Case control study to identify risk factors for typhoid fever in Central Division, Fiji – Preliminary results

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Overview

- **Background**

- **Methods**

- **Results**

- **Conclusions**
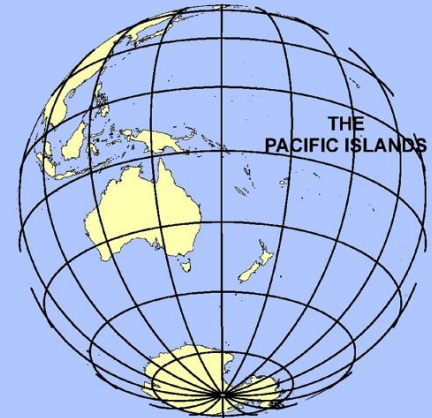
- **Recommendations**

Salmonella Typhi bloodstream infections detected by passive surveillance, Fiji, 1991-2014

Age, Median (range): 27 (0-95) years
Sex: 56.4% male
Ethnicity: >90% Indigenous Fijian
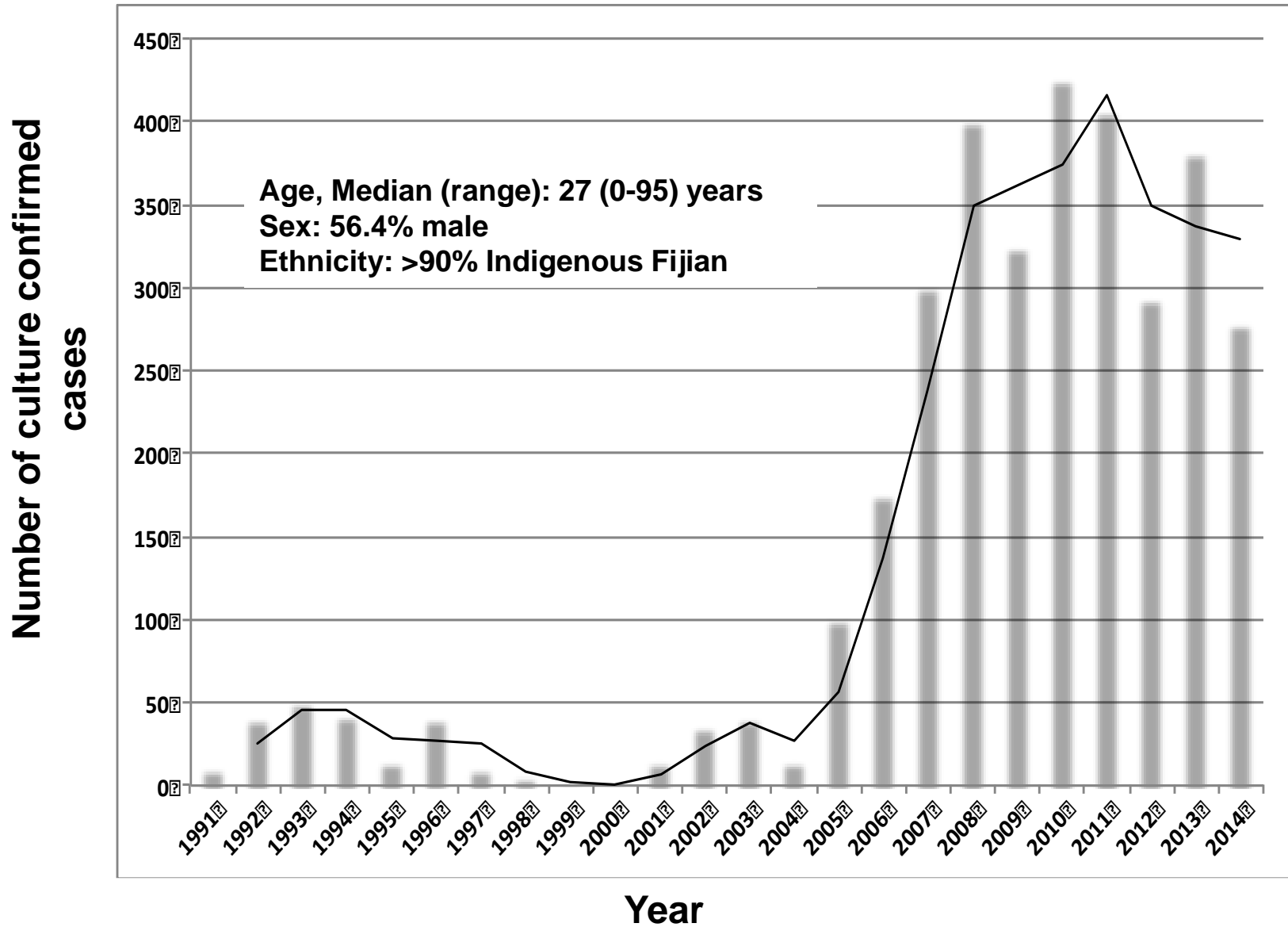
Methods

- **Setting**
  - **Central Division, Fiji residents**
  - **Colonial War Memorial Hospital (CWMH), Suva, Central Division, Fiji**

- **Design**
  - **1:2 neighbourhood, ethnicity, sex, and age-matched case-control study**
  - **All age groups included from 1 May 2014**

Methods

- **Laboratory**
  - Blood cultures collected from febrile patients at clinicians' discretion
  - Incubated for 5-7 days at 35°C in the BacT Alert system
  - Subcultured on blood, chocolate, and MacConkey Agar
  - Microbact identification system, Triple Sugar Iron (TSI) and Lysine Indole Motility (LIM) media
  - Serological identification

- **Statistical methods**
  - Data doubled entered into project database
  - 1:2 matched odds ratio through conditional logistic regression

Results

14,851 patients screened by blood culture

↓

103 (0.7%) cases with blood culture confirmed typhoid fever → **32 (31.1%) not enrolled**

↓

71 (68.9%) typhoid fever patients enrolled in case-control study → **44/88 case/control household visited for environmental sampling**
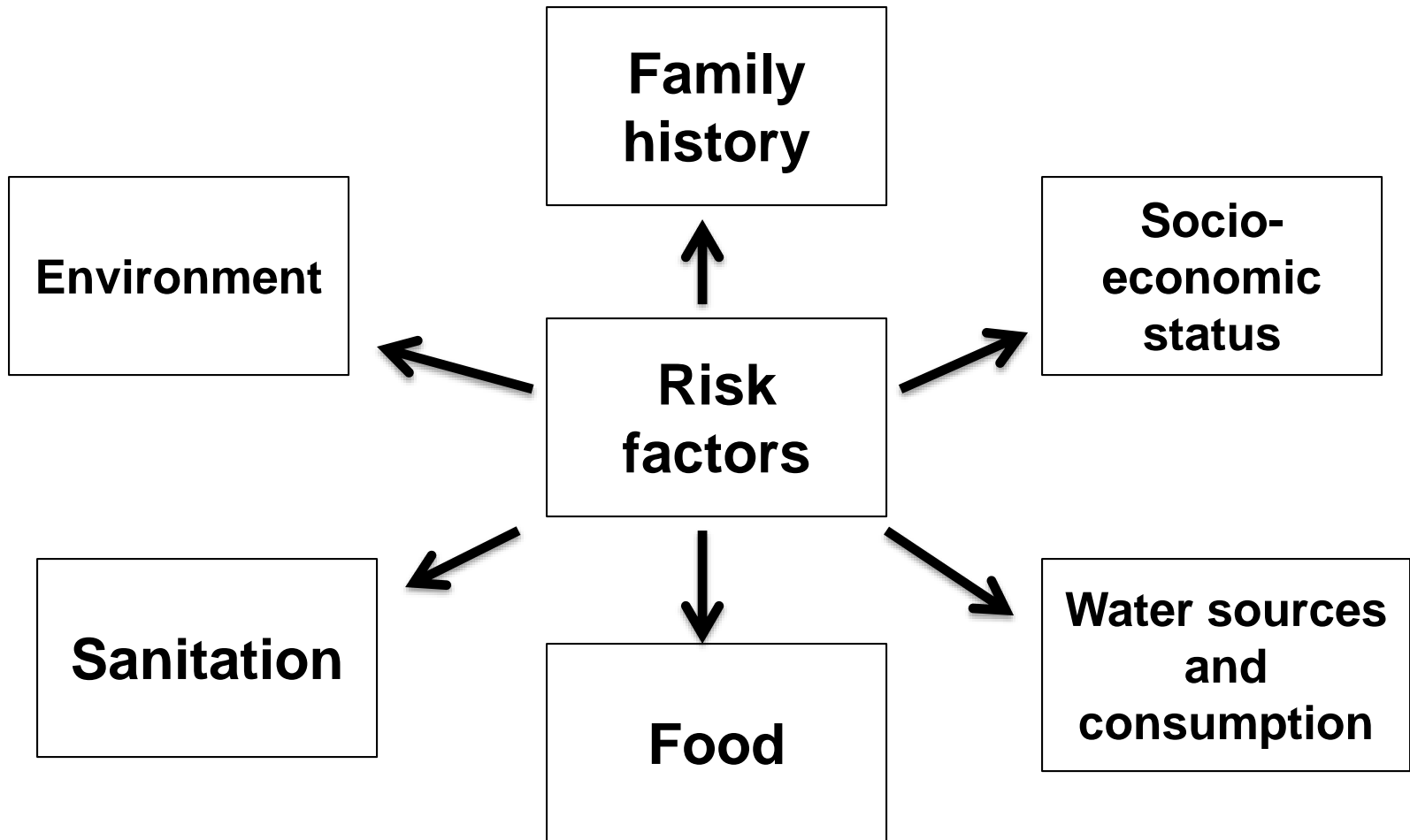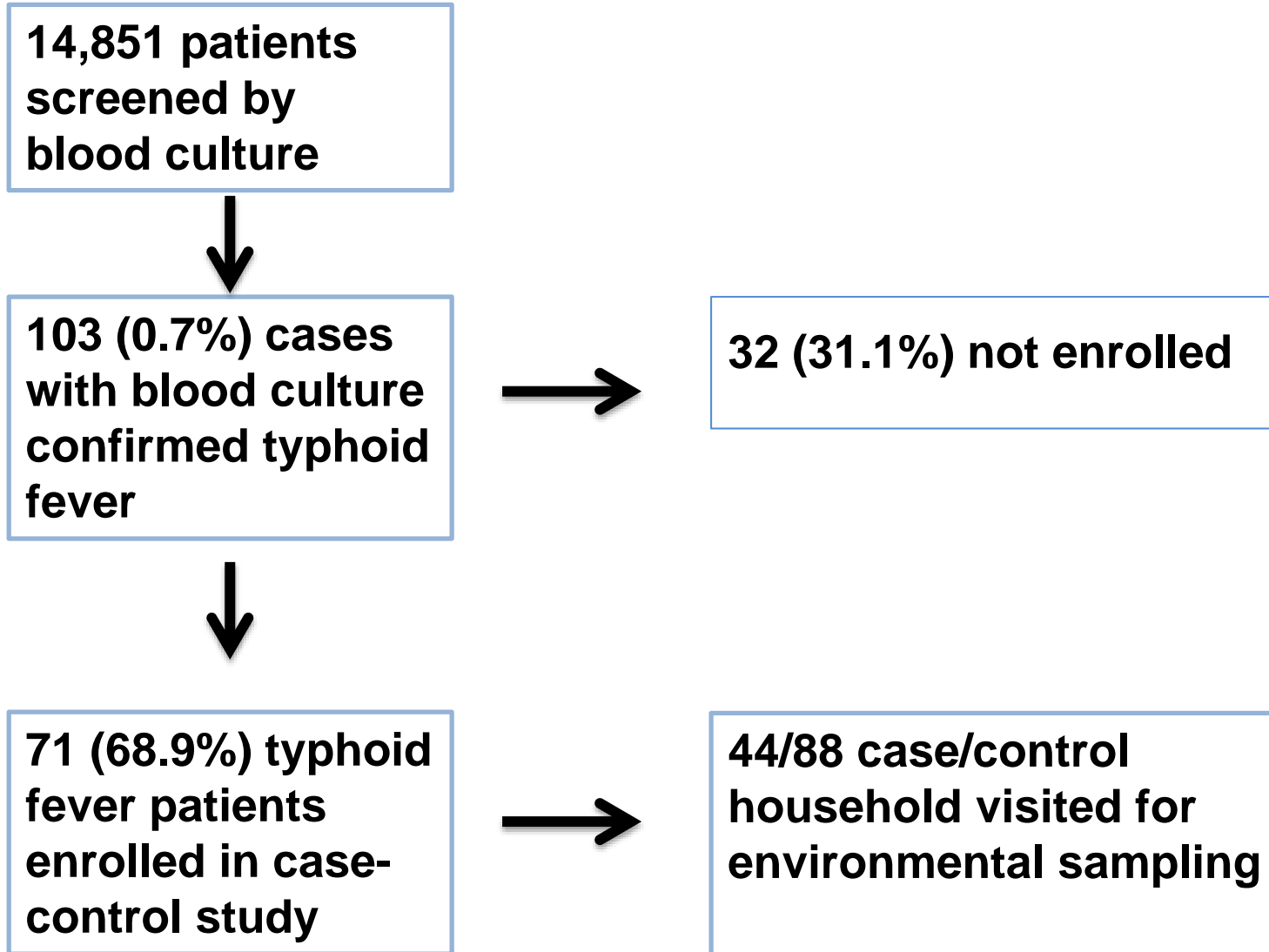
Typhoid case enrollment for Feb 2014-Jan 2015, Central Division, Fiji
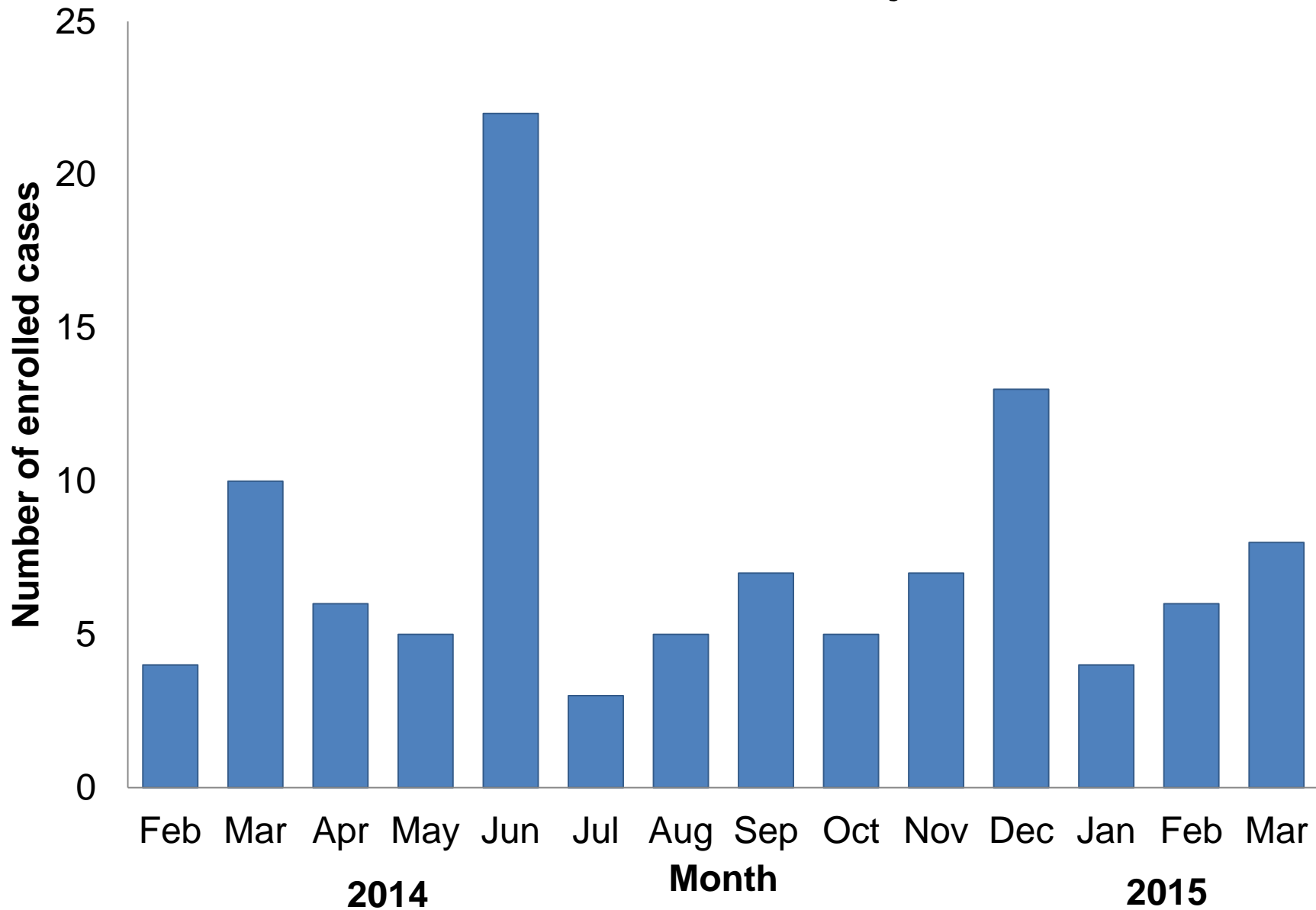
Characteristics of typhoid case control study participants, Fiji, 2014-15

	Cases (%) N	Controls (%)
Age, median (range)	28 (2-78)	26 (4-76)
	N (%)	N (%)
Male	34 (47.9)	68 (47.9)
Ethnicity		
Indigenous Fijian	67 (94.4)	134 (94.4)
Indian	4 (5.6)	8 (5.6)
Other	-	-
Residential Area		
Urban	39 (54.9)	74 (52.1)
Rural	23 (32.4)	47 (33.1)
Peri-Urban	9 (12.7)	21 (14.8)
Primary Occupation		
Student	20 (28.2)	43 (30.3)
Unemployed	16 (22.5)	27 (19.0)
Housewife	10 (14.1)	31 (21.8)
Farmer	8 (11.3)	14 (9.9)

Univariable analysis of risk factors for *Salmonella* Typhi infection, Central Division, Fiji 2014-2015

Risk factor	Cases (n=71)	Controls (n=142)	Matched odds ratio	(95% CI)	P-value
	n (%) participants				
Family History					
History of fever in household	39 (54.9)	29 (20.4)	4.9	(2.48-9.81)	0.000
History of gall bladder disease	0 (-)	2 (1.4)	-		
Typhoid carrier in house	2 (2.8)	1 (0.7)	4.0	(0.36-44.11)	0.258
Household Assets					
Water source, treatment, and storage					
Water stored after collection	53 (74.7)	101 (71.1)	1.2	(0.63-2.29)	0.586
Drank from shared public tap	8 (11.3)	9 (6.3)	3.0	(0.72 – 12.08)	0.131
Consumption of water					
Drank untreated water	18 (25.4)	46 (32.4)	0.5	(0.19-1.26)	0.137
Drank from restaurant	8 (11.3)	31 (21.8)	0.4	(0.19-1.03)	0.058
Drank beverage with ice	25 (35.2)	52 (36.9)	0.9	(0.47- 1.76)	0.780
Drank from street vendor	18 (25.4)	22 (15.6)	1.9	(0.91-4.06)	0.086
Kava and food					
Drinks Kava	32 (45.1)	71 (51.4)	0.7	(0.37-1.38)	0.316
Ate lolo (squeezed coconut)	35(49.3)	89 (62.7)	0.4	(0.19-0.90)	0.026
Washes produce before eating	46 (64.8)	121 (85.2)	0.2	(0.08-0.48)	0.000

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| | n (%) participants | | | | |
Risk factor	Cases	Controls	Matched OR	(95% CI)	P-value
Sanitation					
Washes hands before eating					
Always *	11 (15.5)	51 (35.9)	1 .0		-
Sometimes	53 (74.6)	89 (62.7)	2.9	(1.37-6.15)	0.005
Never	7 (9.9)	2 (1.4)	14.2	(2.99-90.87)	0.001
Washes hands after defecating					
Always *	37 (52.1)	100 (70.4)	1.0		
Sometimes	31 (43.7)	41 (28.9)	2.2	(1.16-4.28)	0.017
Never	3 (4.8)	1 (0.8)	8.5	(0.9-85.2)	0.068
Washes hands before cooking					
Always	53 (74.6)	115 (81.0)	1.0		
Sometimes	13 (18.3)	25 (17.6)	2.2	(0.55-3.58)	0.474
Never	5 (7.0)	2 (1.4)	8.7	(1.06-32.19)	0.042
Hand washing score					
High*	10 (14.1)	41 (28.9)	1.0		
Moderate	51 (71.8)	97 (68.3)	2.4	(1.07-5.27)	0.034
Low	10 (14.1)	4 (2.8)	12.9	(2.93-56.85)	0.001

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Sanitation					
Washes hands before eating					
Always *	**11 (15.5)**	**51 (35.9)**	**1 .0**		**-**
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Risk factor	n (%) participants		Matched OR	(95% CI)	P-value
	Cases	Controls			
Environment					
Heavy to moderate rainfall-2 months	36 (50.7)	59 (41.6)	1.9	(0.87- 3.95)	0.108
Nearest river/stream flooded – 2 months	13 (18.3)	9 (6.3)	5.0	(1.58-15.71)	0.006
Livestock above where water is collected	6 (8.5)	4 (2.8)	4.7	(0.91-23.82)	0.066
Dams higher in river basin	33 (46.5)	51 (35.9)	2.8	(1.11 – 7.19)	0.029

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Multivariate analysis using conditional logistic regression of risk factors for *Salmonella* Typhi infection among 71 cases and 142 controls, Central Division, Fiji 2014-2015

Risk factor	Conditional Odds Ratio	(95% CI)	P-value
Family history			
History of fever in household	7.4	(3.16-17.40)	0.000
Sanitation			
Hand washing score			
Always *	1 .0		-
Sometimes	3.7	(1.44-9.49)	0.007
Never	41.9	(5.01-351.08)	0.001
Food			
Washes produce before eating	0.3	(0.09-0.94)	0.039
Ate lolo (squeezed coconut milk)	0.3	(0.14-0.96)	0.040

Challenges

- **Enrollment of cases has been slower than projected**

- **Alternate etiologies of febrile illness – typhoid cases may have been missed during dengue outbreak due to under utilization of blood cultures**

- **Homogeneity of risk factors**

- **Need to continue to study to get a more definitive picture of typhoid fever risks in Fiji**

Conclusions

- **Results suggest a mixture of behavioral, infrastructural, and environmental risk factors.**

  - Sanitation practices
  - Infrastructure in terms of water supply
  - Flooding and other environmental conditions

- **Improvements in water, sanitation, hygiene infrastructure and practices.**

- **Sample size is still small – continuation of study with multivariate analysis**

Acknowledgements

Sample size estimation

Required sample size for achieving power and an expected odds ratio of 2:

Estimated % exposed among controls	No. of controls/case	Power	Alpha	No. of cases	No. of controls
90%	3	90%	0.05	445	1,335
80%	3	90%	0.05	235	705
90%**	3	80%	0.05	345	1,035
80%	3	80%	0.05	180	540
90%	3	45%	0.05	120	240