotics
- Continue evaluation of healthy housing referral programmes
- Consider trial of intensive targeted interventions for high-risk populations

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*Te Whare Wānanga o Ōtāgo*





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