The role of skin infections and scabies in the aetiology of acute rheumatic fever

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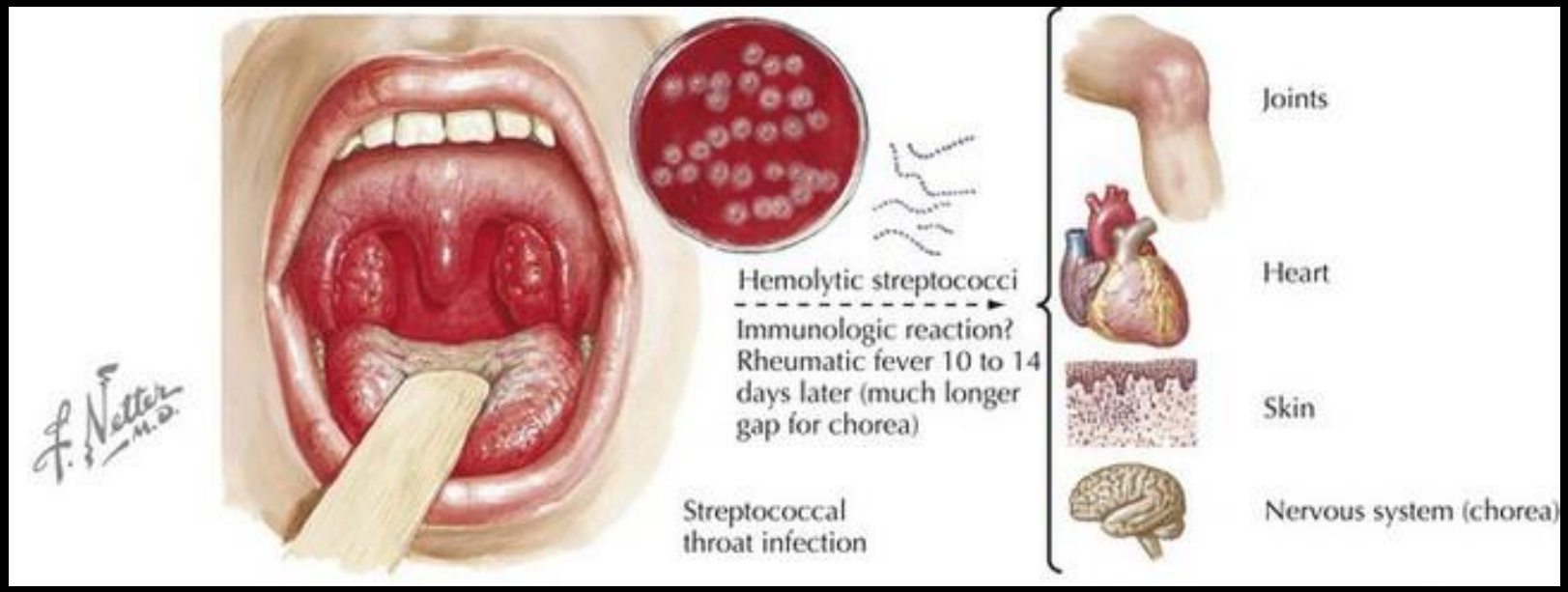
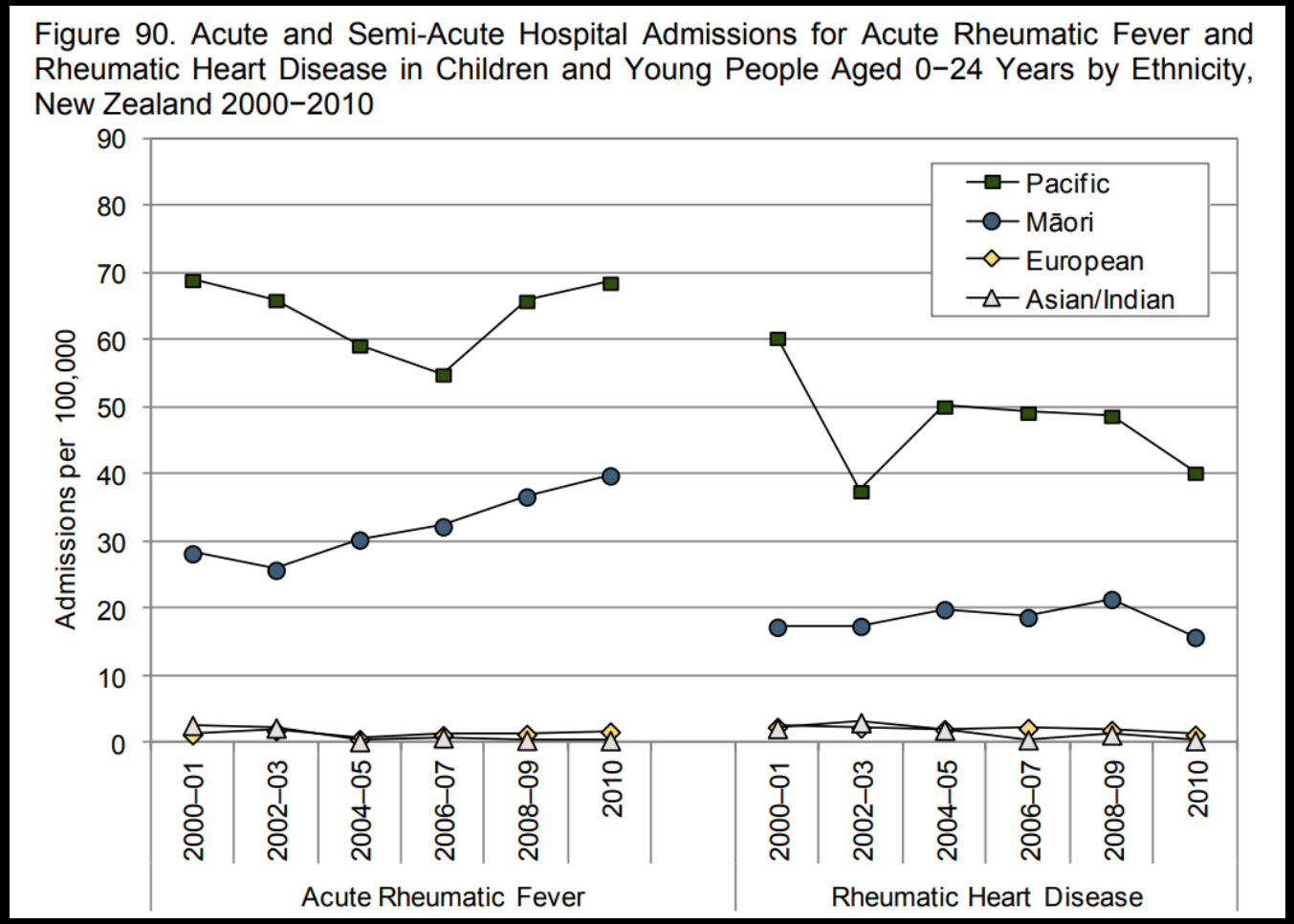
Overview

- Brief overview of ARF epidemiology
- Observations overseas to suggest scabies may be important
- Cohort study
- Conclusions



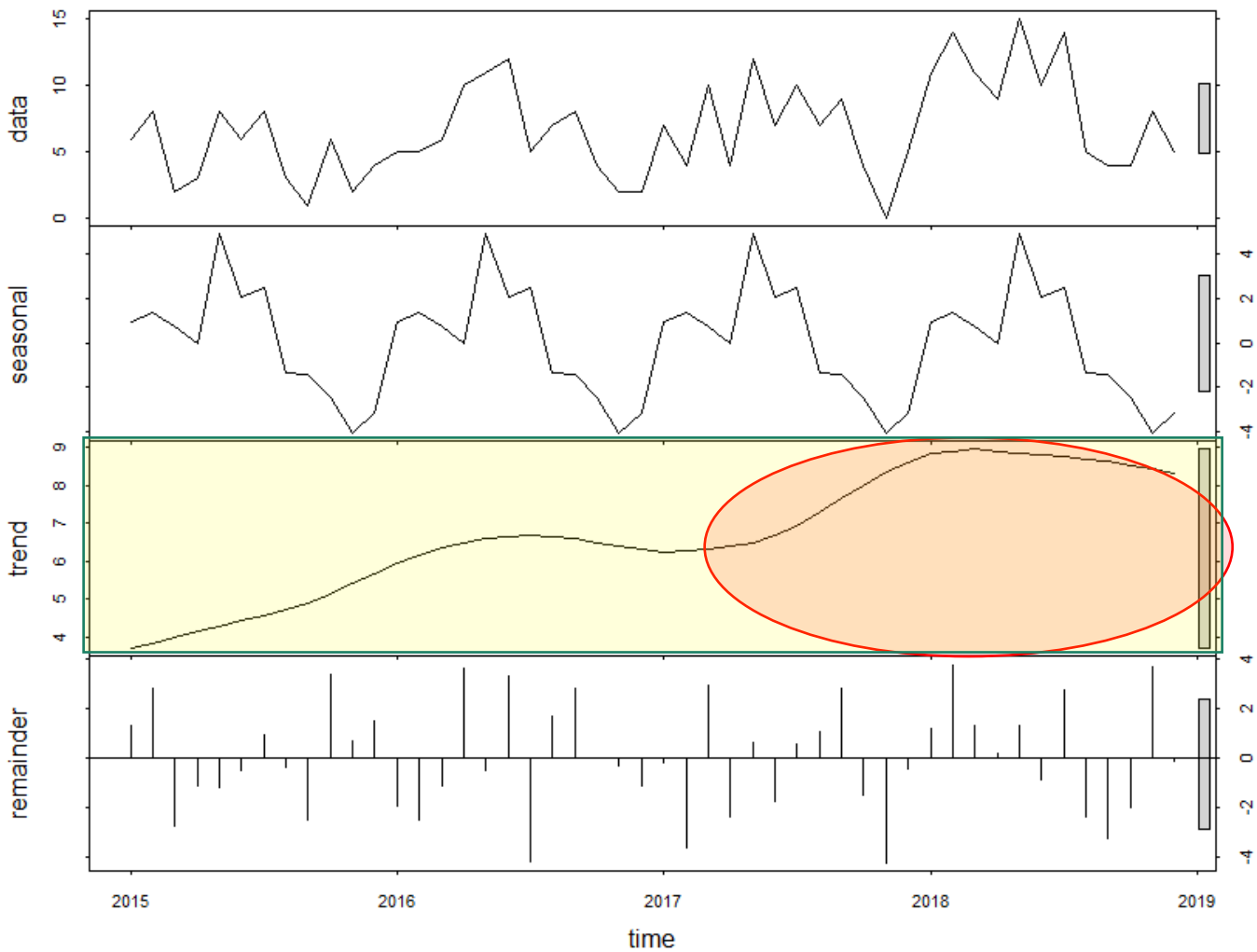
Acute Rheumatic Fever

ARF in hospital, by ethnicity

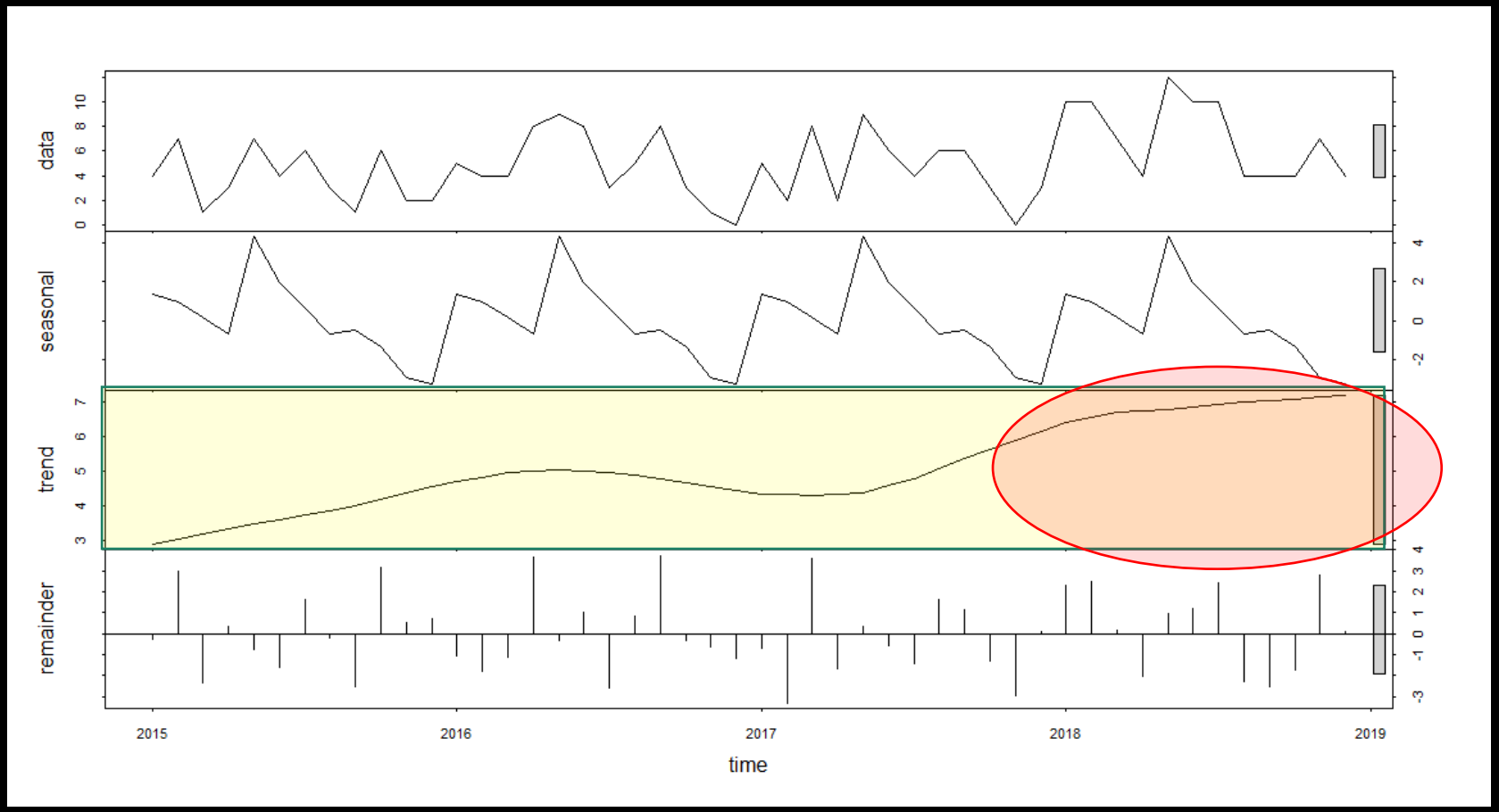


Craig et al (2011) The Health Status of Children and Young People in the Northern District Health Boards

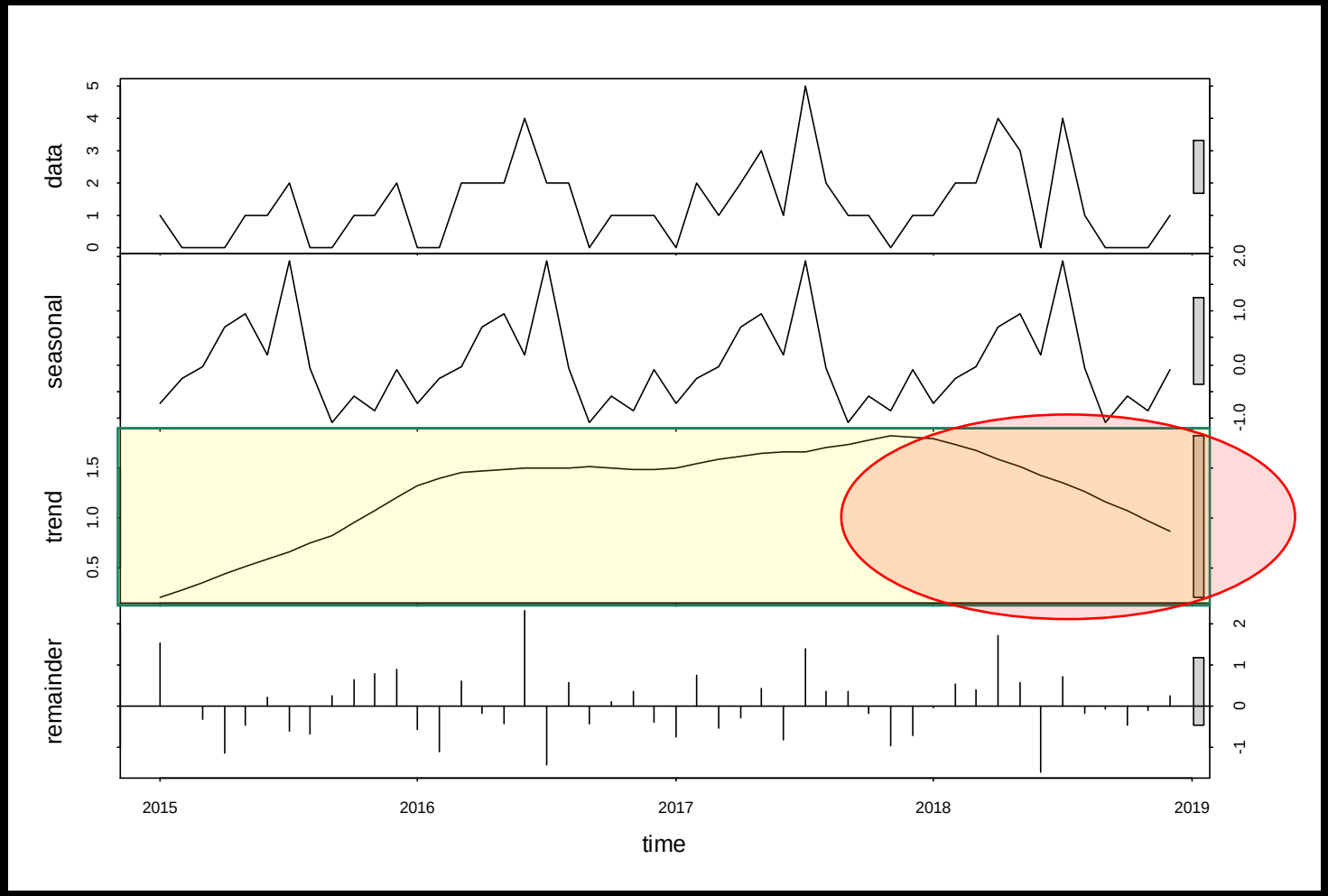
ARF cases in Auckland…



Trends… Pacific



Trends… Māori



From Australia…

- *"In this setting, skin breaks due to scabies, insect bites, and minor trauma in children are almost universal"*

McDonald, M., Currie, B. J., & Carapetis, J. R. (2004). Acute rheumatic fever: A chink in the chain that links the heart to the throat? *Lancet Inf Dis, 4*(4), 240-5.

Scabies

Scabies → ARF

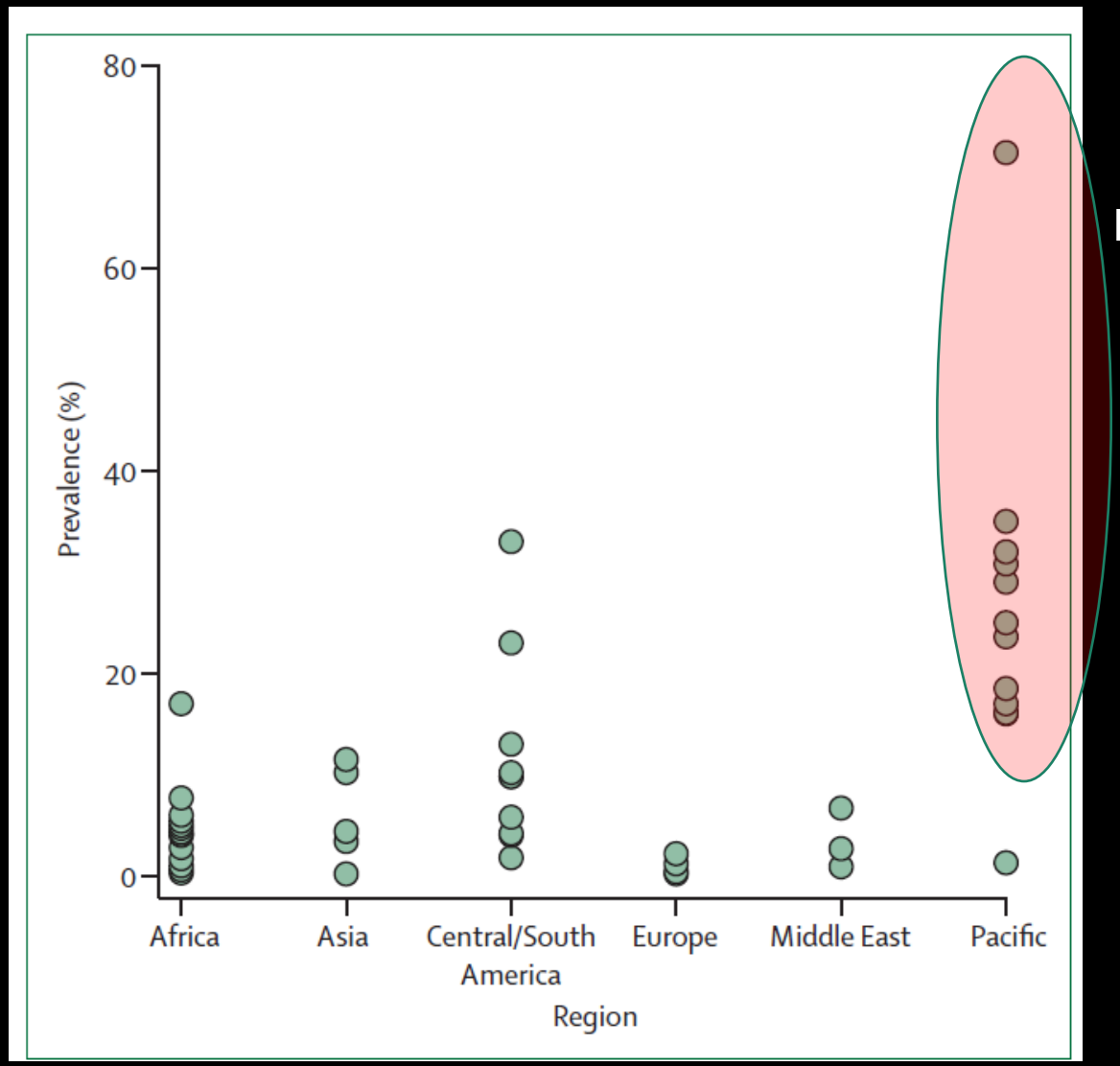
- Trinidad
  - 1970s, “outbreak of ARF followed scabies outbreak”
- Ethiopia & East Timor
  - echo findings of CRHD associated with scabies

Korte, Laura M., et al. "Scabies and impetigo in Timor-Leste: A school screening study in two districts." *PLoS neglected tropical diseases* 12.5 (2018): e0006400.

Gemechu, Tadesse, et al. "Community-based prevalence study of rheumatic heart disease in rural Ethiopia." *European journal of preventive cardiology* 24.7 (2017): 717-723.

Potter, E. V., et al. (1978). "Tropical acute rheumatic fever and associated streptococcal infections compared with concurrent acute glomerulonephritis." J Pediatr **92**(2): 325-333.

Scabies: Global prevalence



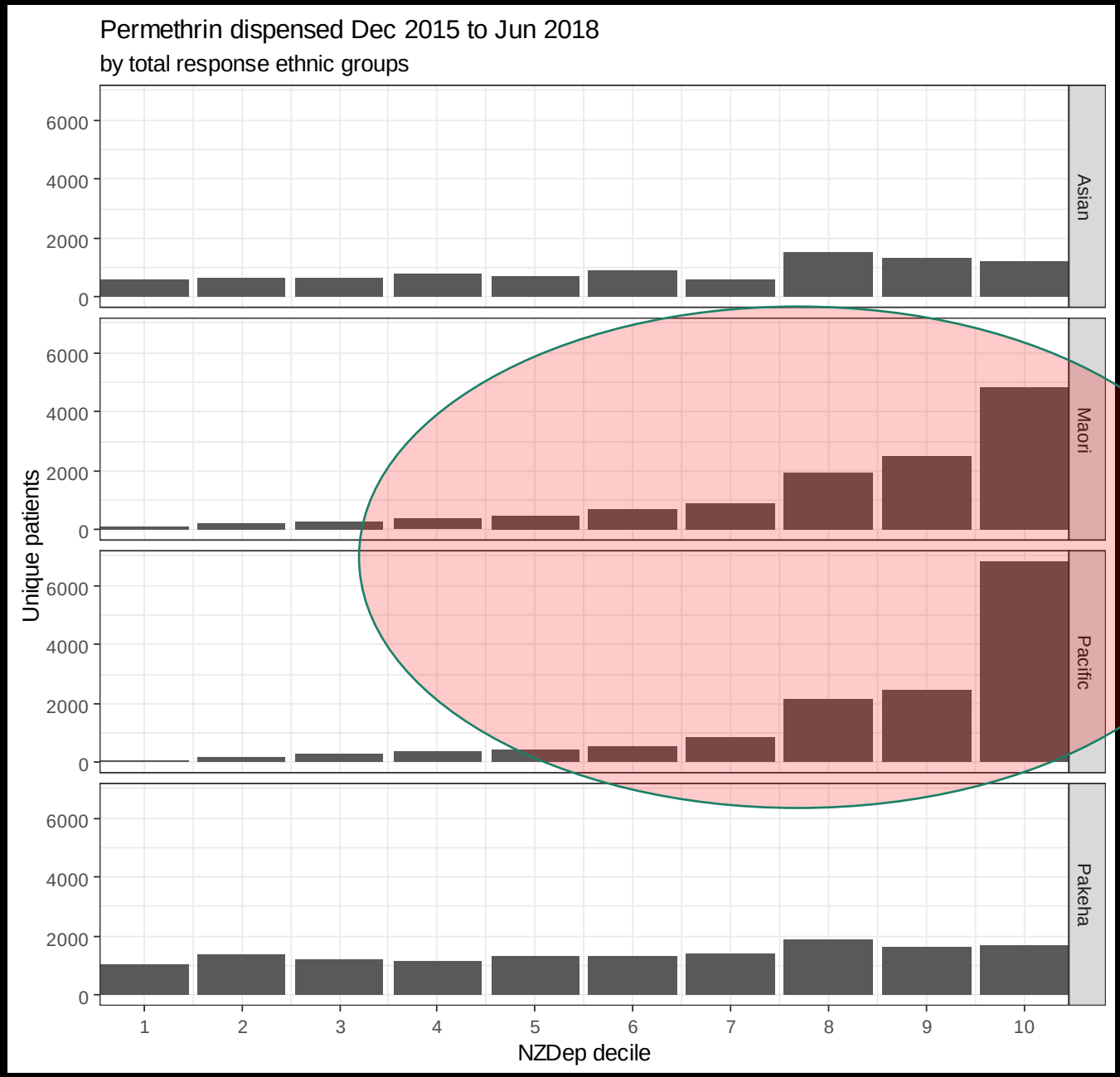
Romani et al. ***Lancet Infect Dis* 2015; 15: 960–67**

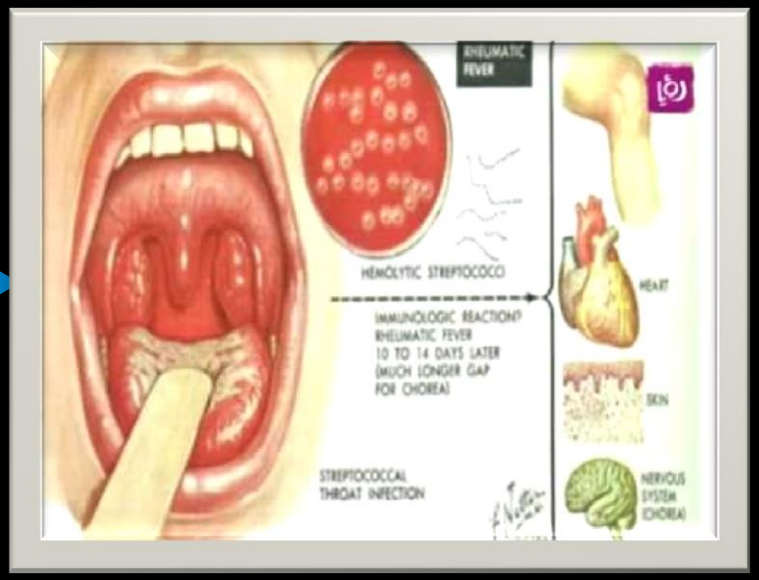
Scabies: *an itch worth scratching*

- Solomon Islands
  - Ivermectin program halved skin infection & haematuria

- High prevalence of scabies in Pacific and Indigenous Australians
  - Skin infection
  - PSGN
  - Rheumatic fever

Lawrence G, Leafasia J, Sheridan J, et al. Control of scabies, skin sores and haematuria in children in the Solomon Islands: another role for ivermectin. *Bull. World Health Organ.* 2005;**83**(1): 34-42
Currie BJ, Carapetis JR. Skin infections and infestations in Aboriginal communities in northern Australia. *Australas. J. Dermatol.* 2000;**41**(3): 139-43.


Permethrin dispensed Dec 2015 to Jun 2018
by total response ethnic groups
Unique patients
6000
4000
2000
0
Asian
Maori
Pacific
Pakeha
1
2
3
4
5
6
7
8
9
10
NZDep decile

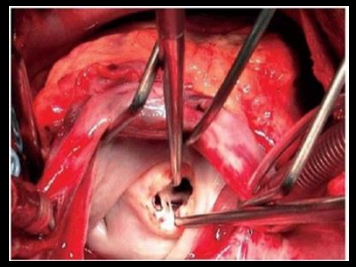


Scabies and rheumatic fever

Hypothesis


Scabies infection
Streptococcal pyoderma
Acute rheumatic fever

Cohort study



3 to 12 years;
n = 213,957

Mean 5.1 years follow-up

Rheumatic fever in hospital; *n* = 440

Scabies in hospital

n = 624

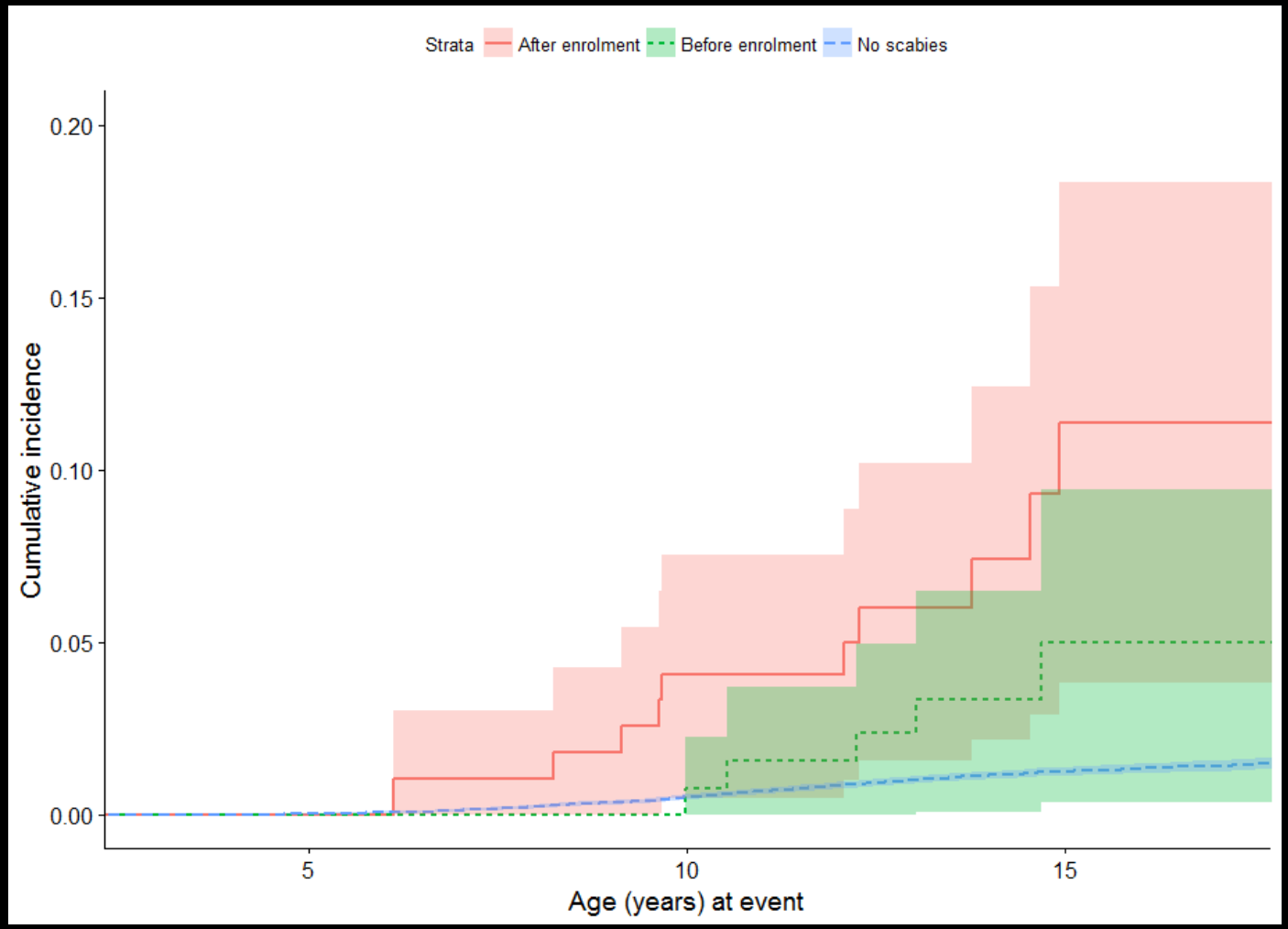
First dental exam

Confounders
Age, gender, ethnicity, SES, rotten teeth

Scabies in hospital

n = 214

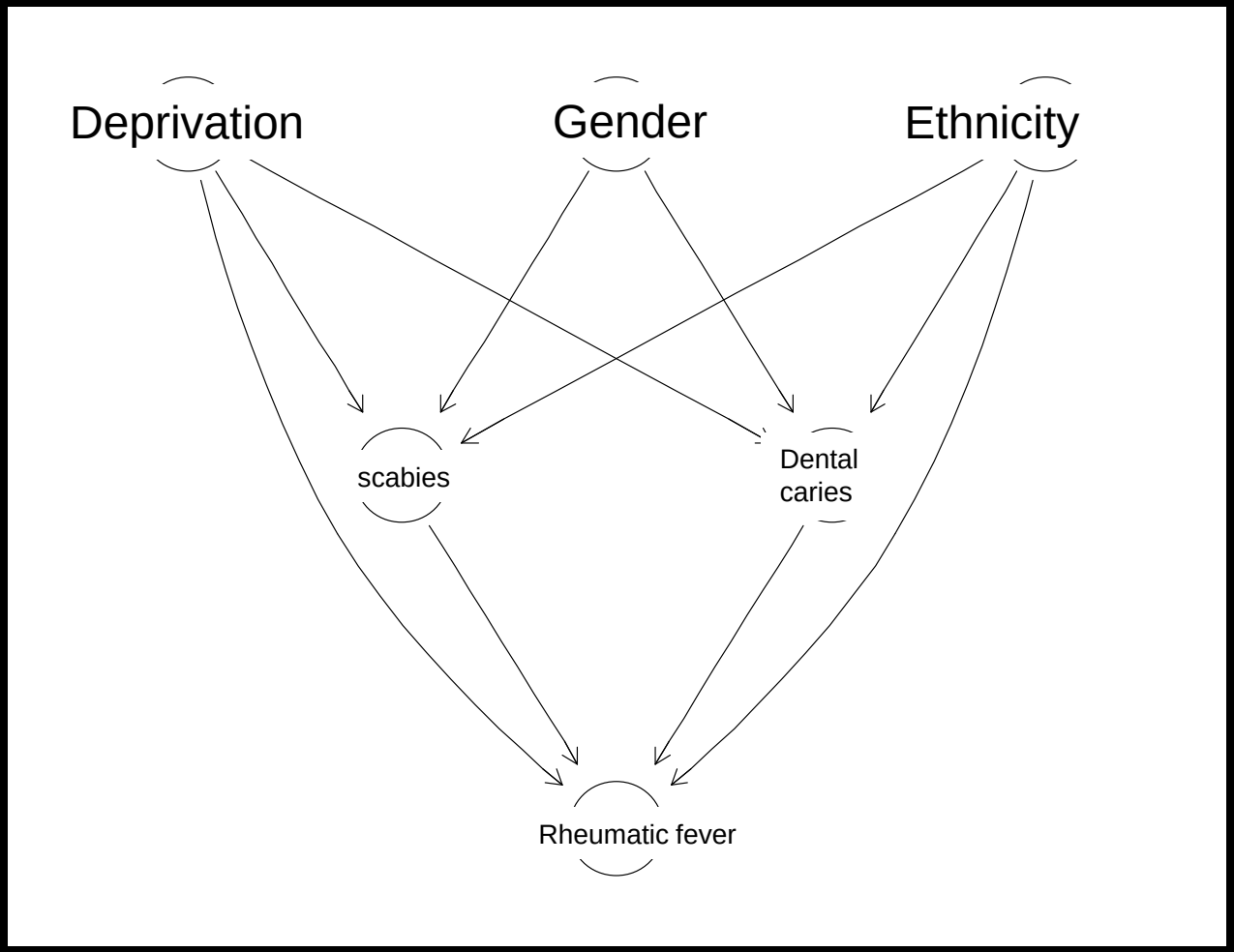
Kaplan-Meier plot

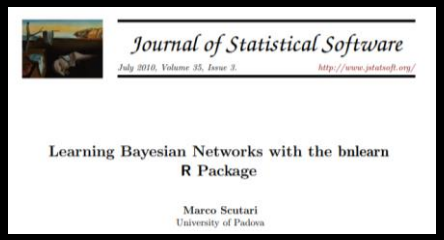


Cox model

Risk factors	Crude HR (95% CI)	Adjusted† HR (95% CI)
Gender (female vs. male)	0.76 (0.63 to 0.92)	1.03 (0.57 to 1.87)
Ethnicity (ref: NZ European & Other)		
Pacific	34.9 (23.3 to 52.2)	20.0 (13.1 to 30.6)
Māori	21.1 (13.9 to 32.1)	14.4 (9.35 to 22.1)
Deprived (deciles 9 and 10 vs. other)	7.08 (5.77 to 8.69)	2.23 (1.80 to 2.77)
Scabies (ref: No scabies diagnosis)		
Diagnosis before enrolment only	11.3 (6.33 to 20.2)	1.64 (0.68 to 3.97)
Diagnosis after enrolment	26.0 (14.2 to 47.4)	8.98 (4.79 to 16.8)
Total caries (per 4 affected teeth)‡	1.76 (1.59 to 1.94)	1.26 (1.12 to 1.42)

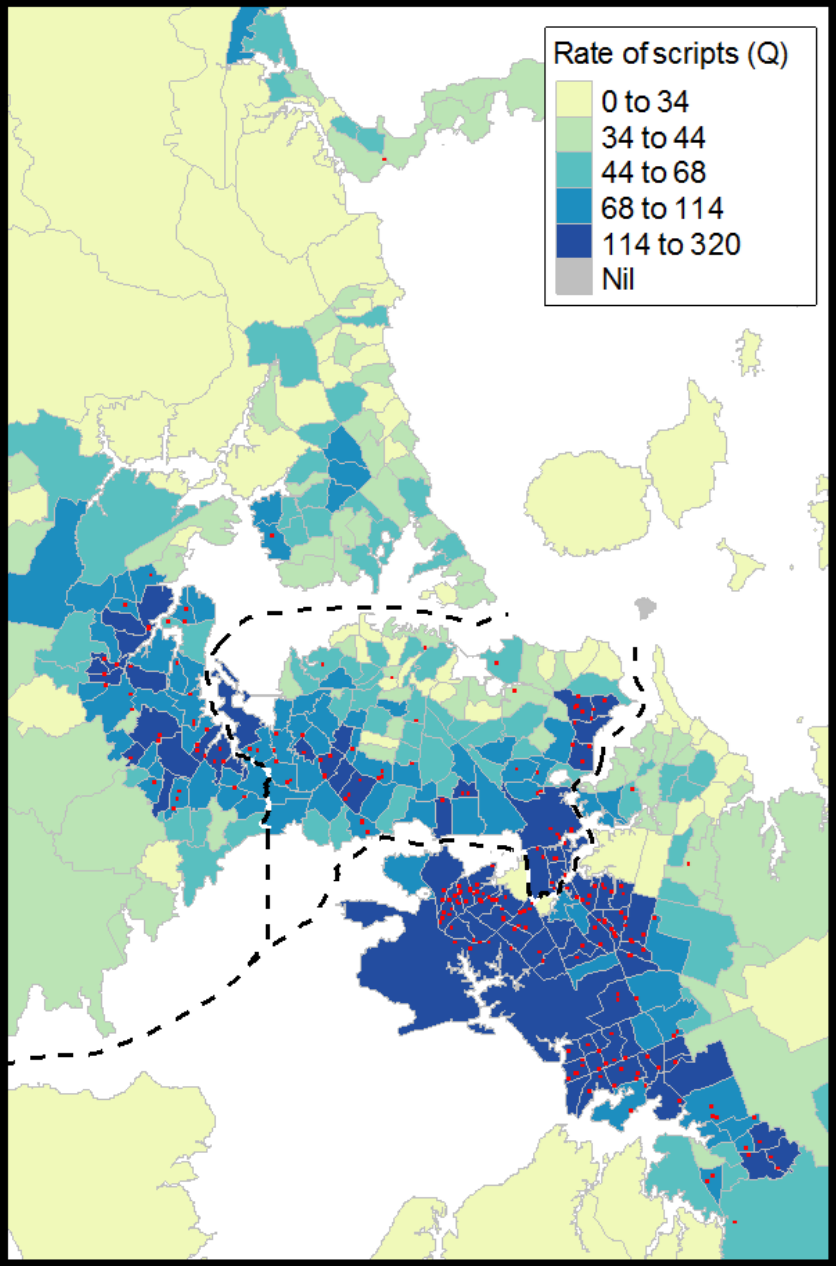
Use learning Bayesian networks




Journal of Statistical Software
July 2010, Volume 35, Issue 3. http://www.jstatsoft.org/

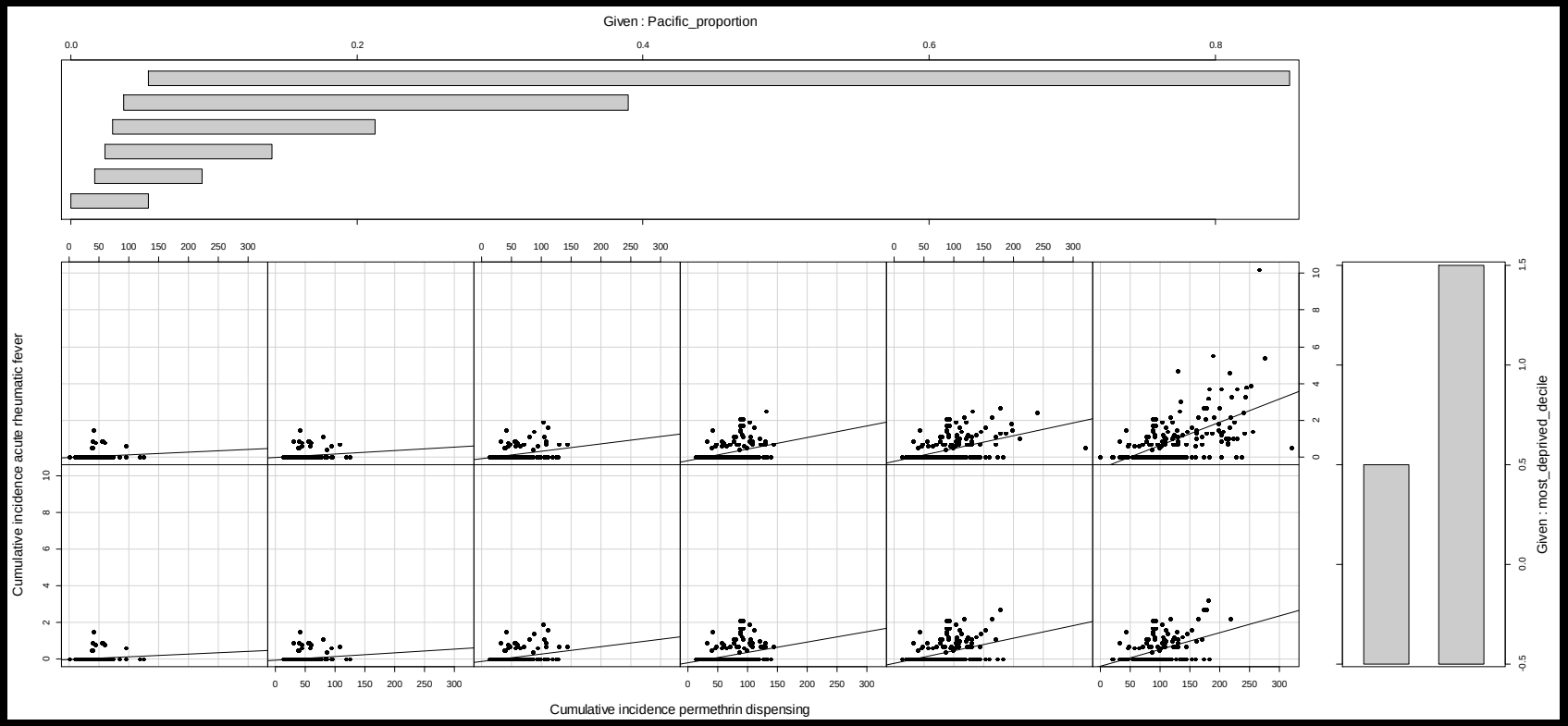
Learning Bayesian Networks with the bnlearn R Package

Marco Scutari
University of Padova



Thanks to Ron King, ARPHS

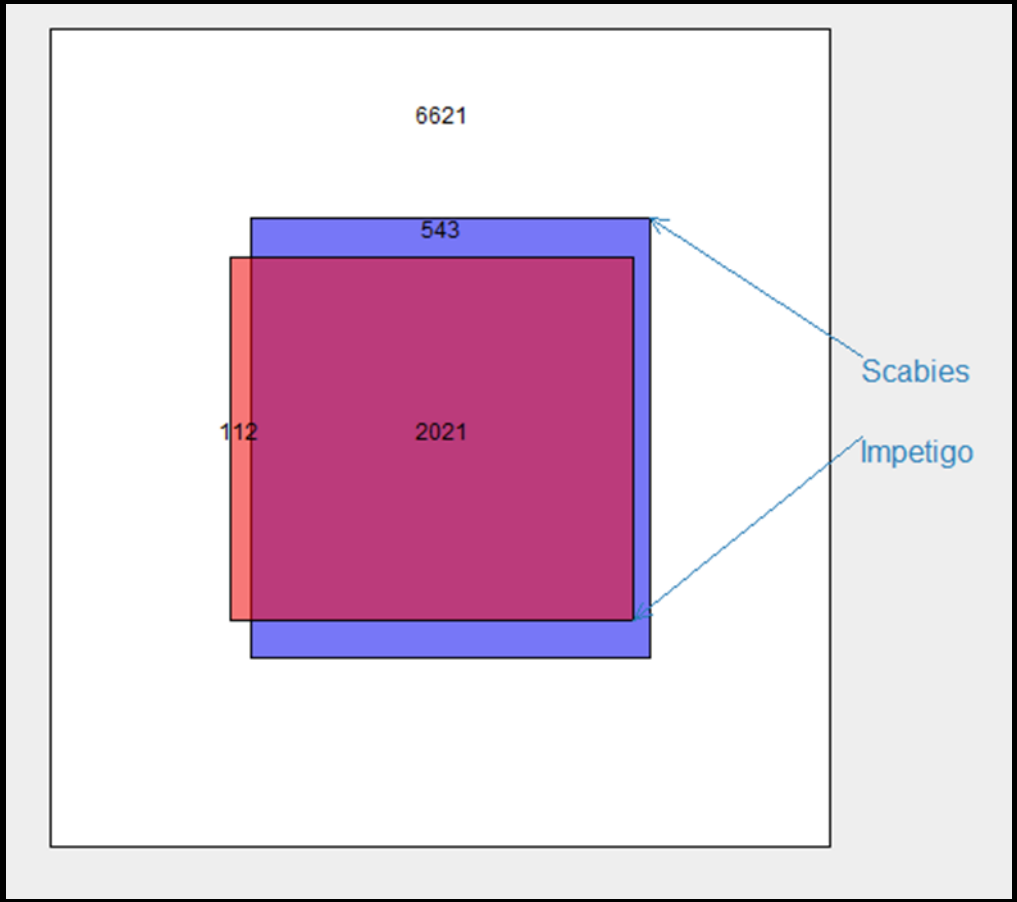
ARF ~ Permethrin | Pacific & dep.



Scabies & Impetigo

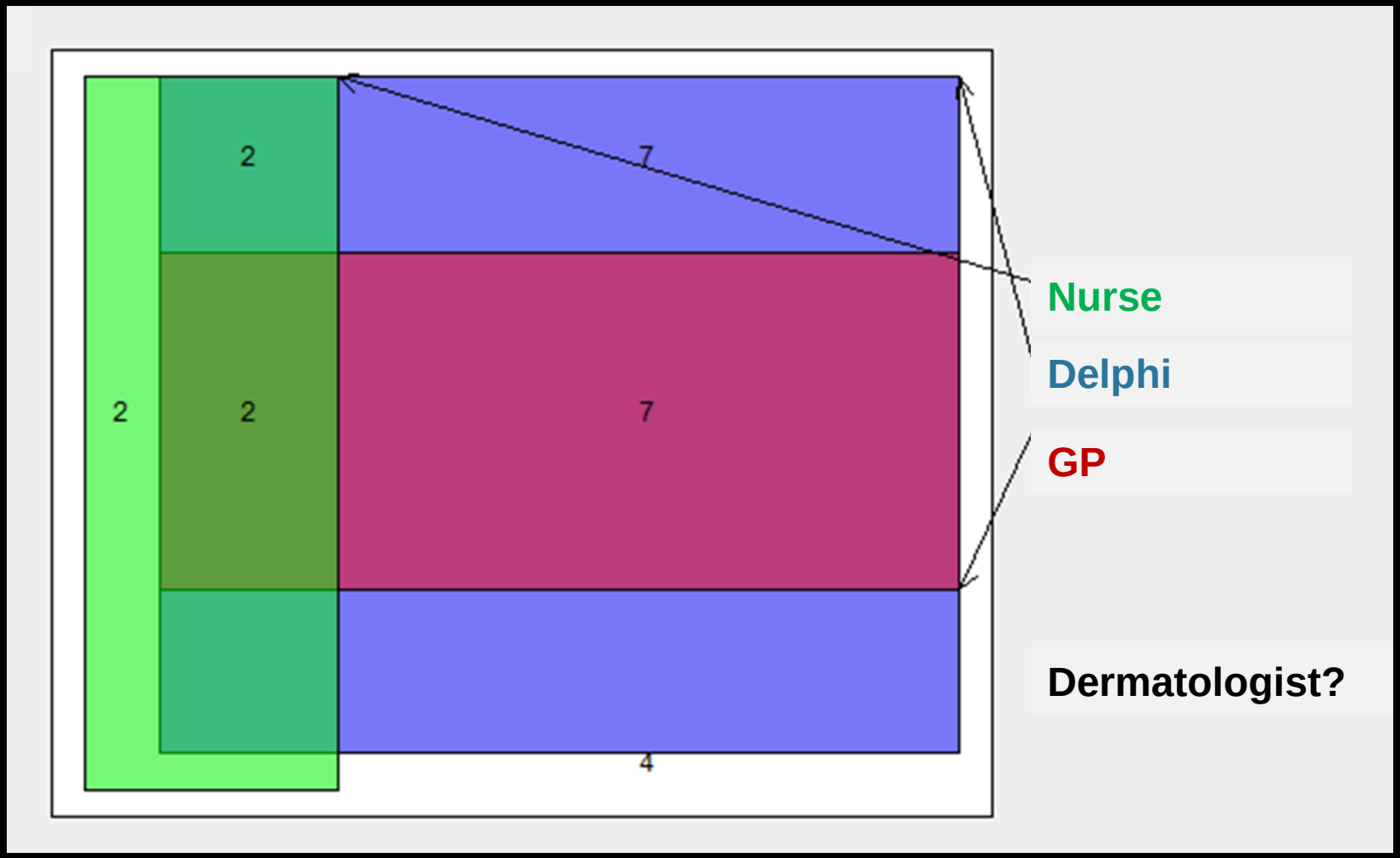
- Accepted treatment these days… topical and systemic antibiotics

- What about scabies?



Romani L, Koroivueta J, Steer AC, et al. Scabies and impetigo prevalence and risk factors in Fiji: a national survey. PLoS Negl Trop Dis. 2015; 9:e0003452

Scabies diagnosis agreement study



Is there a causal relationship?

- Bradford-Hill criteria
  - Strong association (X – strongest association I've seen)
  - Dose-response (X – after, vs. before)
  - Biological plausibility (X – path to Group A strep, complement)
  - Coherence (X – Pacific has high prev. scabies)
  - Consistency (X – West Indies, Ethiopia, East Timor)
  - Temporality (X – cohort study)
  - Analogy (X – post-streptococcal GN linked to scabies)
  - Experiment (Missing)

Conclusion

- I believe scabies is very likely to be a cause of acute rheumatic fever

- Scabies explains:
  - link between skin infection & ARF;
  - high prevalence among Pacific people;
  - risks associated with overcrowding & poverty.

- I believe scabies should be treated like other communicable diseases with emphasis on:
  - improved diagnosis;
  - public health support for treatment;
  - follow-up.

Collaborators:

Ron King, Bryn Thompson, Roger Marshall, Gerhard Sundborn, Matire Harwood, Paul Jarrett, Amanda Oakley, Edwin Reynolds, John Kennelly, Kim Dirks, Alistair Woodward, Grant Schofield, Mark Arbuckle, Sandar Tin Tin.

Thank you

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Thornley S, Marshall R, Jarrett P, et al. Scabies is strongly associated with acute rheumatic fever in a cohort study of Auckland children. *J Paediatr Child Health* 2018

Thornley S, Sundborn G, Arbuckle M, et al. Is impetigo a missed opportunity for scabies treatment? *The New Zealand Medical Journal* 2018;131(1481):78-81.