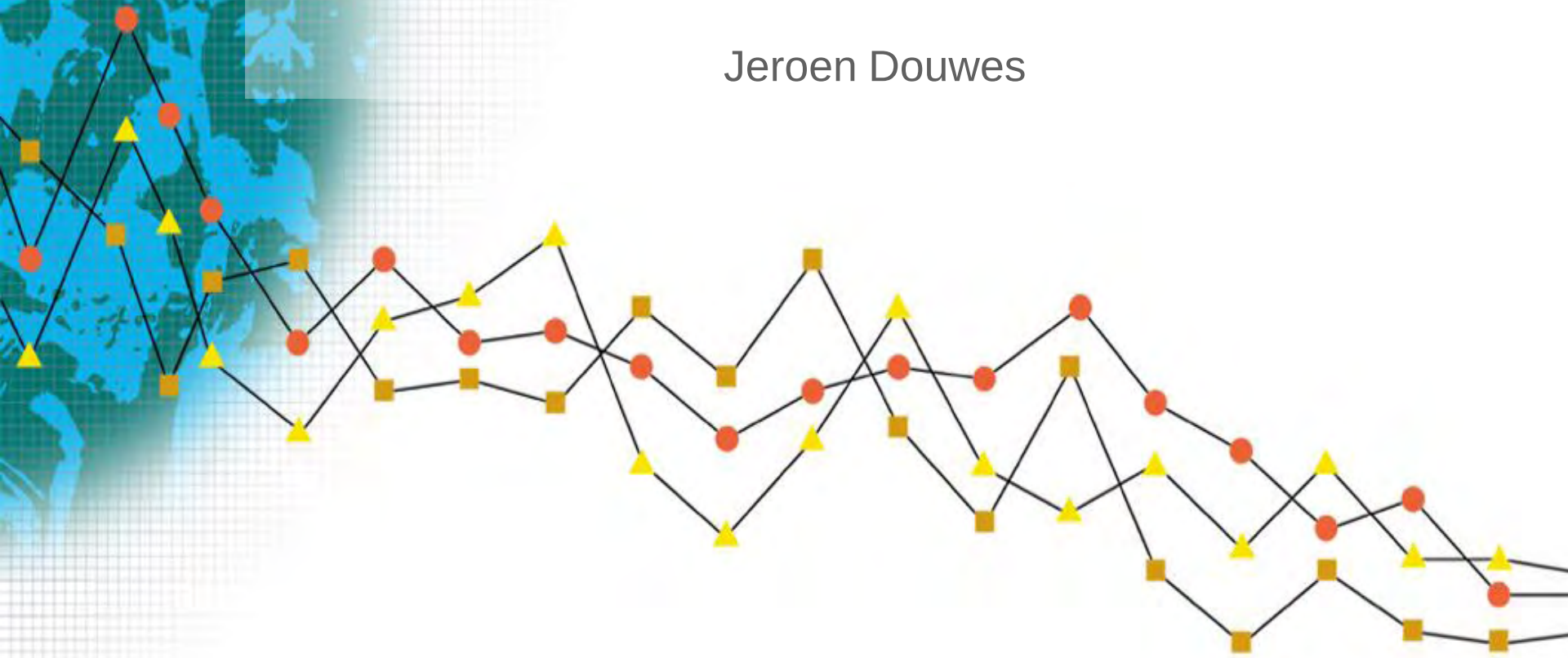
Environmental Health Surveillance: Case Studies

Jeroen Douwes



Centre for Public Health Research
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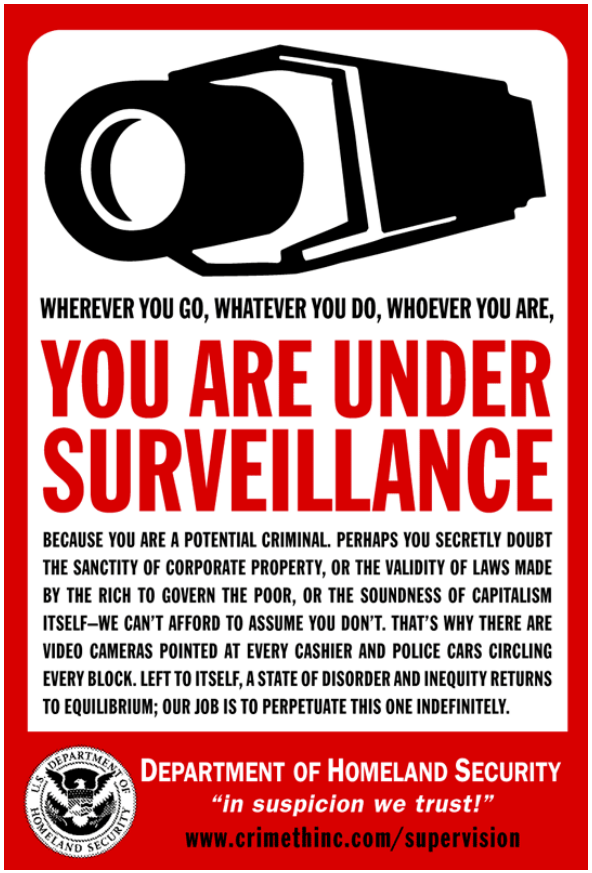
Te Kunenga ki Purehuroa

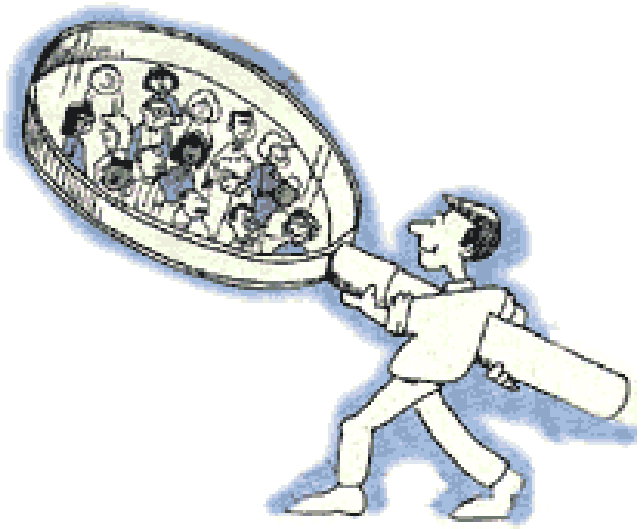
Environmental Health Surveillance

- Environmental health surveillance is the systematic, ongoing collection, collation, and analysis of data correlated to environmentally related disease, environmental hazards, and environmental exposures; and the timely dissemination of information to those who need to know about them in order to take action (Last 2001; Thacker 1996)



Uses of Public Health Surveillance

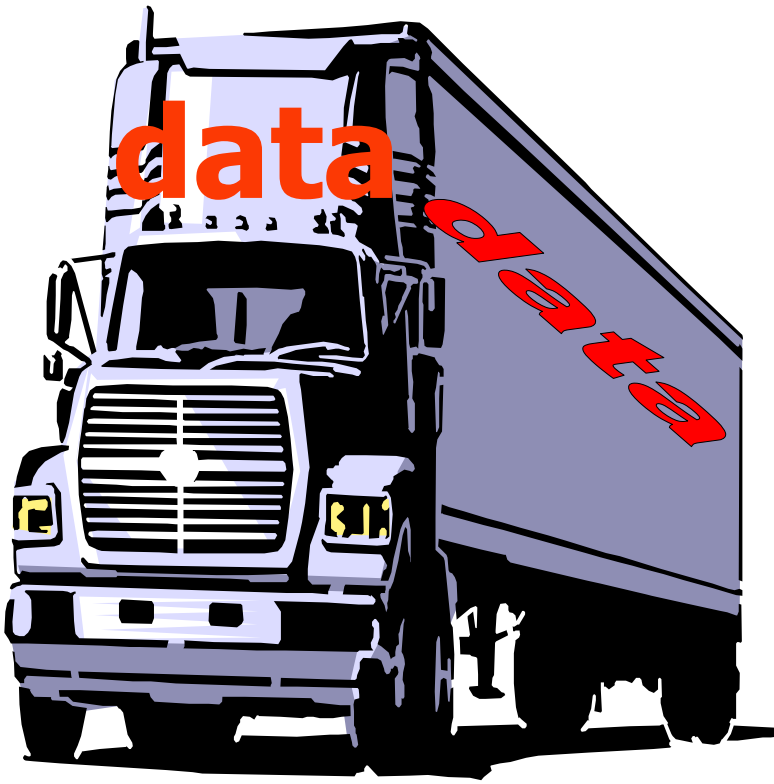
- Monitor trends and estimate magnitude of the problem
- Portray the natural history of a disease
- Epidemic detection and prediction
- Evaluate control measures and interventions
- Generate hypotheses, stimulate research
- Estimate future disease impact
- Monitor programme performance
- Detect changes in health practices
- Understand characteristics of health events
- Facilitate planning



Source: Barry Borman

Types of Public Health Surveillance

- *Passive surveillance* – occurs when data are routinely collected and forwarded.
- *Active surveillance* – occurs when data are sought out by visiting or contracting a reporting site
- *Sentinel surveillance* – occurs when only selected sites report data. This is rarely representative of the population but can be used to monitor trends and collect more detailed information
- *Laboratory surveillance* – when based from laboratories



Source: Barry Borman

What information is available?

- National Minimum Data Set (NMDS):
  - A national collection of public and private hospital discharge information, including clinical information, for inpatients and day patients (since 1993).
- PHARMHOUSE database:
  - A national collection of information on subsidized drug prescribing and dispensing.
- Census Data
- Mortality Collection
- New Zealand Cancer Registry
- Accident Compensation Corporation claims database
- Workbench (HASARD)
- Injury Information Manager (Statistics NZ)
- Notifiable Occupational Disease System

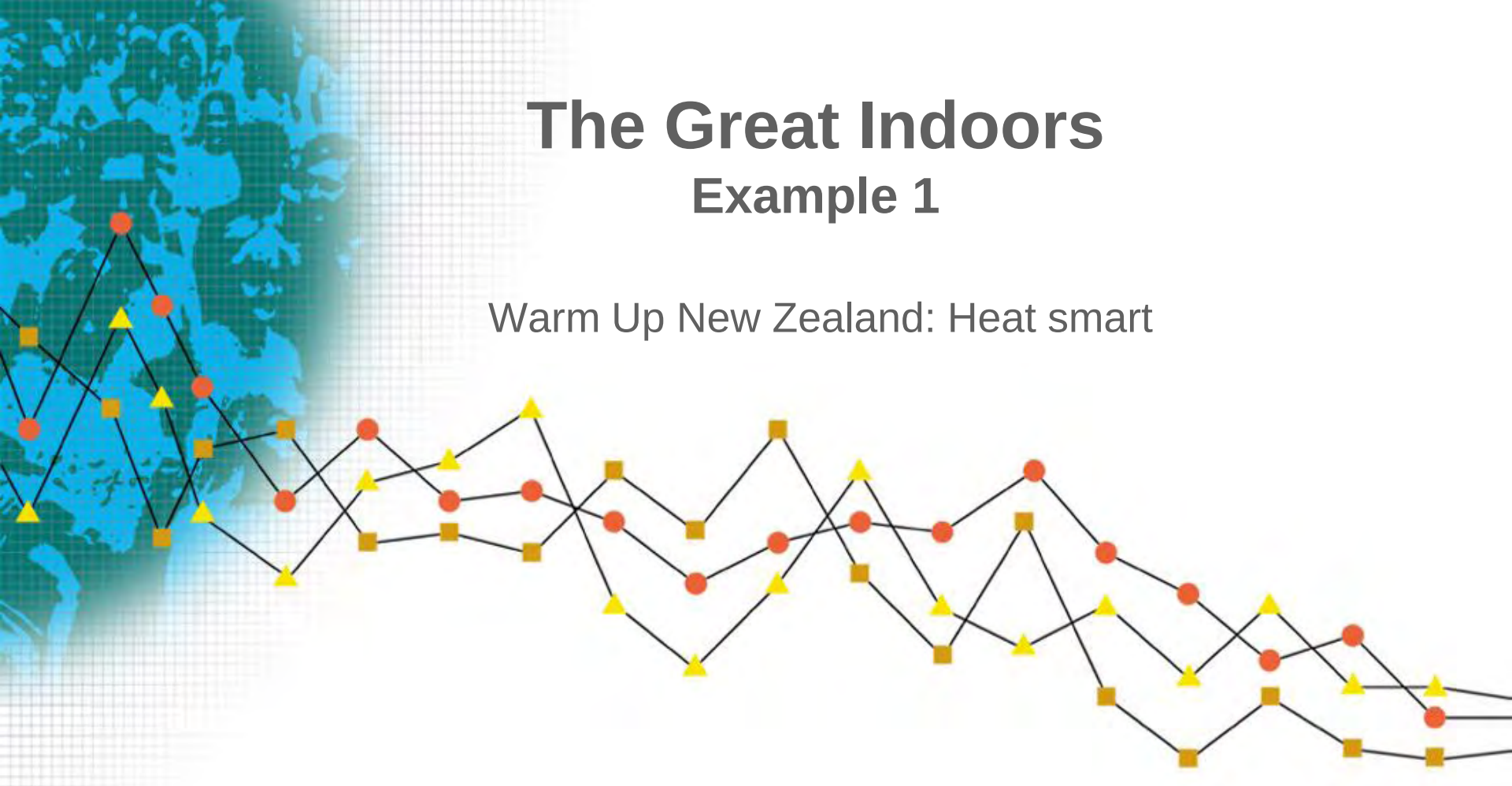
How can this information be used for environmental health issues? **Two examples**

- Health evaluation of the New Zealand Insulation Fund

- Health evaluation of 2010 home heating rules in Canterbury and Nelson to reduce winter air pollution (The clean heat project)

The Great Indoors
Example 1

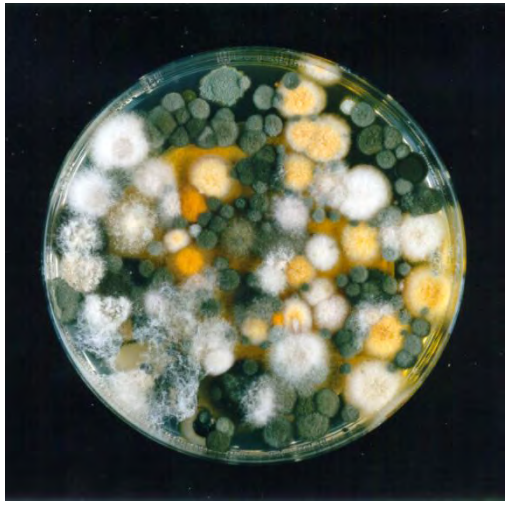
Warm Up New Zealand: Heat smart



"…an insulation and clean heating programme that will give more New Zealanders than ever before the opportunity to make their homes warmer, drier and more energy efficient…"

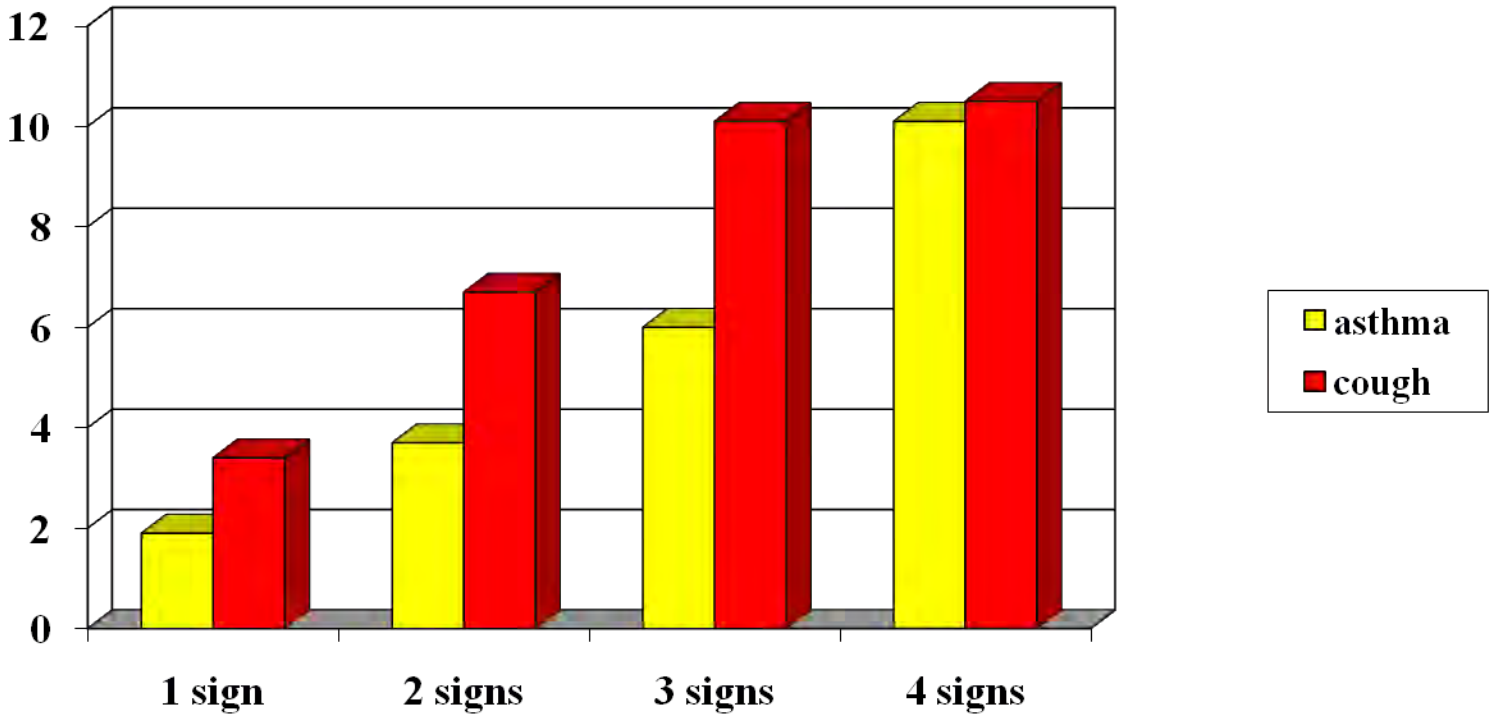
WHO ‘Concern for Europe’s Tomorrow’ (1996)

- Identified exposure to ‘home dampness’ as the single most frequent adverse environmental exposure in the European population



Engvall *Int J Tub Lung Dis 2001;5:468-77*

Relationship of asthma and cough to one or more signs of dampness: condensation, bathroom humidity, odours, water leakage



Nafstad, AJRCCM 1998;157;410-4
Oie, Epidemiology 1999;10;294-9

Bronchial obstruction in 0-2 yr olds		
	Adjusted OR	95% c.i.
Reported damp	2.5	1.1 – 5.5
Observed damp	3.8	2.0 – 7.2
at high ventilation	2.3	0.8 – 6.4
at low ventilation	9.6	1.1 – 87.5

Meta-analyses of the associations of respiratory health effects with dampness and mould in homes in the US

Outcome	Subjects	No. studies	Odds ratio central estimate (CI)	Estimated % increase in damp homes
Upper respiratory tract symptoms	All	13	1.70 (1.44–2.00)	52
Cough	All	18	1.67 (1.49–1.86)	50
	Adults	6	1.52 (1.18–1.96)	–
	Children	12	1.75 (1.56–1.96)	–
Wheeze	All	22	1.50 (1.38–1.64)	44
	Adults	5	1.39 (1.04–1.85)	–
	Children	17	1.53 (1.39–1.68)	–
Current asthma	All	10	1.56 (1.30–1.86)	50
Ever-diagnosed asthma	All	8	1.37 (1.23–1.53)	33
Asthma development	All	4	1.34 (0.86–2.10)	30

Fisk et al., 2007

- Exposures to dampness and mould "raises the risk for various adverse respiratory outcomes by 30-50%"

How common is indoor dampness?

Country	**N**	**%**	***Reference***
Europe	16,190	18% (12-32)	*Gunnbjörnsdóttir et al., 2006*
Taiwan	4,164	60%	*Yang et al., 1997*
China	10,902	11%	*Wong et al., 2004*
Northern Russia	3,368	13%	*Dotterud and Falk, 1999*
Palestine	188	78%	*Al-Khatib et al., 2003*
New Zealand	613	35%	*Howden-Chapman et al., 2005*
New Zealand*	1310	66-75%	*Howden-Chapman et al., 2005*
US	review	50%	*Mudarri and Fisk, 2007*
US, Canada, Europe	review	>20%	*IOM, 2004*

* At least one person with respiratory symptoms, low income communities

Effect of insulating existing homes on health: A community based cluster randomised study (Howden-Chapman, BMJ 2007)

Health outcome (N=1350*)	OR (95% CL)**
Fair or poor self related health	0.50 (0.38-0.68)
Self reports of wheeze in past 3 months	0.57 (0.47-0.70)
Day off school	0.49 (0.31-0.80)
Day of work	0.62 (0.46-0.83)
Visits to GP	0.73 (0.62-0.87)
Hospital admissions for respiratory conditions	0.53 (0.22-1.29)

* Highly selective group (at least one person with respiratory symptoms, low income communities). How representative for the whole population?

** Short follow up. Perceived positive effects may no longer be detectable once the initial “excitement” of the intervention wears off.

Warm Up New Zealand: Heat smart

- Warm Up New Zealand: Heat Smart is a government programme aiming to insulate existing houses. It also provides some funding towards ‘clean’ efficient heating.
  - Ceiling and under-floor insulation, up to the required standard
  - A clean, efficient heating system, if your home has been insulated to a level specified by EECA first.
  - A hot water cylinder wrap, pipe lagging, draught-stopping, and a ground moisture barrier, where necessary.
- “It started on 1 July 2009, and aims to retrofit more than 188,500 New Zealand homes over the next four years. It's run by EECA..”
- “Better insulation means our homes are warmer, cosier, and easier to heat. Warmer, drier homes bring health benefits, especially for those with respiratory illness or other conditions derived from living in cold and damp houses.”

Warm Up New Zealand: Heat smart
Health Improvements?

- Unique opportunity to evaluate the health effects using routinely collected health data.
- Data linkages:
  - EECA database with householder names
  - NZ Census data through both address and house holder name to expand the database of names to include all members of the household (including all children)
  - All household members will then be linked with the Ministry of Health National Health Index (NHI) to enable further database linkage through NHI
  - De-indentify data to ensure confidentiality
  - Linkage with National Minimum Data Set (NMDS) (hospital admissions)
  - Linkage with PHARMHOUSE (drug dispensings)

Asthma and COPD data in NMDS (shown only for ICD10)

Source	Code Type	ID	Description	Diagnosis
NMDS	ICD10AM	J450	Predominantly allergic asthma	Asthma
NMDS	ICD10AM	J451	Nonallergic asthma	Asthma
NMDS	ICD10AM	J458	Mixed asthma	Asthma
NMDS	ICD10AM	J459	Asthma, unspecified	Asthma
NMDS	ICD10AM	J46	Status asthmaticus	Asthma
NMDS	ICD10AM	J40	Bronchitis, not specified as acute or chronic	COPD
NMDS	ICD10AM	J410	Simple chronic bronchitis	COPD
NMDS	ICD10AM	J411	Mucopurulent chronic bronchitis	COPD
NMDS	ICD10AM	J418	Mixed simple and mucopurulent chronic bronchitis	COPD
NMDS	ICD10AM	J42	Unspecified chronic bronchitis	COPD
NMDS	ICD10AM	J430	MacLeod's syndrome	COPD
NMDS	ICD10AM	J431	Panlobular emphysema	COPD
NMDS	ICD10AM	J432	Centrilobular emphysema	COPD
NMDS	ICD10AM	J438	Other emphysema	COPD
NMDS	ICD10AM	J439	Emphysema, unspecified	COPD
NMDS	ICD10AM	J440	Chronic obstructive pulmonary disease with acute lower respiratory infection	COPD
NMDS	ICD10AM	J441	Chronic obstructive pulmonary disease with acute exacerbation, unspecified	COPD
NMDS	ICD10AM	J448	Other specified chronic obstructive pulmonary disease	COPD
NMDS	ICD10AM	J449	Chronic obstructive pulmonary disease, unspecified	COPD
NMDS	ICD10AM	J47	Bronchiectasis	COPD

Source: Craig Wright

Asthma and COPD data in PHARMHOUSE

Source	Code Type	ID	Description	Diagnosis
Pharmhouse	Chemical ID	1056	Aminophylline	Both
Pharmhouse	Chemical ID	1065	Fluticasone	Asthma
Pharmhouse	Chemical ID	1066	Salmeterol	Both
Pharmhouse	Chemical ID	1083	Eformoterol fumarate	Both
Pharmhouse	Chemical ID	1108	Beclomethasone dipropionate	Asthma
Pharmhouse	Chemical ID	1168	Budesonide	Asthma
Pharmhouse	Chemical ID	1218	Montelukast	Asthma
Pharmhouse	Chemical ID	1292	Choline theophyllinate	Both
Pharmhouse	Chemical ID	1492	Ipratropium bromide	COPD
Pharmhouse	Chemical ID	1580	Theophylline	Both
Pharmhouse	Chemical ID	1903	Orciprenaline sulphate	Reversible
Pharmhouse	Chemical ID	2096	Salbutamol	Both
Pharmhouse	Chemical ID	2374	Fenoterol hydrobromide	Reversible
Pharmhouse	Chemical ID	2375	Fenoterol hydrobromide with ipratropium bromide	Reversible
Pharmhouse	Chemical ID	2404	Terbutaline sulphate	Both
Pharmhouse	Chemical ID	3710	Bambuterol hydrochloride	Both
Pharmhouse	Chemical ID	3758	Budesonide with eformoterol	Asthma
Pharmhouse	Chemical ID	3858	Fluticasone with salmeterol	Both
Pharmhouse	Chemical ID	6311	Salbutamol with ipratropium bromide	Both

Source: Craig Wright

Warm Up New Zealand: Heat smart
Health Improvements?

- Changes in respiratory health will be assessed using changes in frequency of prescriptions and changes in hospital admission (over a period of several years before and after the 'intervention')
- Comparisons will be made with a random sample of the total population who have not received the intervention
- Data for >>100,000 representative householders
- Analyses will be adjusted for age, gender, ethnicity, NZDEP
- (Potential to do further linkages with MoH NZ Mental Health and Well-being Survey and Ministry for Social Development NZ Living Standards Survey)

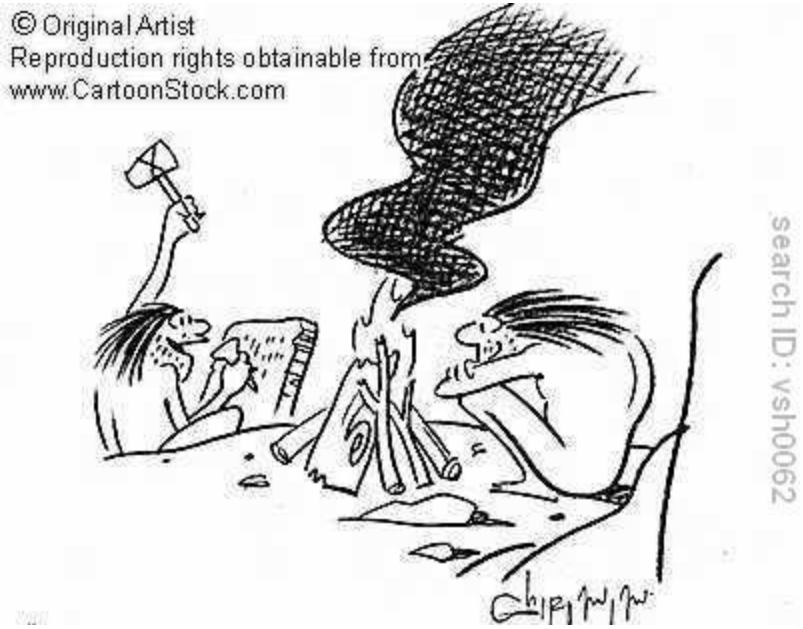
The Great Outdoors

Example 2

2010 home heating rules in Canterbury and Nelson to reduce winter air pollution

Health effects of outdoor air pollution

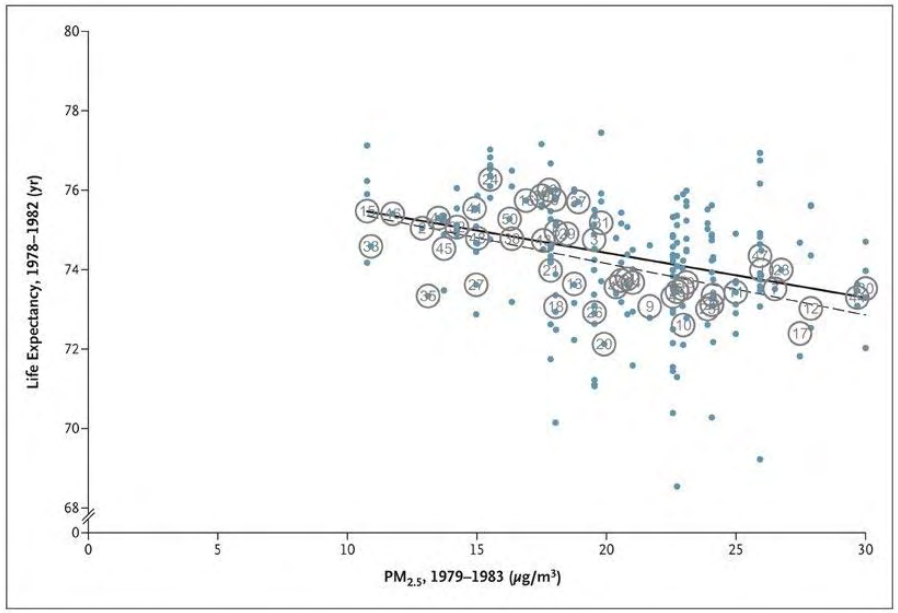
- Acute effects
  - Daily mortality
  - Respiratory and cardiovascular hospital/emergency department/primary care visits
  - Use of respiratory and cardiovascular medications
  - Acute respiratory symptoms and decreased lung function
- Chronic effects
  - Mortality due to cardiovascular and respiratory disease
  - Chronic respiratory disease
  - Chronic cardiovascular disease

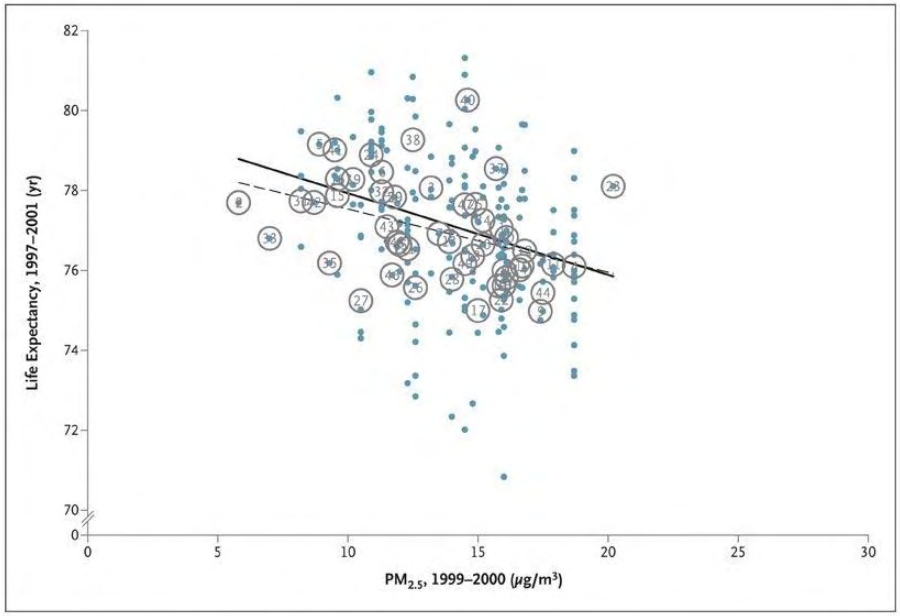


How do you want to be known, as the discoverer of fire, or as the first man to pollute the atmosphere?

Fine-Particulate Air Pollution and Life Expectancy in the United States (NEJM, 2009)

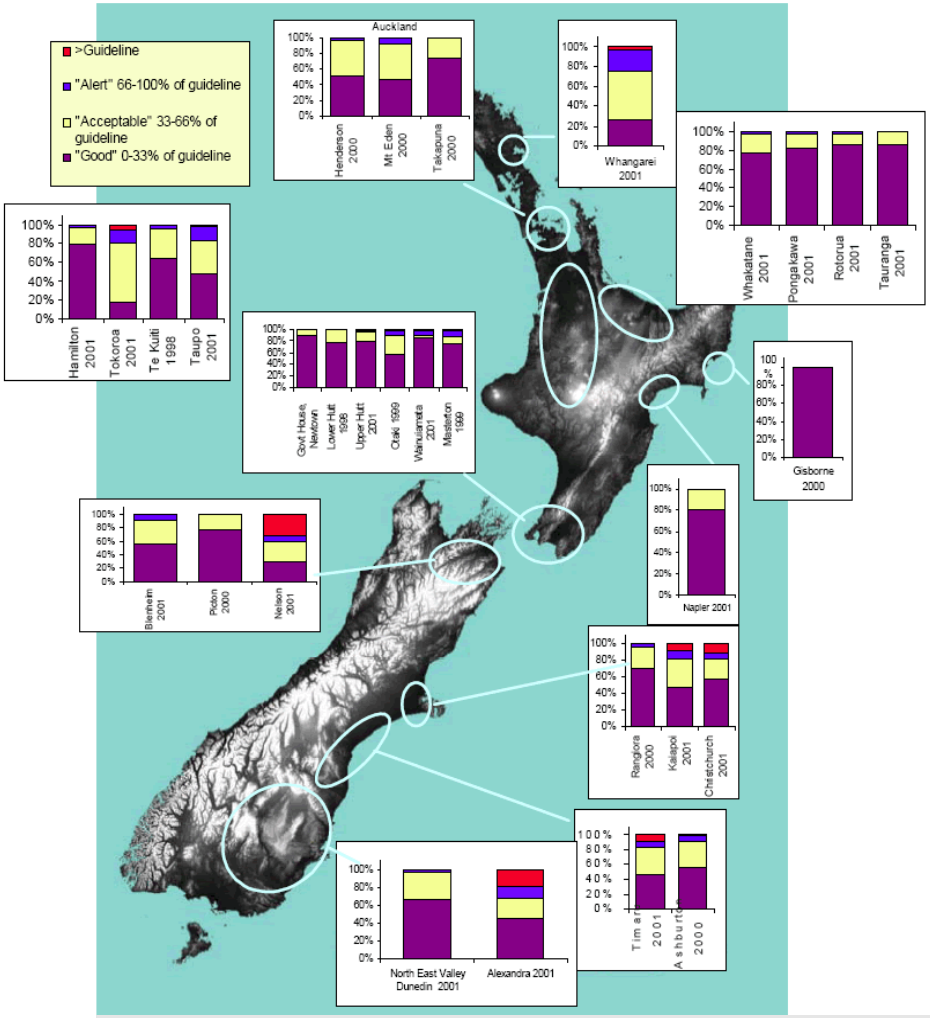
C. Arden Pope, III, Ph.D., Majid Ezzati, Ph.D., and Douglas W. Dockery, Sc.D.



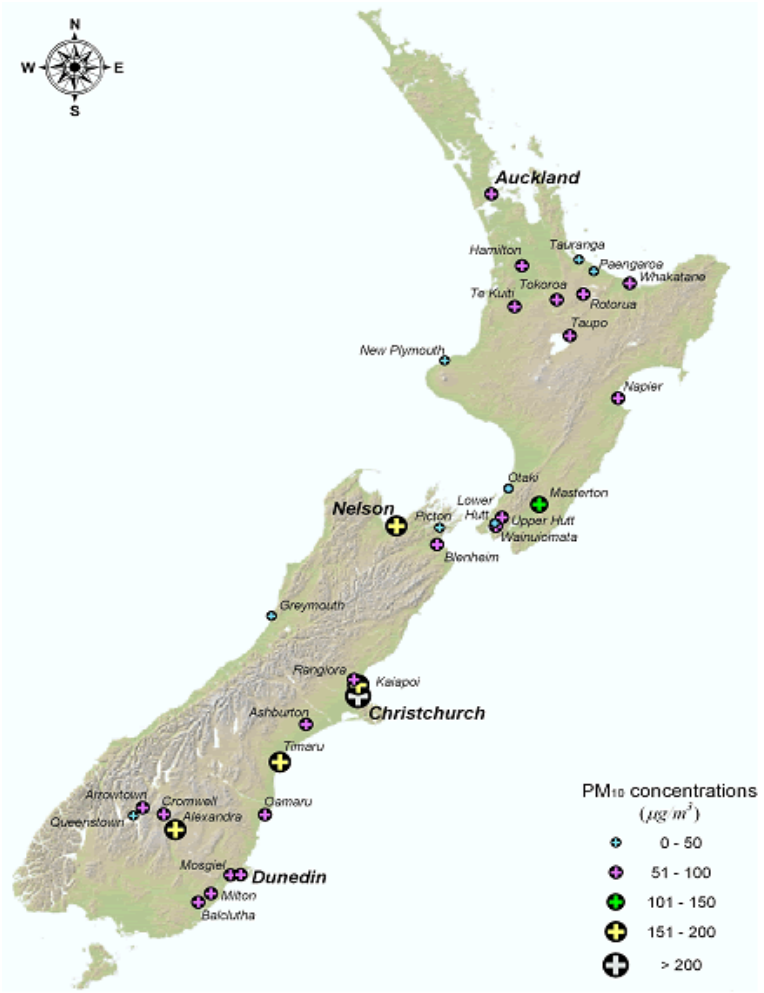


- A decrease of 10 µg per cubic meter in the concentration of fine particulate matter was associated with an estimated increase in mean (SE) life expectancy of 0.61 0.20 year (P=0.004).
- Reductions in air pollution accounted for as much as 15% of the overall increase in life expectancy in the study areas.

The percentage of measured 24-hour average PM_{10} concentrations within air quality categories in New Zealand



Maximum 24-hour average PM_{10} concentrations in New Zealand measured between 1997 and 2001



80% of winter air pollution in Canterbury and Nelson is coming from open fires and high emission solid fuel burners

Source: Health Effects of PM_{10} in New Zealand, MfE 2003

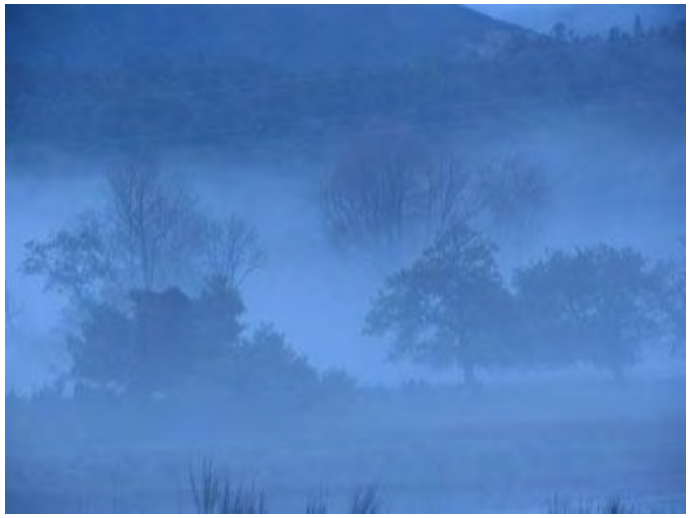
Estimates of health impacts of particle concentrations in New Zealand

Area	Estimated annual mortality	Estimated hospitalisations per year	Estimated restricted activity days per year
Auckland	436(3)	200	750,000
Wellington	79(3)	30	100,000
Christchurch	182(3)	80	300,000(1)
Dunedin	48(3)	20	80,000
Nelson	20(4)	14(2)	58,000(2)
Hamilton	40(4)	30	90,000
Timaru	20(4)	10	30,000
Lower Hutt	10(4)	20	60,000
Upper Hutt	20	10	30,000
Alexandra	5	<5	10,000
Tokoroa	10	5	20,000

Source: Health Effects of PM_{10} in New Zealand, MfE 2003

New Air Rules for Canterbury and Nelson

- From 1 April 2010, the use of open fires in Christchurch is banned from 1 April to 30 September each year.
- From 1 April 2010, the use of solid fuel burners that are 15 years or older in Christchurch is banned from 1 April to 30 September each year.
- You cannot install an open fire or any new wood burner
- Subsidies and assistance for replacement heating and insulation through the Clean Heat Project
- Similar rules apply to Kaiapoi, Ashburton and Nelson
- Reduced PM10 and PM2.5 exposures

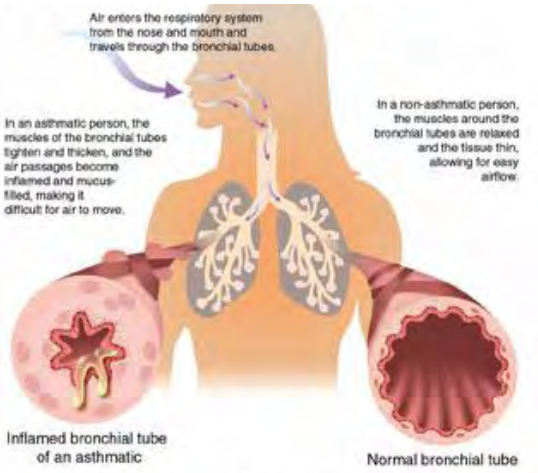


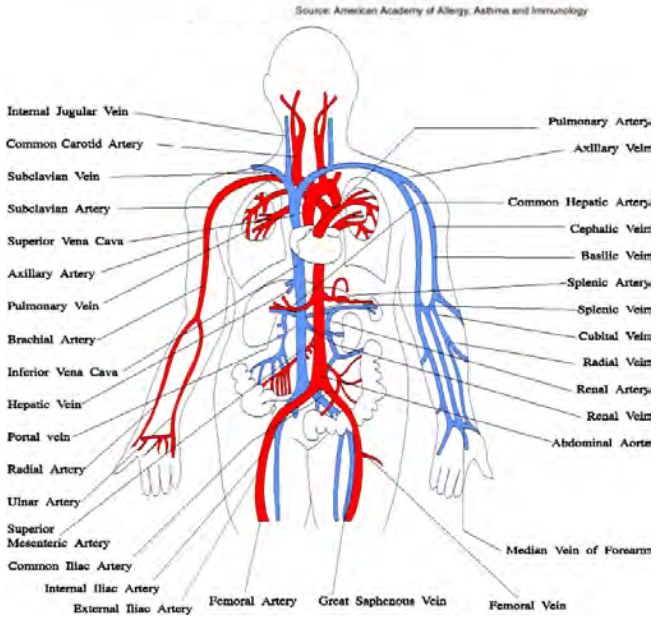
Ban on open fires and restrictions on wood burners
Health Improvements?

- Unique opportunity to evaluate the specific health effects of air pollution caused by burning solid fuel.
- Unique opportunity to evaluate the specific health effects of exposure reducing measures.
- Data linkages:
  - Geo-code NHI data:
  - Christchurch, Kaiapoi, Ashburton, and Nelson
  - Four other similar areas without high air pollution
  - Linkage with National Minimum Data Set (NMDS) (hospital admissions)
  - Linkage with PHARMHOUSE (drug dispensings)
  - Linkage with Mortality Collection
  - "Linkage" with routinely collected PM_{10} and $PM_{2.5}$ data

Ban on open fires and restrictions on wood burners
Health Improvements?

- Changes in respiratory and cardiovascular health and mortality can be assessed using changes in frequency of prescriptions and changes in hospital admission (over a period of several years before and after the 'intervention')
- Changes in exposure can be assessed by comparing routinely collected exposure data before and after intervention
- Comparisons should be made with similar communities with low PM_{10} and $PM_{2.5}$ exposures
- Analyses can be adjusted for age, gender, ethnicity, NZDEP

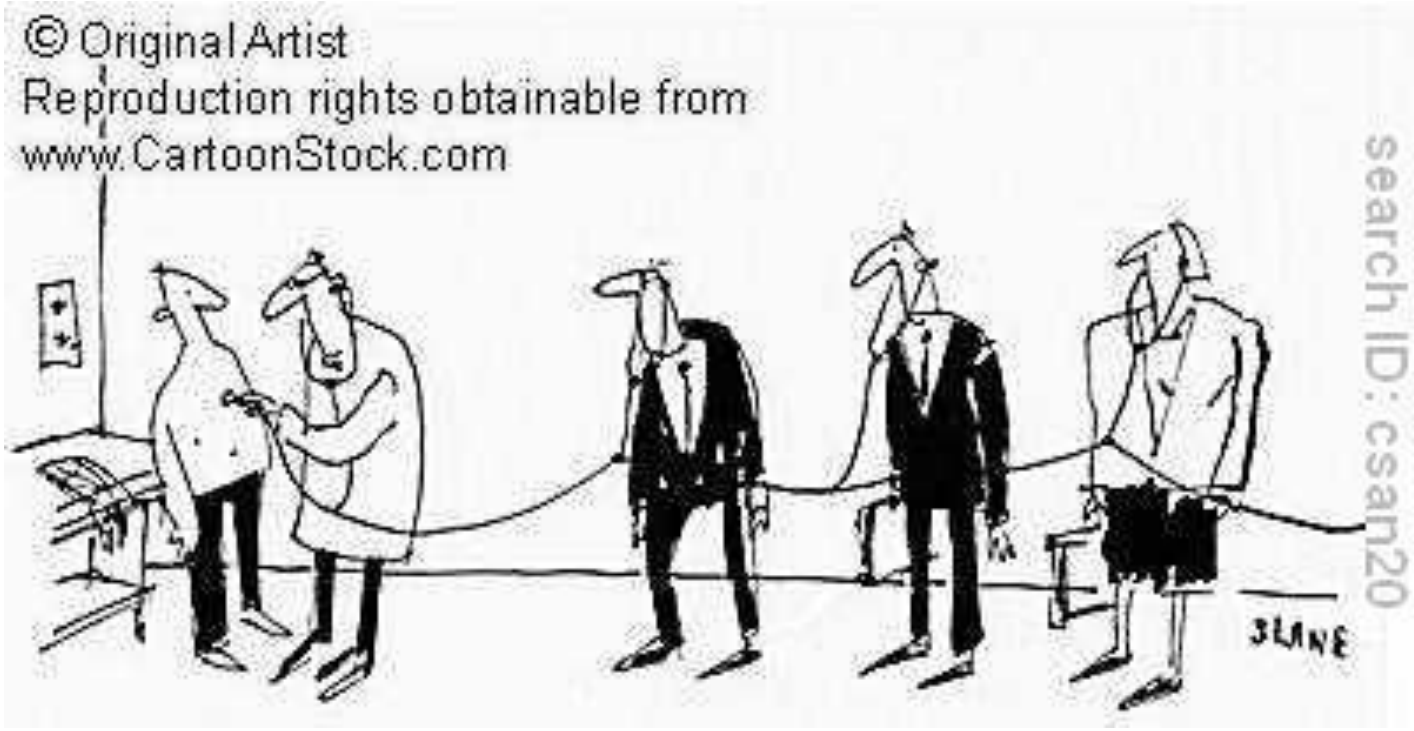




Other examples of how routinely collected health data can be used in New Zealand

- Effects of farming on respiratory disease, cancer, mortality and injuries
- Effects of occupational exposures on respiratory disease, cancer, dermatitis
- Health effects of occupational exposures on offspring of exposed workers (e.g. asthma, birth defects)
- Effects of climate change on health?
- Etc…

"Are you just pissing and moaning, or can you verify what you're saying with data?"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