

Changing patterns of epidemic polio mortality in New Zealand



Heather T. Battles

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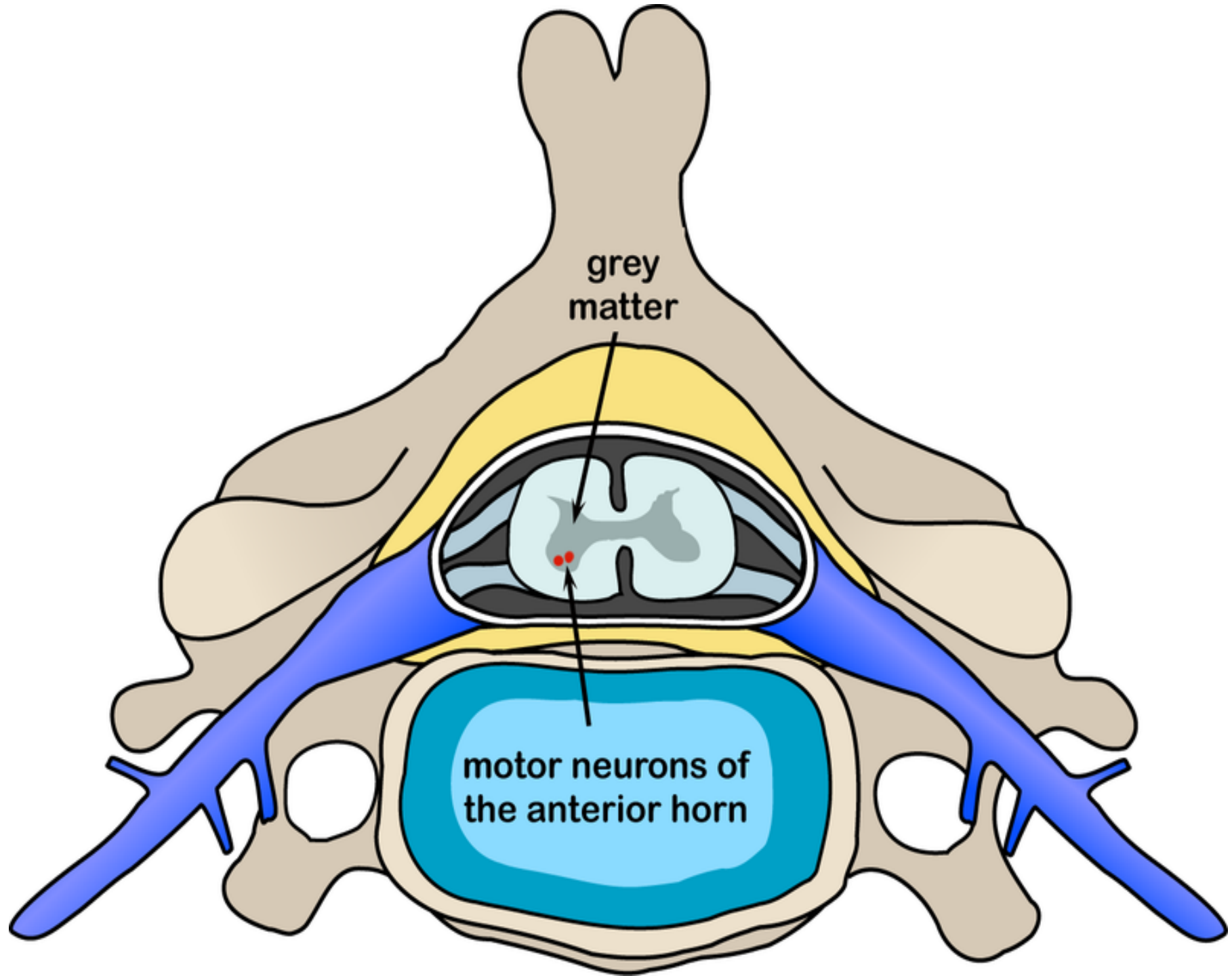
COMPASS seminar 18 July 2018



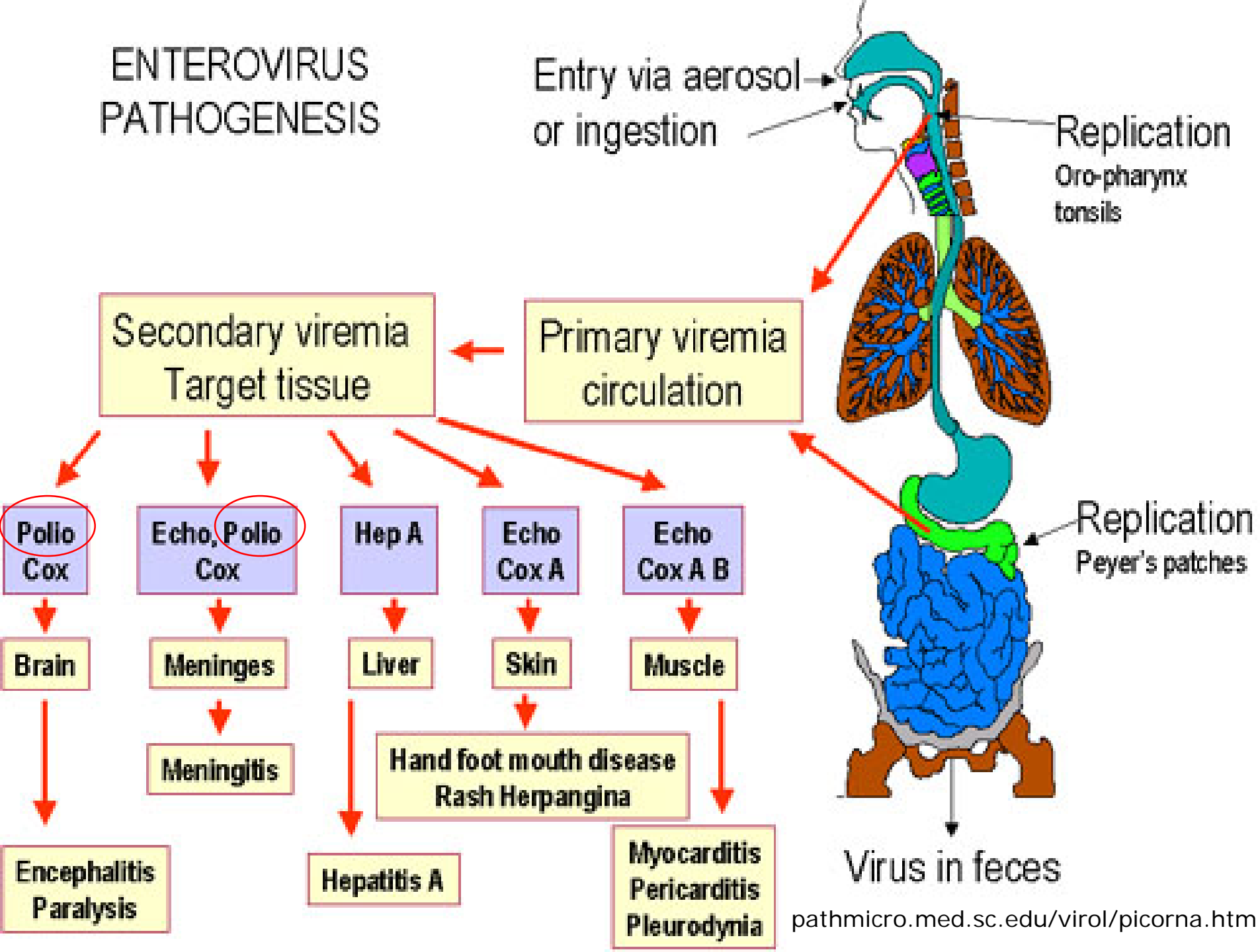
Outline

1. Intro to polio and broad research questions
2. Summary of previous project (Ontario)
3. Overview of NZ project results to date (1916-1949)
 - Brief closer look at 1916 epidemic (*topic for tomorrow's seminar!*)
4. Next steps





ENTEROVIRUS PATHOGENESIS



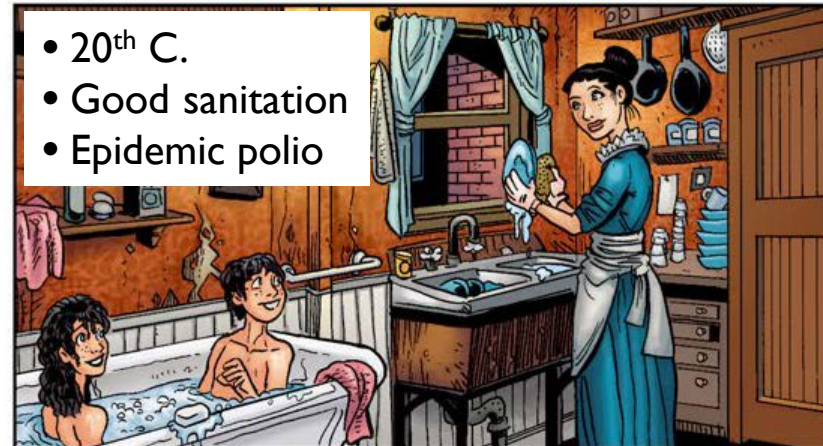
Paralysis: The New Epidemic

By Helen MacMurchy, M.D.

Infantile Paralysis is epidemic in some parts of Canada. The germ attacks rich as well as poor, adults as well as children. In Ontario last month half the cases were fatal. Dr. MacMurchy is able to give our readers the latest developments concerning this dread disease direct from the great specialists, having recently attended a medical congress where the question was discussed. It is now thought that the germ is carried mainly by the stable fly. Dr. MacMurchy says, Never let a fly rest on an infant.

Background

- Traditional model based on **hygiene hypothesis**
 - Higher SES, smaller families
- **Intensive Exposure (IE) hypothesis** (Nielsen et al.)
 - Crowding
- Use of mortality data for testing predictions of hypotheses, informing understanding of epidemiological transition



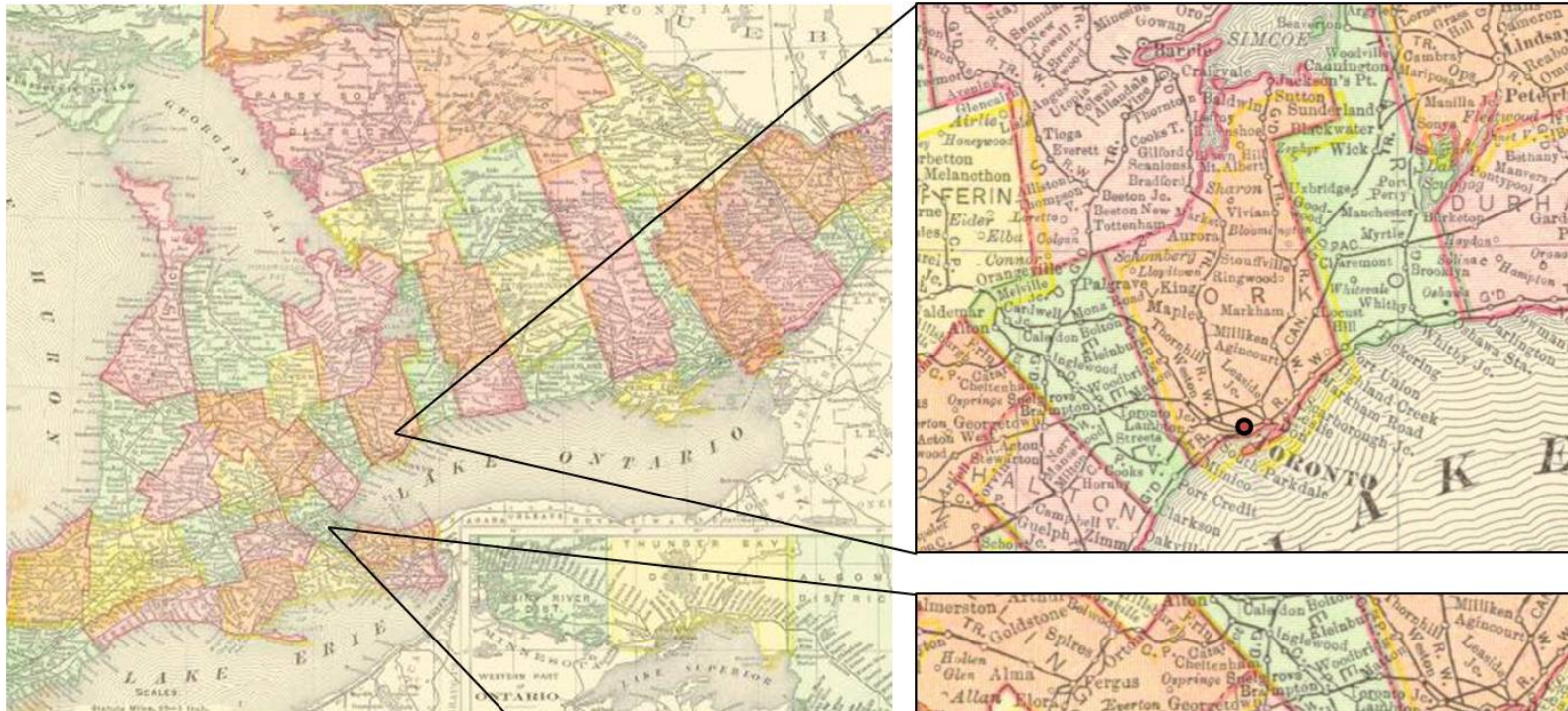
Questions

- 1) What groups were the most vulnerable?
- 2) Emergence of, or increase in, excess male mortality over time?
- 3) How were the epidemics shaped by their social, political, and economic structures and contexts – and vice versa?

Children from the Wilson Home for crippled children, about to go to hospital by ambulance, for special treatment, Takapuna, Auckland. Pascoe, John Dobree, 1908-1972 :Photographic albums, prints and negatives. Ref: 1/4-000651-F. Alexander Turnbull Library, Wellington, New Zealand. [/records/22846507](#)



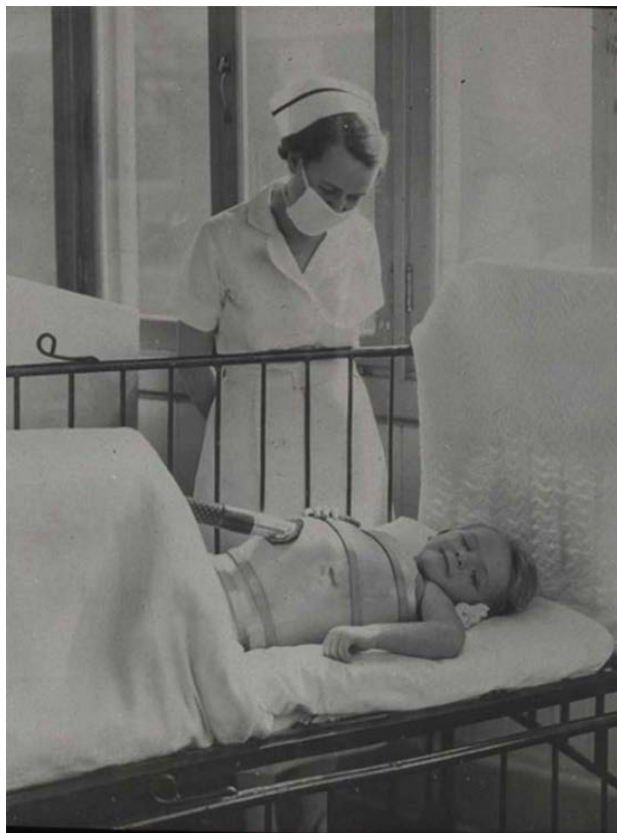
Ontario Project Overview



- Wentworth and York Counties
- Major epidemics in 1910, 1922, 1929/30, 1937
- 337 deaths (1900-1937)
- Mapping with ArcGIS

Data

- Age
- Sex
- Illness duration
- Seasonality
- Nativity
- Birthplace
- Ethnicity
- Religion
- Family size
- Birth order
- Occupation (SES)
- Residence



5122
239

CERTIFICATE OF REGISTRATION OF DEATH

Township of North York Sick Children House No. 005921
 Street (If death occurred in a hospital or institution, give the name instead of street and number)

(a) In Province ON (b) In Canada (if immigrant)

Name of deceased JANE RNN (Date of name)

City, Town, Village or Township Toronto Province Ontario
 (For use of address. Post Office address for residents in rural parts not sufficient)

Married, divorced, or widowed W

MEDICAL CERTIFICATE OF DEATH

21. DATE OF DEATH August 30 1936
 (Day) (Year)

24. I HEREBY CERTIFY that I attended deceased from _____ to _____ and last saw h. _____ alive on _____

CAUSE OF DEATH

I
 Immediate cause
 Give direct injury or complication which caused death, and the mode of injury, such as heart failure, rupture, etc.
(a) acute & chronic myocarditis

II
 Medial condition, if any, giving rise to immediate cause (state in order proceeding backwards from immediate cause).
 due to _____
 due to _____
 due to _____

III
 Other medical condition (if important) contributing to death but not closely related to immediate cause.

25. If a woman, was the death associated with pregnancy?

26. Was there a surgical operation? No Date of operation _____
 State findings _____ Was there an autopsy? No

27. If death was due to external causes (violence) fill in also the following:—
 Accident, suicide or homicide? _____ Date of injury _____
 Manner of injury _____ (State which)
 Nature of injury _____ (How sustained)

Specify whether injury occurred in industry, in home, or in public place

Signed by H. G. W. Weston
 Address 171 Denby Ave. Date August 30 1936

28. Division Registrar's Record Number _____
 29. Filed _____

THIS FORM MUST BE FILLED FOR THE DIVISION REGISTRAR OF THE DEATH OCCURRED BEFORE A BURIAL OR CREMATION. WRITE PLAINLY WITH UNFADING INK. Every item of information should be carefully supplied.

19. AGE in 66 yrs. or 66 mth.

21. Trade, profession or kind of work as spinner, teamster, office clerk, etc. Nurse

22. Kind of industry or business, as cotton-mill, bookbinding, bank, etc.

23. Date deceased last worked at this occupation _____

24. Total yrs. spent in this occupation _____

25. If married give name of wife or husband of deceased _____

16. NAME Archibald Mullin

17. BIRTHPLACE Canada (Province or Country)

18. MAIDEN NAME Oliveria Finlayson

19. BIRTHPLACE United States (Province or Country)

20. Person giving information S. A. Mullin
 Address 376 BROADVIEW AVE
 Relationship to deceased Wife

21. Place of Burial, Cremation or Disposition Mount Pleasant
 Date of burial or removal Aug 31-36

22. Undertaker W. J. O'Connell 3055 Dan W. (Name and address)

Predictions of Nielsen et al.

- Intensive-exposure:
 - Polio deaths will increase with family size
 - U-shaped age curve in polio deaths
- Cross-sex transmission:
 - Higher sex ratio in smaller families

Predictions of traditional hygiene model

- Mortality by SES:
 - Greater mortality at higher SES



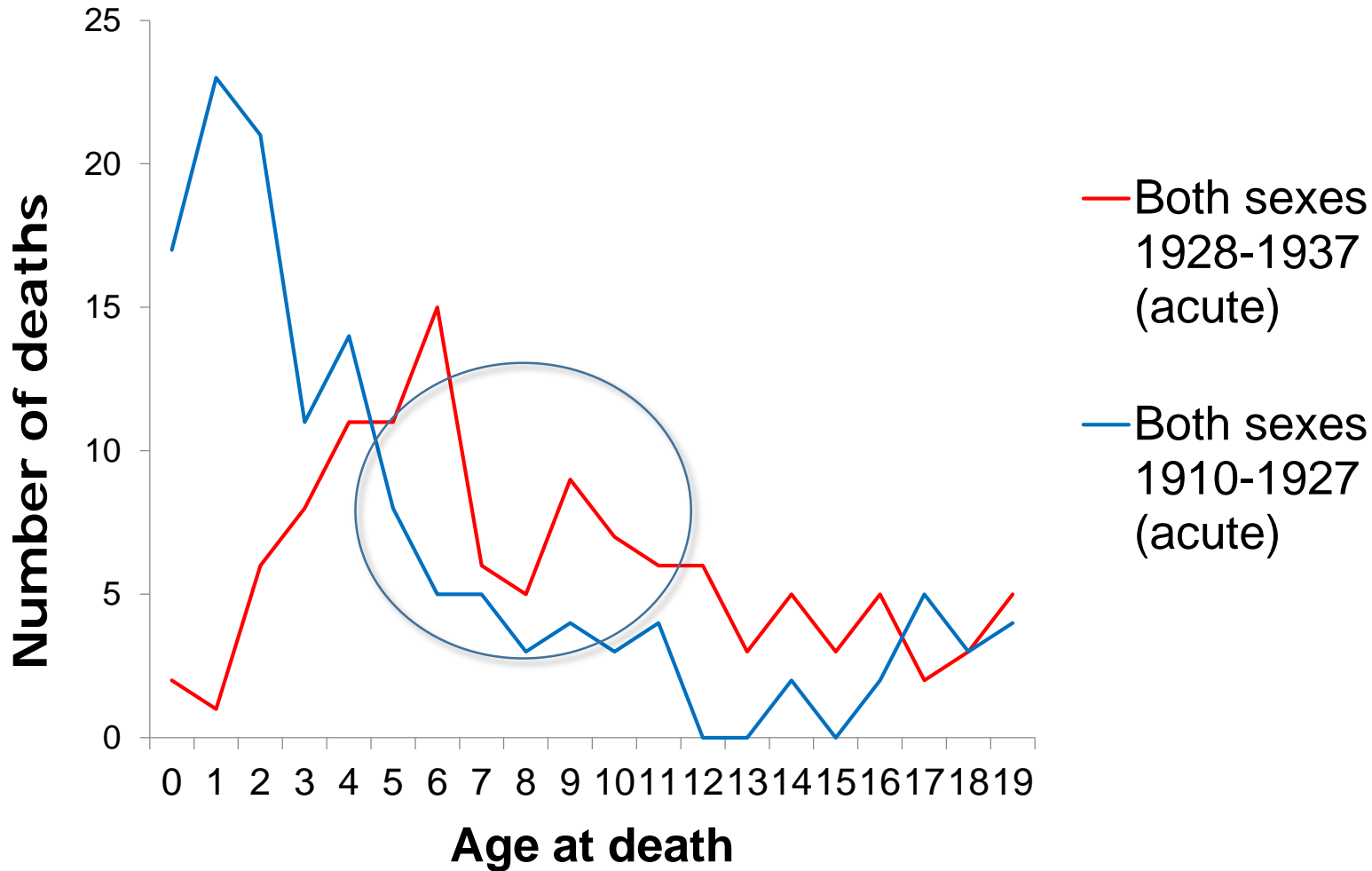


Figure. Number of acute polio deaths by age in Wentworth and York Counties, ages 0-19.

SES by status scores

Status score	Category	Example occupations
1	Professional	Dentist, Lawyer
2	Entrepreneurial/Clerical	Clerk, Farmer, Sales manager
3	Skilled labour	Carpenter, Stonemason
4	Semi-skilled labour	Porkpacker, Teamster
5	Unskilled labour	Farm labourer, Travellers

Based on Hauser, R. M. 1982. Occupational status in the nineteenth and twentieth centuries. *Historical Methods* 15:111-26.

Polio deaths by status score

TABLE 5. *Proportions of acute polio deaths by status score over time*

<i>Status score</i>	<i>1900–29</i>		<i>1930–37^a</i>		<i>1900–37</i>			
	<i>Acute only</i>		<i>Acute only</i>		<i>Acute only</i>		<i>Chronic and acute</i>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
1	3	2.54	5	6.76	8	4.17	8	3.74
2	39	33.05	28	37.84	67	34.90	76	35.51
3	51	43.22	29	39.19	80	41.67	87	40.65
4	17	14.41	9	12.16	26	13.54	29	13.55
5	8	6.78	3	4.05	11	5.73	14	6.54
<i>Total</i>	<i>118</i>	<i>100.0</i>	<i>74</i>	<i>100.0</i>	<i>192</i>	<i>100.0</i>	<i>214</i>	<i>100.0</i>

^aA chi-square test found no evidence of a real difference between the proportions of deaths by status score for the 1930–37 period compared to those of the 1900–29 period ($\chi^2(4, n = 74) = 7.04, p = .13, V = .15$).

Proportion of population vs polio deaths by status score

Table 8 Proportion of population in each status score according to the 1921 Census (Toronto and Hamilton) and proportions of polio deaths in Toronto and Hamilton combined, 1900–1937

Status score	Census % ^a	Polio % ^b	Polio <i>n</i> expected ^c	Polio <i>n</i> observed ^{b, d}
1	1.46	3.33	2.18	5
2	28.08	23.33	42.13	35
3	40.77	52.00	61.15	78
4	10.98	14.00	16.47	21
5	18.71	7.33	28.06	11

Source: Census of Canada 1921 (Canada, Dominion Bureau of Statistics 1925, Table 41).

~~Based on Census % of out of a total of 100 polio deaths.~~

^d A chi square test found evidence of a real difference between the observed polio deaths versus the expected number of deaths based on the Census distribution for status scores two through five, $\chi^2(3, n = 145) = 17.75, p < .001, V = .22$.

^e This status score versus sum of remaining status scores. Two-tailed *p* values reported. Status score one not tested itself due to its small sample size.

Pre-Depression (1900-29) vs Depression (1930-37)

Table 10 Median and untransformed mean ages by status score for acute polio deaths in the pre-Depression (1900–1929) and Depression (1930–1937) periods

Status score	Age at death, in years				<i>n</i>	
	Median		Mean (SD)			
	1900-29 ^a	1930-37 ^b	1900-29	1930-37	1900-29	1930-37
1	18.66	16.50	18.23 (0.79)	13.97 (8.15)	3	5
2	14.21	11.22	16.65 (14.40)	14.11 (8.88)	39	28
3	4.95	10.89	8.60 (9.70)	12.60 (6.23)	51	29
4	2.44	11.04	5.26 (7.39)	12.59 (9.12)	17	9
5	3.05	18.26	7.62 (9.78)	14.38 (10.13)	8	3
All status scores	5.87	10.97	10.95 (11.87)	13.14 (7.88)	118	74

^a A Kruskal-Wallis test rejected the null hypothesis that age at death was the same across the status scores for the 1900–1929 period, $H(4) = 19.89, p < .001$. Jonckheere's test demonstrated a trend of decreasing median age over the status scores, $J = 1498, z = -4.28, p = .000, r = -.39$.

^b A Kruskal-Wallis test found no difference in age at death across the status scores for the 1930-1937 period, $H(4) = .30, p = .99$.

Working class plague

- Working classes (skilled/semi-skilled labourers) hardest hit
- Fits with findings of the *Report on Poliomyelitis in Ontario, 1937*
 - Households with epidemic polio cases had more persons per household and fewer rooms per person
- Mixed high and low risk?
 - *“In poor and unhygienic households you were more likely to be protected against the virus but you were also more likely to meet it”* (Cockburn 2005)



Battles, H.T. (2017)
Differences in polio mortality by socioeconomic status in two southern Ontario counties, 1900–1937. *Social Science History* 41(2): 305–332.

Overview of Findings

- 2-stage pattern for Wentworth/York:
 - 1910-1927 vs. 1928-1937
- Changes in polio deaths, socio-ecology
- Consistent with predictions of Nielsen *et al.*

	Stage 1 (1910-1927)	Stage 2 (1928-1937)
Age at death	Majority <5	Majority >5
U-shaped age curve	Absent	Present (dip at ages 7-8)
Sex ratio (ages 0-19)	1.0 (equal)	1.5 (excess males)
Family size	Median = 4	Median = 2
Age gradient by SES	Present	Absent

Conclusions

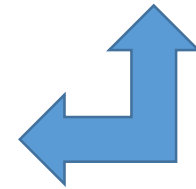
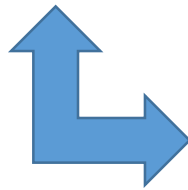
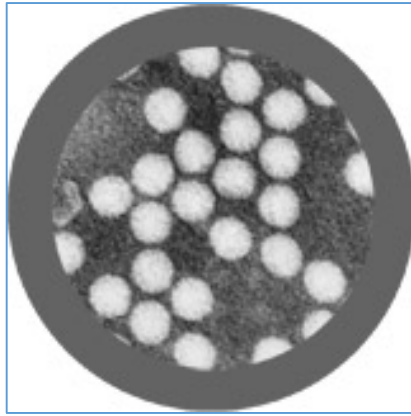
Quantitative results + Social/economic context of southern Ontario pre-SWW (esp. during Depression)

= polio more accurately characterized as a 'working-class plague'



Polio's patterns were not static – they changed as the environment changed.

Bio-eco-cultural approach to the study of emerging disease



NZ Project Overview

- Non-Māori death registrations
- Four major epidemics:
 - 1916
 - 1924/25
 - 1936/37
 - 1947-49



Children and nurses from the Wilson Home for crippled children in Takapuna, Auckland, at the home's private beach. Pascoe, John Dobree, 1908-1972 : Photographic albums, prints and negatives. Ref: 1/4-000654-F. Alexander Turnbull Library, Wellington, New Zealand. /records/23194193

Materials and Methods

- Death registrations – infantile paralysis/ poliomyelitis
- 20th C. reports and research papers (e.g. in *NZMJ*)
- Census (esp. 1916)
- Newspapers (via Papers Past)
- Autobiographic accounts (published and unpublished)

DEATHS IN THE DISTRICT OF *Waikato* DURING THE QUARTER ENDING THE [REDACTED] OF [REDACTED], 1916. LA FORM. 11/10-1904

No.	DESCRIPTION OF DECEASED.		CAUSE OF DEATH.		PARENTS.		IF BURIAL REGISTERED.		WHERE BORN.	IF DECEASED WAS MARRIED.		INFORMANT.	REGISTRAR.
	When and where died.	1. Name and Surname. 2. Rank, Profession, or Occupation.	Sex and Age	1. Cause of Death. 2. Duration of last Illness. 3. Medical Attendant by whom certified. 4. When he last saw Deceased.	1. Name and Surname of Father. 2. Name and, if known, Maiden Surname of Mother. 3. Rank or Profession of Father.	When and where buried.	Name and Religion of Minister, or Name of Witness of Burial.	1. Where born. 2. How long in New Zealand.	1. Where married. 2. At what Age married. 3. To whom married. 4. Age of widow, if living.	If Issue living, state Number, Age, and Sex.	1. Signature of the Informant. 2. His or her Description. 3. Residence. 4. If Entry a Correction of a former Entry, Signature of Witnesses attesting the same.	1. Signature of the Registrar. 2. Date of Registration.	
[REDACTED]	1916	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	<i>Undertaker!</i>	[REDACTED]

true duplicates of all the entries, numbered [REDACTED] to [REDACTED] inclusive, made in the Register-book of Deaths in my office during the quarter ending the [REDACTED]

Results

- 415 deaths identified
- 1916: 125 deaths
- 1924/25: 181 deaths
- 1936/37: 44 deaths
- 1947-49: 65 deaths
- December – April (i.e., summer/early autumn)

...and after drying and grinding is revealed in the fact that the pumice shipped away contains 130 per cent of moisture, which will not be present in future consignments. The plant will shut out when once completed, running full time, between 7000 and 8000 sacks per week

...an exciting Vitagraph drama, "The Girl in the Case," showing how cleverly a girl outwits a dishonest Bank President, will be the principal attraction. Another excellent programme, headed by "The Intriguers," is booked for the following Wednesday. Syd. Chaplin will be to the fore in a laughter-compelling farce, "Gussle the Golfer."

STILL RAMPANT.

INFANTILE paralysis is still going the rounds and spreading widely. A sad death is reported from Mount Albert, Auckland. A young lady resident, who was to have been married a few days ago, sickened two days prior to her wedding day, and died of infantile paralysis about the hour arranged for the ceremony.

THE HAWK.

AT the last meeting of the Hobson Acclimatisation Society, the members expressed very strong opinions against the Government protection of hawks, and the secretary was instructed to write to the Minister of Internal Affairs urging him to have the Animals Protection Act amended to enable Societies where hawks are pests to have the protection removed.

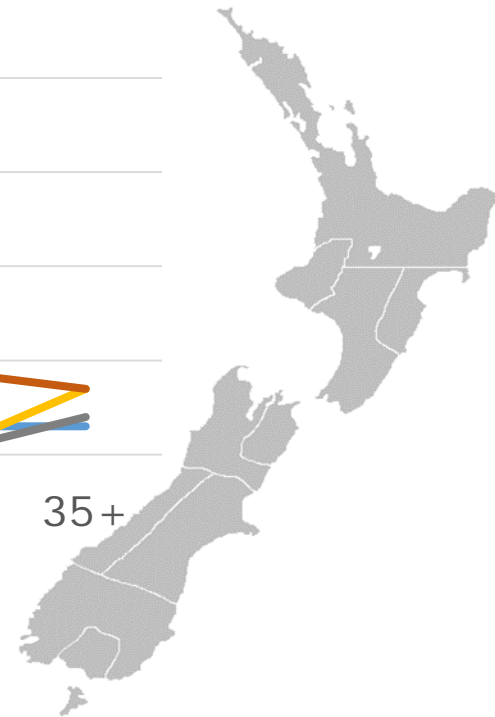
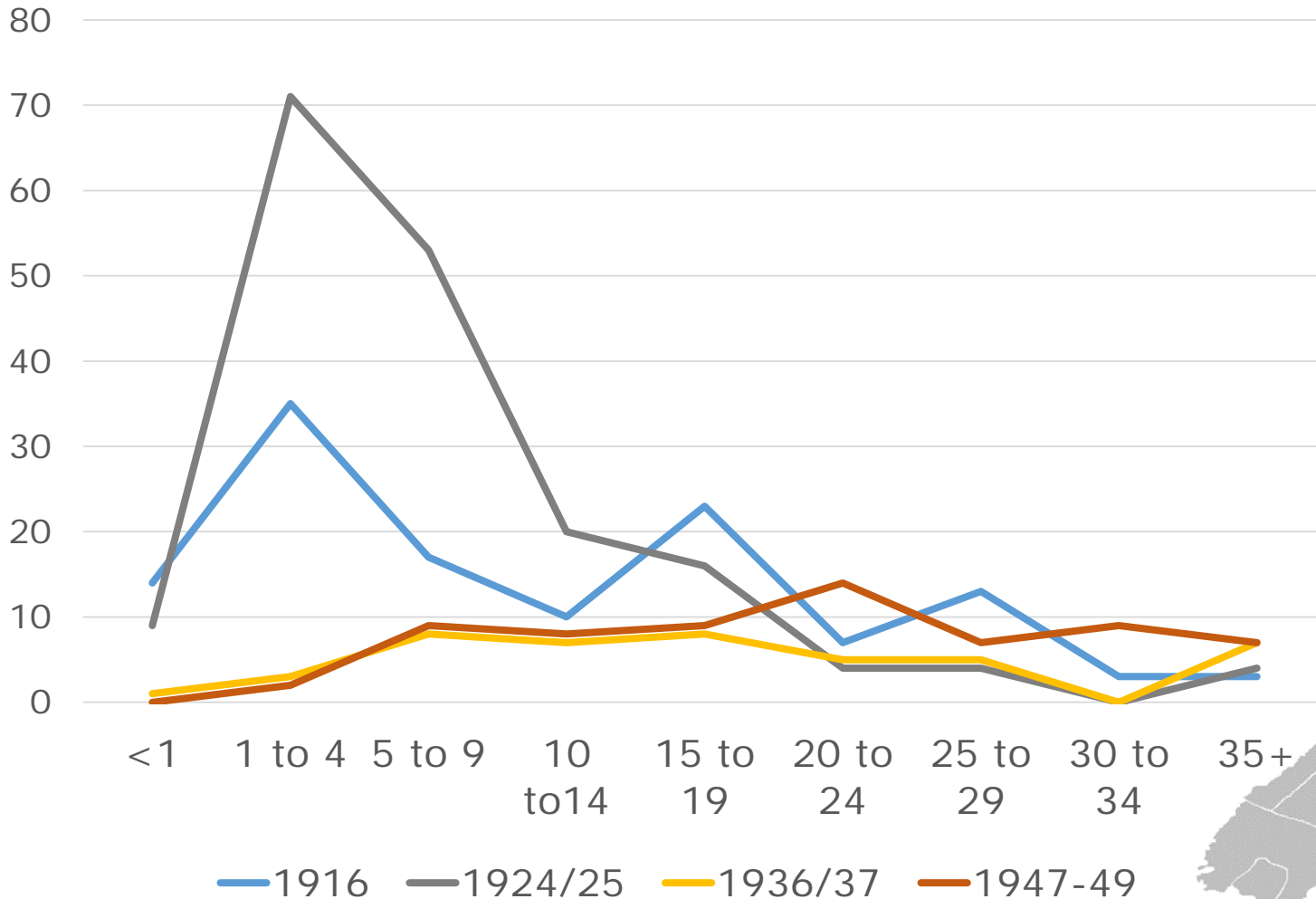
CURE FOR RHEUMATISM.

This is not a patent medicine, it is a prescription of an eminent English specialist. For years I have been a sufferer

...economic condition and Province. For all comes the cry from this hell of suffering. Consider for a position of the Government in July, 1914. We civil rights and liberties. In every market of were welcomed, from in friendly rivalry. States, the arts, the the maritime resc land. All our legitimate interests were safeguarded and protected and conventions. honoured and respected out the world. To-day the German scorn of civilisation flag has become infamy. Chivalry in our ranks. It has in the trenches in the village of Brabant. For our loathed by all honest hide them is impossible stand naked and exposed. We who love our passionate devotion reach the dawn of which shall restore and win back for the honour we have barbarous cruelties. I must have written to heavy hearts. Napoleon failed. must fail, and there peace until he has

...carbohydrates, but for the beneficent bacteria found in it. Another interesting and important assertion is to the effect that persons who make cheese

Deaths by age: *Which groups were most vulnerable?*



Polio and war



- Gear (1952:6):
“In the second world war, as in the first, poliomyelitis was more prevalent than in more normal times.”
- Blamed the South African epidemics of 1918 and 1944/45 on troops returning from Middle East



'The Homecoming from Gallipoli' (Wellington, NZ, 15 July 1915) by Walter Armiger Bowring

Country	Region	Death Rate (per 100,000)
US (regions)	New England (6 states)	11.3
	Middle Atlantic (3 states)	24.1
	South Atlantic (4 states)	3.4
	<i>Atlantic regions combined</i>	<i>17.3</i>
NZ (Prov. Districts)	Auckland	20.1
	Taranaki	21.5
	Hawke's Bay	18.4
	Wellington	9.9
	Marlborough	24.1
	Nelson	4.6
	Westland	0.0
	Canterbury	2.7
	Otago – Otago Portion	0.0
	Otago – Southland Portion	11.7
	<i>North Island</i>	<i>16.4</i>
	<i>South Island</i>	<i>4.0</i>



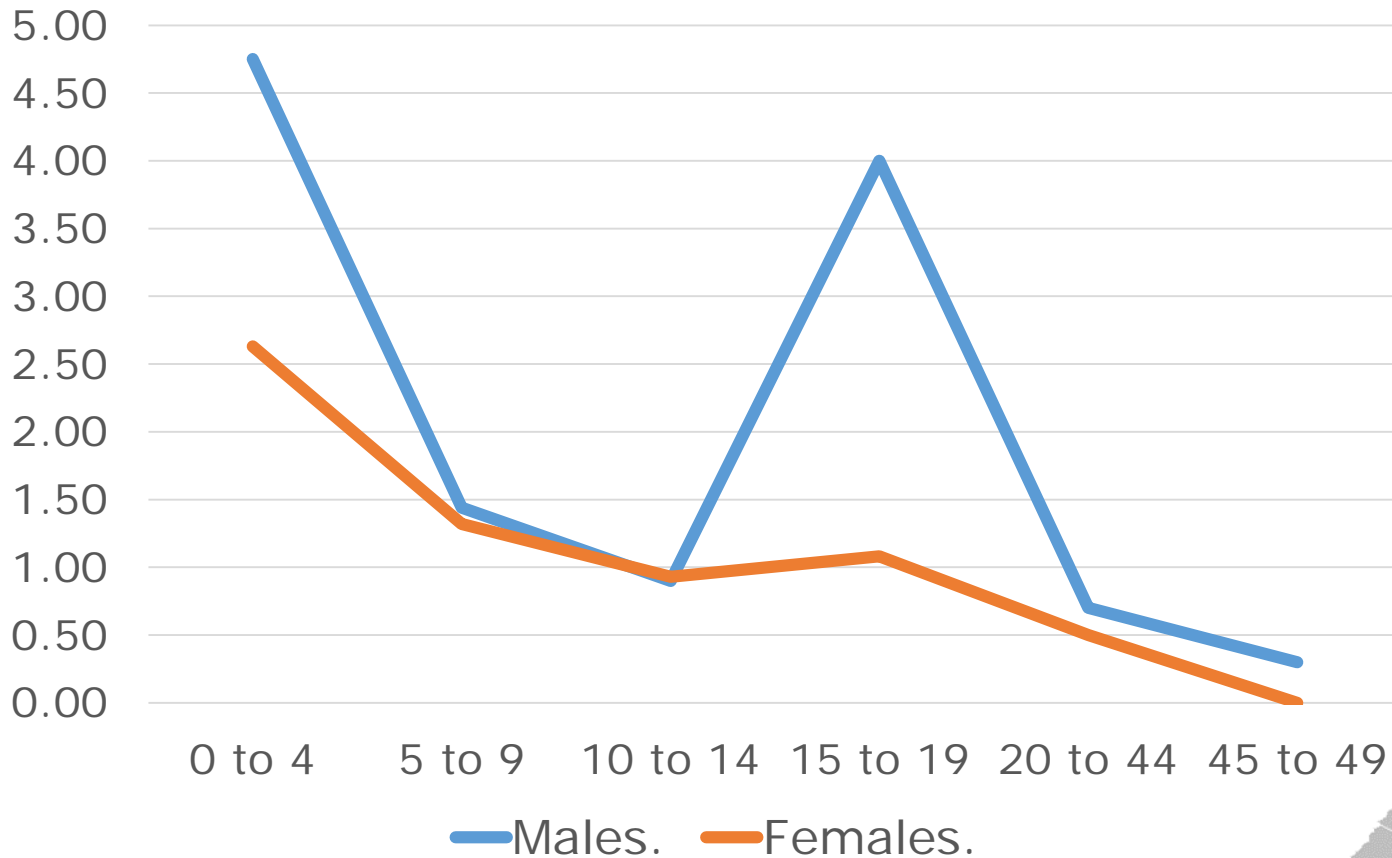
New York City,
July 1916
(Credit Bettmann/Corbis)

Country	Region	Death Rate (per 100,000)
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	Taranaki	21.5
	Hawke's Bay	18.4
	Wellington	9.9
	Marlborough	24.1
	Nelson	4.6
	Westland	0.0
	Canterbury	2.7
	Otago – Otago Portion	0.0
	Otago – Southland Portion	11.7
	<i>North Island</i>	<i>16.4</i>
<i>South Island</i>	<i>4.0</i>	



1916 Results: Age and sex

1916 death rate per 10,000

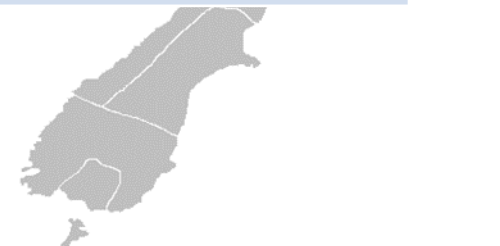


$\chi^2 = 4.393, df = 4, p = 0.36$



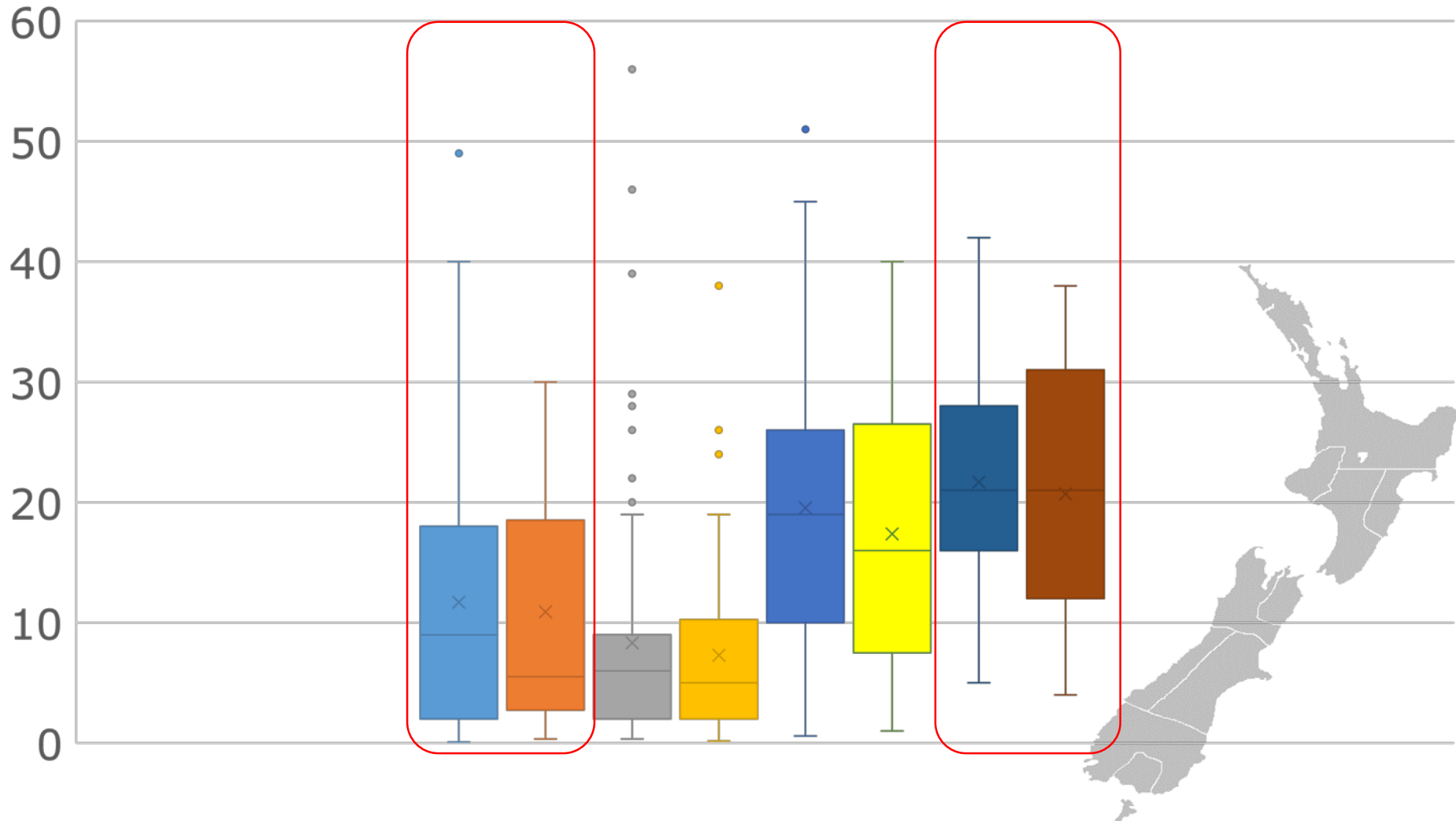
Did the sex ratio in polio mortality increase over time?

Epidemic	Median age at death (years)		Sex ratio (M:F)	Chi square test results
	M	F		
1916	8	7.5	1.7 (79:46)	$\chi^2 (1,125) = 8.712, p = .003,$ $\phi = .26$
1924/25	6	5	1.1 (95:86)	$\chi^2 (1, 306) = .448, p = .50$
1936/37	19	16	2.4 (31:13)	$\chi^2 (1,44) = 7.364, p = .007,$ $\phi = .41$
1947-49	21	21	1.0 (33:32)	n/a



Age at death by sex

- 1916 M
- 1916 F
- 1924/25 M
- 1924/25 F
- 1936/37 M
- 1936/37 F
- 1947-49 M
- 1947-49 F



Questions from first results

- Can we say there are general patterns for polio?
 - How variable?
 - Did they vary according to certain rules/conditions, as Nielsen et al. suggest?
- How to address the problem of small sample sizes?





Results so far

- **Preliminary** results show partial fit with expectations of traditional model
- No evidence of polio among NZ troops in FWW
- Excess male mortality - but sex ratio fluctuates
- Polio pandemics? (1916? 1937?)



Next steps

- SES analysis - *Was there differential mortality during New Zealand's polio epidemics?*
 - Status scores and/or HISCLASS
 - Compare to Ontario pattern
 - Compare to Rice and Bryder's finding re: 1918 influenza in NZ
- The 1916 epidemic and the First World War
 - How they were linked biologically and socially
 - Why was this epidemic 'forgotten'?
 - How was the epidemic linked to imperialist anxiety (including fears of disability/impairment)?



ANTHROPOLOGY SEMINAR

To be held on Thursday, 19th July 2018

4.00 to 5.30 pm in Room HSB 802 (Social Sciences Staff Room)


Heather Battles
(University of Auckland)

The First World War and the 'forgotten' 1916 polio epidemic in New Zealand

This presentation examines New Zealand's 1916 polio epidemic, which resulted in over 1,000 notified cases and 125 deaths among Pākehā alone, in addition to an unknown number cases and deaths among Māori. Despite the proportionately heavy toll of this epidemic, it has been largely forgotten', subsumed in historical and public memory by the upheaval and impact of the Great War as well as the subsequent mass mortality of the 1918 Flu.

Scholarship on the once-forgotten 1918 influenza pandemic has illuminated not only many factors which contributed to this 'forgetting' but also how intimately linked that disease was to the War - both biologically and socially. Are similar links to be found in the case of polio in 1916?

I present the results of quantitative and qualitative research of the non-Māori death registrations, contemporary newspapers, and other historical sources. I find little evidence of a direct biological link between wartime conditions and the spread and severity of the disease. Much clearer are the ways in which the epidemic articulated socially and politically with the War. I examine the negative and positive repercussions of these connections for the treatment of polio patients and how these connections to the War contribute to our understanding of collective forgetting versus remembering.



Dr. Heather Battles completed her BA in Anthropology and History at the University of Victoria in BC, Canada, in 2005, before moving to Ontario for graduate studies. She completed her Masters in the Anthropology of Health and her PhD in Biological Anthropology, both at McMaster University. Her doctoral dissertation used historical records to examine the shifting social, geographical, and demographic patterns of polio mortality in southern Ontario in the early 20th century. She took up her current position in Biological Anthropology at the University of Auckland in 2014, beginning her ongoing research into polio mortality in New Zealand. She takes an inter-/multi-disciplinary approach to the study of epidemics, combining historical demography, infectious disease ecology, medical anthropology, and social history.



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NEW ZEALAND

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- Previous research on
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and Deborah Simpson



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