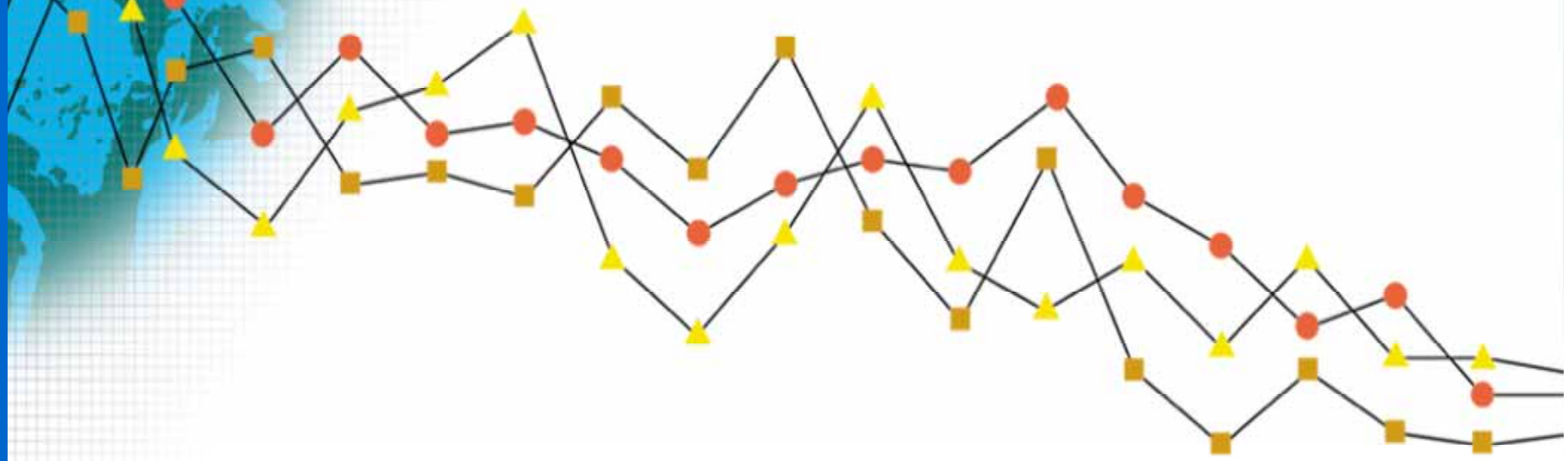
Historical Cohort Studies of Occupational Cancer in New Zealand



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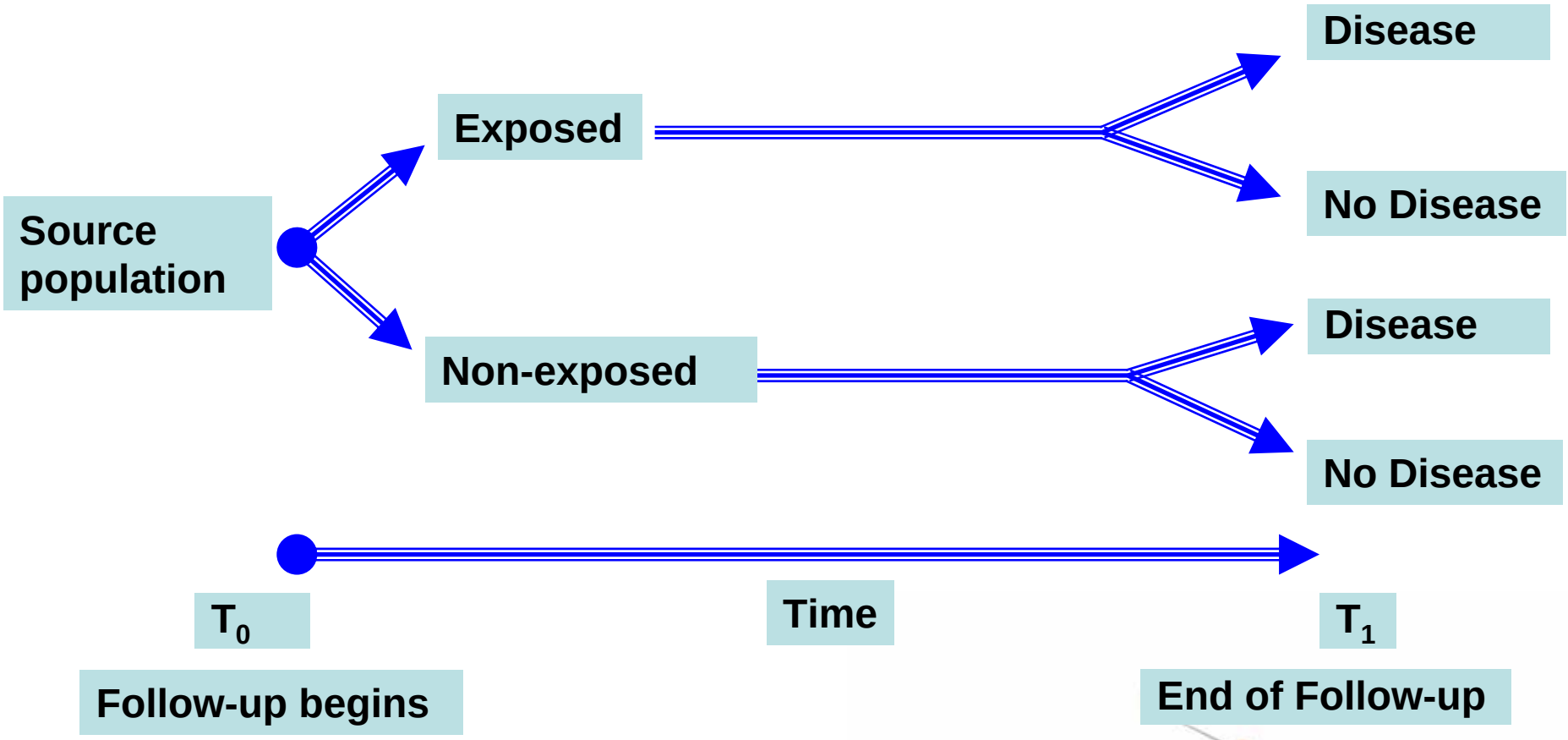
BROHNZ Building Research in Occupational Health in New Zealand

Historical Cohort Study Design



Historical Cohort Studies

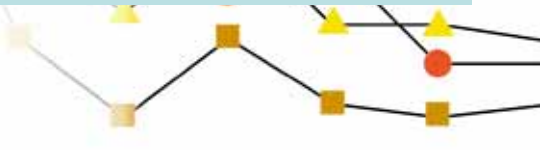
The most generally accepted epidemiological study design because they:

- include the entire population rather than a sample, and
- They closely resemble a standard experimental design:
  - administer an agent to disease-free subjects,
  - follow-up over time, and
  - observe disease effects among exposed and non-exposed groups.

Exposures that are rare in the general population can be examined by selecting an exposed occupational group

Multiple outcomes (diseases) can be studied

Useful for studying health outcomes with long induction and latency intervals – such as cancer.



Occupational Cancer Cohort Studies in New Zealand

1. **Kogevinas** *et al*. Cancer mortality in workers exposed to phenoxy herbicides, chlorophenols, and dioxins. *Am J Epidemiol* 1997; 145: 1061-1075.
2. **Firth** *et al*. Historical cohort study of a New Zealand foundry and heavy engineering plant. *Occup Environ Med* 1999; 56: 134-138.
3. **Bates** *et al*. Is testicular cancer an occupational disease of fire fighters? *Am J Ind Med* 2001; 40: 263-270.
4. **McLean** *et al*. Mortality and cancer incidence in New Zealand pulp and paper mill workers. *N Z Med J* 2002; 115: 186-90.
5. **McLean** *et al*. Mortality and cancer incidence in New Zealand meat workers. *Occup Environ Med* 2004;61: 541-7.
6. **'t Mannetje** *et al*. Mortality in New Zealand workers exposed to phenoxy herbicides and dioxins. *Occup Environ Med* 2005; 62: 34-40.
7. **McLean** et al. Cancer mortality in workers exposed to organochlorine compounds in the pulp and paper industry: an international collaborative study. *Environ Health Perspect* 2006: 114: 1007-1012.
8. **McLean** *et al*. Mortality and cancer incidence in a New Zealand sawmill workers cohort. *Australasian Epidemiologist* 2007, (Abstract).

Enumerating a Cohort

Employment Record — Health and Safety

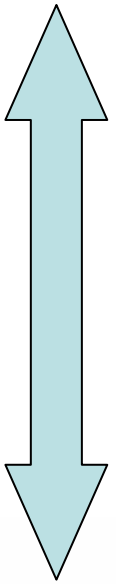
Service From	Position	Rate	Department	Remarks
5-29-62	Laborer	1.75	Shipping	E
6-1-62	Temp. Bake Clean. Feedman	1.90	B/L-Processing	TT
6-11-62	Temp. Table Operator	2.06	B/L-Processing	TT
6-16-62	Temp. Helper & Carloader	1.97	" "	TT
6-20-62	Laborer	1.75	T/S Oper.	T
7-25-62	Temp. Lineman Helper	1.90	M.Misc -Elect Shop	TT
8-1-62	Temp. Lineman Helper	1.90	Elec.Misc.-Elec Shop	T Dept. Change
10-22-62	Laborer	1.75	Dan Triple	T
10-31-62	Laborer	1.75	Chem. Oper.	T
11-8-62	"	1.75	Shipping	T
11-14-62	Temp. Painter	2.39	Ch. Misc	TT
11/21/62	Laborer	1.75	T/S Oper	T
	8/21-63	1.88	Contract Rate	Miscellaneous Remarks:
9/4/63	Crane Helper	1.95	T/S Operat.	F-60

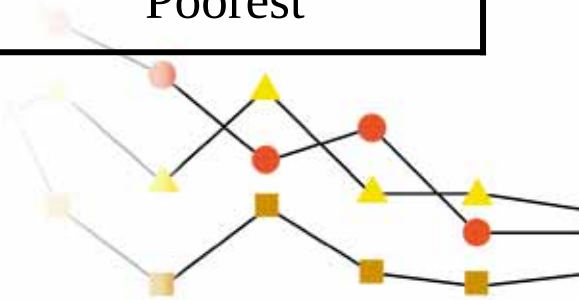
CODE –

CC – Classification Change	LO – Laid Off	R – Resigned
D – Discharged	M – Military Service	RA – Rate Adjustment
E – Employed	MI – Merit Increase	RE – Re-employed
EA – Evaluation Adjustment	MP – Merit Promotion	RI – Reinstated
GI – General Increase	Q – Quit	T – Transfer
		TT – Temp. Transfer

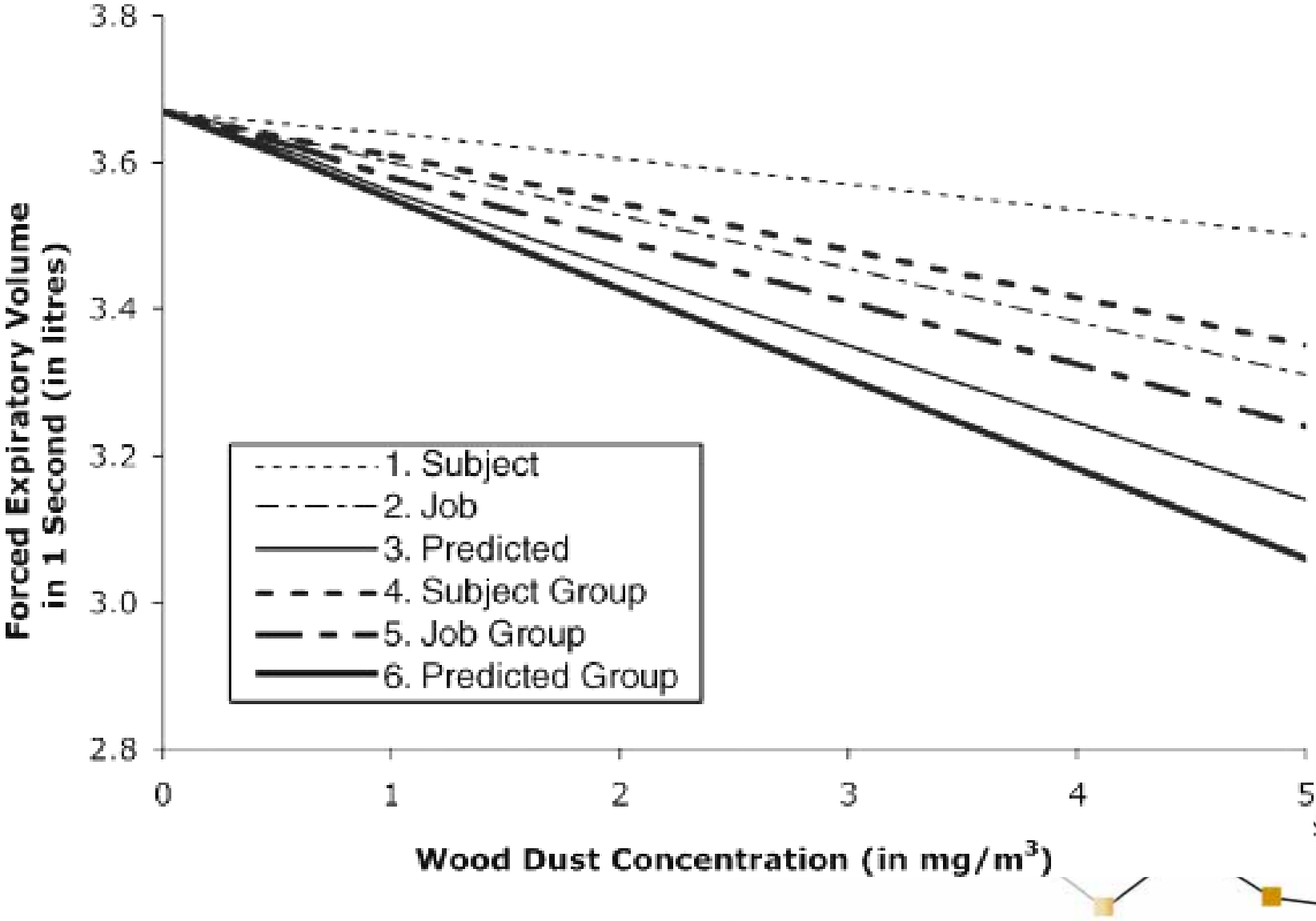
Figure 2–1. Sample work history from a personnel file for a worker in the Florida phosphate industry. (Source: Checkoway et al., 1985a.)

Exposure Definition

Exposure estimated by	**Approximation to dose**
1.Quantitative personal measurements 2.Quantitative area or job-specific characterisation of exposure 3.Semi-quantitative ordinal ranking of jobs/tasks (e.g. low, med, high) 4.Duration of employment in the industry 5.Ever/never employed in the industry	Best  Poorest



Attenuation in exposure-response relationships Teschke *et al, Am J Ind Med* 2004



Ascertainment of Vital Status

Deaths (or cancer registrations) can be identified through national records.

- Registration of both deaths and cancer virtually complete in New Zealand

To confirm that the remaining study participants are still actually alive, vital status can be searched in sources such as:

- Employment records
- NZHIS records
- WINZ pension records
- Electoral rolls

"Healthy Worker Effect"

- Occupational cohorts typically have a lower relative risk of death or chronic disease, as:
  - relatively healthy individuals are more likely to gain employment and to remain employed
  - there is selection of unhealthy persons out of the workforce
- The effect is particularly strong for heart disease and non-malignant respiratory disease, and usually less pronounced for cancer risk
- The effect diminishes with increasing time since first employment

Cause-specific mortality in NZ pulp and paper workers

McLean *et al*, *NZ Med J* 2002.

Cause of death	Observed	Expected	SMR
All Causes	314	394.28	**0.80***
All Cancers	103	108.37	**0.95**
Oesophagus	6	3.19	**1.88**
Colon	7	10.31	**0.68**
Liver	5	2.08	**2.40**
Pancreas	6	4.34	**1.38**
Lung	37	27.86	**1.33**
Haematologic	5	9.65	**0.52**
Circulatory system	119	153.42	**0.78***
Respiratory system	22	23.08	**0.95**
Digestive system	10	9.39	**1.07**
External causes	39	70.85	**0.55**

*** $p<0.05$**

Cause-specific mortality in NZ phenoxy herbicide producers 't Mannetje *et al*, *Occup Environ Med* 2005.

Cause of death	Observed	Expected	SMR
All Causes	122	123.5	**0.99**
All Cancers	43	34.6	**1.24**
Digestive organs and peritoneum	15	10.8	**1.38**
Trachea, bronchus and lung	12	8.8	**1.37**
Haematologic	5	3.03	**1.65**
Multiple myeloma	3	0.5	**5.51**
Circulatory system	51	53.0	**0.96**
Respiratory system	9	9.7	**0.93**
Digestive system	7	4.2	**1.68**
External causes	6	13.1	**0.46**

Cause-specific mortality in NZ meat workers

Mclean *et al*, *Occup Environ Med*. 2004

Cause of death	Obs	Exp	SMR	95% CI
All Causes	227	203.6	**1.12**	0.98-1.27
All Cancer	69	61.4	**1.12**	0.88-1.42
Larynx	1	0.4	**2.63**	0.07-14.62
Lung	23	12.9	**1.79**	1.13-2.68
Haematologic	6	6.3	**0.96**	0.35-2.09
NHL	4	2.8	**1.45**	0.49-3.45
Leukaemia	2	2.3	**0.86**	0.17-2.75
Circulatory system	73	63.7	**1.15**	0.90-1.44
Respiratory system	10	9.1	**1.10**	0.57-1.96
External causes	56	44.2	**1.27**	0.96-1.65

Subcohort Analyses

- Comparison of disease rates with an external reference group e.g. general population:
  - Indicates which diseases occur more frequently in the cohort
  - Subject to “Healthy Worker Effect”
- Comparison of disease rates between subgroups of a cohort defined on the basis of exposure:
  - aids in the identification of specific high-risk exposures or jobs
  - less bias e.g. from lifestyle factors

Standardised mortality ratios for all cancer mortality in NZ phenoxy herbicide producers.

't Mannetje *et al*, *Occup Environ Med*. 2005

	All cancer deaths			
	N	**Obs/exp**	**SMR**	**95% CI**
Producers	813	43/34.62	**1.24**	0.90-1.67
0-5 years		26/19.18	**1.36**	0.89-1.99
5-10 years		8/6.52	**1.23**	0.53-2.42
>10 years		9/8.93	**1.01**	0.46-1.91
Test for linear trend			*p*=0.44	
Synthesis workers	164	11/6.49	**1.69**	0.85-3.03
0-5 years		4/4.34	**0.92**	0.25-2.36
5-10 years		4/1.26	**3.18**	0.86-8.13
>10 years		3/0.89	**3.37**	0.70-9.85
Test for linear trend			*p*<0.04	

Lung cancer incidence in NZ meat workers by employment duration in selected departments.

McLean *et al*, *Occup Environ Med*. 2004

	Duration of employment								
	Not exposed		1-4 yrs		5-14 yrs		15+ yrs		*p* for trend
	Obs	SMR	Obs	SMR	Obs	SMR	Obs	SMR	
Slaughter	13	**1.56**	2	**1.05**	5	**1.71**	6	**2.80***	0.21
Processing	21	**1.55**	2	**3.85**	2	**3.63**	1	**1.53**	0.64
Maintenance	203	**1.59**	0	**0.00**	3	**2.89**	3	**4.05***	0.07

*** $p<0.05$**

Lung cancer incidence in NZ meat workers by employment duration in selected biological exposure categories.

McLean *et al*, *Occup Environ Med*. 2004

	Duration of employment								
	Not exposed		1-4 yrs		5-14 yrs		15+ yrs		*p* for trend
	Obs	SMR	Obs	SMR	Obs	SMR	Obs	SMR	
Raw meat	10	**1.60**	3	**1.17**	6	**1.63**	7	**2.51***	0.30
Urine	6	**1.63**	2	**0.62**	8	**1.65**	10	**2.84***	0.07
Faeces	5	**1.08**	3	**0.98**	8	**1.88**	10	**2.97****	0.02
Blood	6	**1.24**	3	**0.95**	7	**1.73**	10	**3.07****	0.03

*** $p<0.05$; ** $p < 0.01$**

Conclusions

- There have been relatively few historical cohort studies of occupational cancer conducted in New Zealand.
- Have confirmed findings from studies in other countries.
- Have contributed data to several large multi-centre studies.
- Main impediment is access to historical employment records.

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