Cancer case-control studies: Occupational risk factors

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Estimated mortality from occupational cancer in NZ

The number of deaths due to work-related disease in New Zealand is estimated at 692 to 980 per annum.

About 35%-43% of these deaths are due to occupational cancer, i.e. 237 to 425 deaths per annum.

2%-5% of cancer incidence in people age 30 or older is estimated to be work related

- For males estimated to be 3%-8%
- For females estimated to be 0.5%-1.5%

‘t Mannetje and Pearce, *Scand J Work Environ Health*. 2005.

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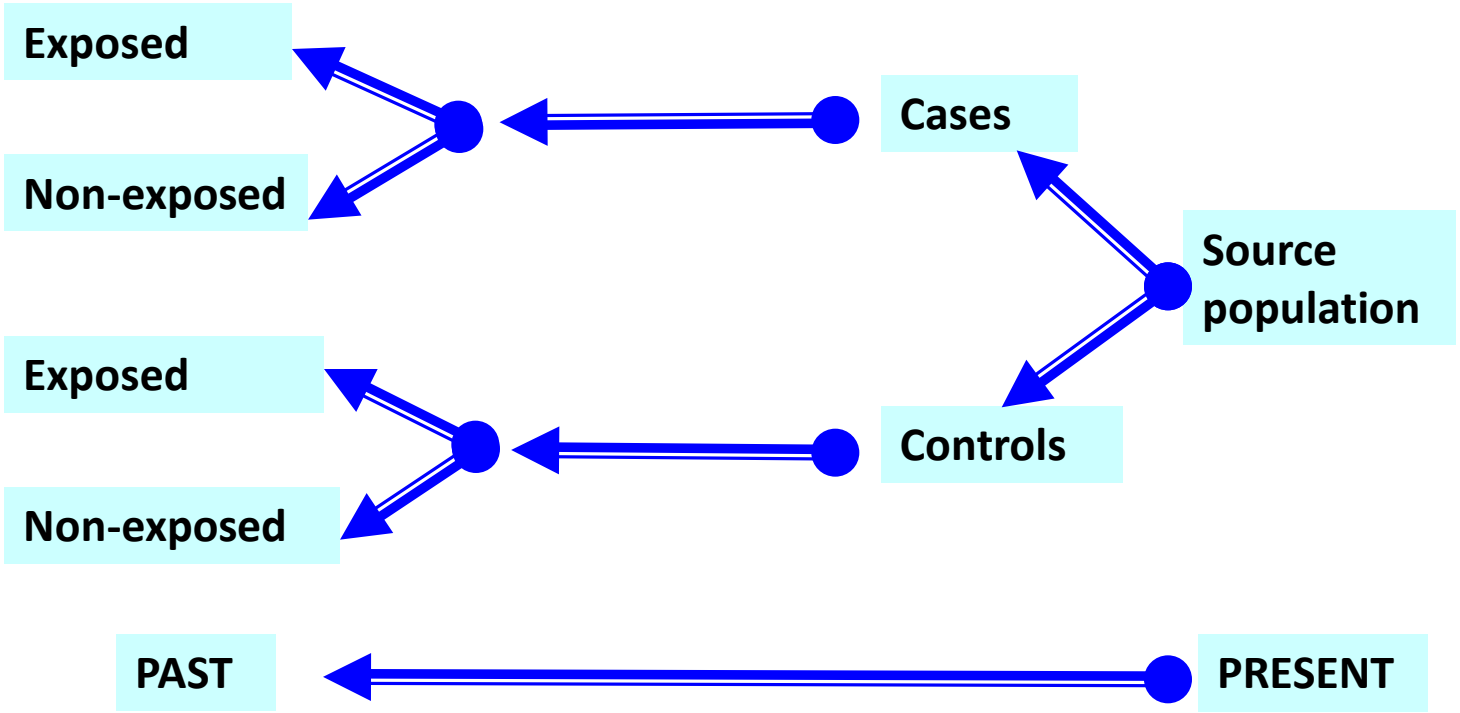
Case-Control Study Design

Case-control studies are observational studies in which study subjects are selected on the basis of their disease status (yes/no), and then past exposure status is determined.



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Advantages

Suitable for the study of relatively rare diseases with long induction, e.g. cancer.

Are efficient in time and cost c.f. prospective cohort studies.

Do not require access to the workplace.

Can investigate a wide range of risk factors.

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Disadvantages

Controls must represent the population from which the cases are drawn (*selection bias*).

Difficult to obtain accurate and unbiased measures of past exposures (information bias).

Multiple comparisons may result in chance findings.

Not suitable for investigating rare exposures.

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Occupational Cancer in Adult New Zealanders (OCANZ)

A series of New Zealand Cancer Registry-based case-control studies of occupational factors as causes of:

- Bladder cancer,
- non-Hodgkin's lymphoma,
- Leukaemia, and
- Lung cancer.

Aims:

To quantify the proportion of cases of these cancers that are due to well recognised occupational causes, and

To identify additional occupational causes of these cancers.

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OCANZ Methods

- For each study all incident cases (aged 20-75) notified to the new Zealand Cancer Registry over a two year period were enrolled.
- Controls were selected at random from the Electoral Roll, frequency matched by age.
- All cases (or proxies) and controls were interviewed face-to-face or by telephone to collect:
  - Personal and demographic information
  - Information on potential confounders including social class and smoking
  - Detailed employment history

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OCANZ Methods

- Associations between occupation/industry and the specific cancers analysed using unconditional logistic regression.

  Explanatory variables:
  - > **Occupation**
  - > **Industry**
  - > **Specific exposures**

  Confounders:
  - > **Gender**
  - > **Age**
  - > **Smoking**
  - > **Ethnicity**
  - > **Occupational status**

- Internal analyses conducted to establish whether duration of employment/level of exposure was associated with an increased risk.

- semi-Bayes adjustments were made to identify the most robust findings.

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Results

Cancer site	Total Numbers	
	Cases	Controls
Bladder Dryson *et al. Int J Cancer* 2008;**122**: 1340–1346.	213	471
NHL 't Mannetje *et al. Occup Environ Med* 2008;**65**;354-363.	291	471
Leukaemia McLean *et al. Int J Epidemiol* 2009;**38**:594–606.	225	471
Lung Corbin *et al. Am J Ind Med* 2011; 54: 89-101.	457	792

Bladder Cancer: Main findings

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Occupations and Industries	OR (95%CI)	Duration-response association	Possible Exposures
Hairdressers			
Hairdressers	**9.15** (1.60-62.22)		**Hair dyes** containing aromatic amines
Hairdressing and Beauty Salons	**5.35** (1.03-9.69)		
Textile products machine operators			
Textile products machine operators	**1.93** (0.96-3.88)		**Textile dyes** containing aromatic amines
Sewing machinists	**3.07** (1.35-6.96)	✓	

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NHL: Main findings

Occupations and Industries	OR (95%CI)	Duration-response association	Possible Exposures
Market farmers and crop growers			
Field crop and vegetable growers	**2.74** (1.04-7.25)		Herbicides, insecticides, fungicides etc
Nursery grower Nursery worker	**3.16** (1.37-20.9)		
Horticulture and fruit growing	**2.28** (1.37-3.79)		
Plant Nurseries	**4.30** (1.08-17.2)		
Apple and pear growing	**4.91** (1.26-19.1)		

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NHL: Main findings

Occupations and Industries	OR (95%CI)	Duration-response association	Possible Exposures
Meat/fish processing			
Slaughterers	**1.81** (0.97-3.97)		Blood, urine, faecal matter, other biological agents
Metal product man.			
Metal product manufacturing	**1.92** (1.12-3.28)		Metal dust/fume, MWFs, Solvents, PAHs
Elementary occ's			
Cleaners	**2.11** (1.21-3.65)		Cleaning products, solvents, disinfectants, infectious agents.

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Leukaemia and Agricultural Occupations "ever-worked in"

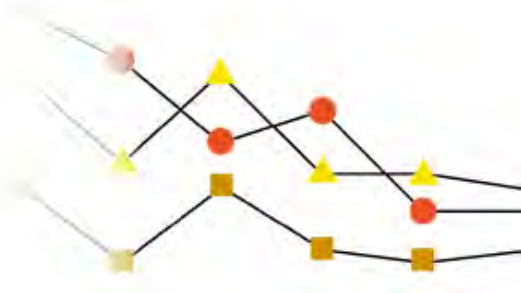
SCO	Job Title	Cases/Controls	**OR[a]**	95% CI
6	*Agriculture & Fishery Workers*	73/118	**1.37**	0.94 – 1.99
611	**Market Farmers and Crop Growers**	37/44	**1.84[b]**	1.12 – 3.02
6111	**Field Crop and Vegetable Growers**	11/7	**3.98[c]**	1.46 – 10.85
61112	**Market Gardener and Related Worker**	9/4	**5.50**	1.59 – 19.02
6112	**Fruit Growers**	17/20	**2.01**	0.99 – 4.10
61131	**Nursery Grower, Nursery Worker**	9/5	**4.23**	1.34 – 13.35

[a] Adjusted for gender, age group, smoking and Maori ethnicity
[b] Persisted after semi-Bayes adjustment (OR=1.66, 95% CI 1.06-2.59)
[c] Persisted after semi-Bayes adjustment (OR=2.07, 95% CI 1.00-4.29)

Leukaemia and occupation by gender

	Men (137 cases, 221 controls			Women (88 cases, 250 controls)		
	Cases/ Controls	**OR**	95% CI	Cases/ Controls	**OR**	95% CI
6-Agriculture and Fishery Workers	51/75	**1.30**	0.81-2.08	22/43	**1.37**	0.72-2.63
611-Market Farmers and Crop Growers	19/29	**1.15**	0.61-2.19	18/15	**3.48***	1.54-7.86
6111-Field Crop and Vegetable Growers	5/5	**2.38**	0.65-8.70	6/2	**7.62**	1.33-43.76
61112-Market Gardener and Related Worker	3/3	**2.25**	0.43-11.64	6/1	**15.74**	1.66-149.1
6113-Gardeners and Nursery Workers	7/14	**0.70**	0.26-1.84	8/4	**5.02**	1.35-18.63
61131-Nursery Grower, Nursery Worker	1/3	**0.52**	0.05-5.39	8/2	**11.70**	2.28-59.91
823-Rubber and Plastic Products Machine Operators	9/3	**4.62**	1.19-17.99	0/1	-	-

* Persisted after semi-Bayes adjustment (OR=2.24, 95% CI 1.12-4.46)



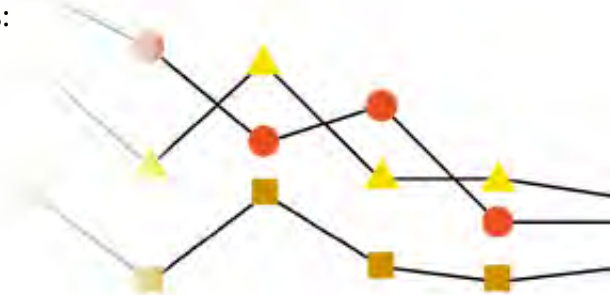
"a priori" high risk industries

	Cases/Controls	**OR**	95% CI
Agriculture	59/101	**1.42**	0.95 – 2.11
Horticulture and Fruit Growing	32/32	**2.62**	1.51-4.55
Plant Nurseries	8/3	**7.51**	1.85-30.38
Vegetable Growing	10/8	**3.14**	1.18-8.40
Other Livestock Farming	8/2	**9.06**	1.86-44.23
Textile, clothing, footwear and leather manufacturing	24/50	**1.29**	0.73 – 2.27
Plastic product manufacturing	10/8	**2.66**	0.98 – 7.23
Metal product manufacturing	23/30	**1.54**	0.84 – 2.82
Electrical services	6/10	**1.28**	0.44– 3.73
Education	45/128	**0.78**	0.51 – 1.20

Numbers were too small (fewer than 10 cases and controls) for the following high risk industries:

rubber product manufacturing

chemical product manufacturing.



Leukaemia and industry by gender

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	Men (137 cases, 221 controls			Women (88 cases, 250 controls)		
	Cases/ Controls	**OR**	95% CI	Cases/ Controls	**OR**	95% CI
Agriculture	39/58	**1.35**	0.81-2.26	20/43	**1.38**	0.71-2.69
Horticulture and Fruit Growing	13/18	**1.43**	0.66-3.12	19/14	**4.71***	2.09-10.62
Plant Nurseries	1/0	**-**	-	7/3	**7.75**	1.83-32.90
Vegetable Growing	5/6	**1.73**	0.51-5.93	5/21	**7.98**	1.33-47.75
Plastic Product Manufacturing	8/4	**3.78**	1.06-13.45	2/4	**1.36**	0.20-9.30

* Persisted after semi-Bayes adjustment (OR=2.69, 95% CI 1.34-5.40)

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Lung Cancer: Main findings

Occupations and Industries	OR (95%CI)	Duration-response association	Possible Exposures
Wood workers			
Timber processing machine operators	**4.63** (1.05-20.29)	✓	**Wood dust:** IARC Group 1 carcinogen
Log sawmilling and timber dressing industry	**2.85** (1.17-6.95)		
Metal workers			
Metal and mineral products processing machine operators	**4.10** (1.37-12.32)		**Asbestos, metal fumes and dust**
Drivers			
Heavy truck drivers	**2.24** (1.19-4.21)	✓	**Diesel and gasoline exhaust** respectively IARC Group 2A and Group 2B
Road transport industry	**1.78** (1.05-3.03)	✓	
Road freight transport industry	**3.02** (1.45-6.27)	✓	

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OLCANZ: Main findings

Occupations and Industries	OR (95%CI)	Duration-response association	Possible Exposures
Meat/Fish workers			
Meat and fish processing machine operators	**2.17** (1.22-3.88)	✓	Exposure to blood, urine, faecal matter and other biological agents
Textile workers			
Textile products machine operators	**1.55** (0.97-2.47)	✓	Exposure to organic solvents and textile dyes?
Textile bleaching, dyeing and cleaning machine operators	**2.35** (1.03-5.39)	✓	
Textile product manufacturing industry	**1.89** (0.88-4.10)	✓	

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Association of lung cancer with wood dust exposure

NZ JEM category	Cases	Controls	OR Adj[#] (95% CI)
Never exposed	142	266	1
Ever exposed	219	443	0.95 (0.69-1.29)
High exposure*	42	66	1.46 (0.82-2.60)

[#] adjusted for sex, age, ethnicity, smoking and SES

* >50% exposed to levels in excess of ≥ 0.5 mg/m^3

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Association of lung cancer with asbestos exposure

NZ JEM category	Cases	Controls	OR Adj# (95% CI)
Never exposed	108	250	1
Medium exposure	310	476	1.30 (0.94-1.81)
High exposure*	37	52	2.58 (1.30-5.10)

adjusted for sex, age, ethnicity, smoking and SES
* >50% exposed to levels ≥ 1 f/ml

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Conclusions

- Our findings are generally consistent with those reported in the literature from studies overseas.
- Widespread exposure to the risk factors identified, e.g. of the NZ working population it is estimated that 20% are employed in NHL risk occupations and that 5 – 6 % are exposed to wood dust.
- Gender differences in risk are evident for leukaemia in particular.
- Several new associations suggested.