Estimating the burden of passive smoking:

Methodological issues

Epidemiology at its limits?

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Epidemiology

From the Greek:
Epi [among] d*emos* [the people] *ology* [study of]

From: Last JM. *A dictionary of epidemiology*

- The study of the distribution of health-related states or events in specified populations, and the application of this study to the control of health problems.

'Application' makes explicit the aim to promote, protect, and restore health

Richard Doll

J Public Health 2004:26:327-336.

"I think you can best serve the purpose of public health by getting the right answer and to do that you must remain objective.

"I'm not saying that epidemiologists shouldn't be putting pressure on governments to do things, but not about their own research."

Doug Weed

Ann Epidemiol 2002;12:67-72.

"Epidemiologists have been mixing science and policymaking for a long time and there is a strong sense that the benefits of public stewardship outweigh the risks. ….

"With additional training and a broader recognition that public health policymaking is an appropriate professional pursuit, epidemiologists can look to a bright and challenging future in the science and practice of public health."

Creative epidemiology

Chapman ~1995

- Need for *'creative epidemiology'* in presenting the 2nd NHMRC report on passive smoking

- Non-sensicality of *'half a death'*

Cited in Tobacco Institute of Australia *vs*. NHMRC

Jamrozik, Chapman, Woodward. *How the NHMRC got its fingers burnt.* Med J Aust 1997; 167: 372-4.

Passive smoking

- What do we know?

- How long have we known?

- What is the associated burden?

- Some very conservative estimates

- Where are the uncertainties?

- Epidemiology at its limits?

What do we know?

Every reputable medical and scientific organisation that has reviewed the evidence has concluded that <u>active</u> smoking is <u>the leading cause</u> of premature death and preventable ill-health in developed countries.

Passive smoking:
How long have we known?

1973 – First double-blind randomised
         controlled trial indicating CO
         aggravates angina

1974 – First reports on passive smoking
         and acute respiratory illness in
         infants and children

Passive smoking:
How long have we known?

1981 – First reports of association between lung cancer in adults and passive smoking

1985 – First report on passive smoking and excess coronary mortality in non-smokers living with smokers

Passive smoking:
How long have <u>they</u> known?

1978 – Roper Organization advises tobacco industry of threat posed by passive smoking

Recommendations from Roper

- Dispute the science
- Recruit and publicise dissenting scientists
- Create supportive alliances
- Support and publish contradicting research
- Propose alternatives
  - courtesy
  - ventilation
- Oppose smoke-free policies as unworkable and economically disastrous

Evaluating the evidence

Do the statistical associations reflect causal relationships?

1. Evidence from experiments

2. Bradford Hill criteria

How good is the evidence on lung cancer?

Criterion	Active smoking	Passive smoking
Strength - dose-response	✓ ✓	Limited ✓
Consistency	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓
Specificity	? Squamous Ca Lung	No
Reversibility	✓ ✓	? ?
Temporal sequence *	✓	✓
Biological plausibility	✓	✓

How long have we known?

1985

NHF: 'So you think you're a non-smoker'

TIA: 'There is little evidence and nothing which proves scientifically that cigarette smoking causes disease in non-smokers'

1986 – First report on passive smoking from the NHMRC

[1992 – Morling rules that TIA's statement was 'misleading and deceptive']

What is the burden?

The population attributable proportion depends on:

- Prevalence of exposure (p)

AND

- The relative risk associated with exposure (RR)

$$PAP = p.(RR-1) / [1 + (p.(RR-1))]$$

Estimating <u>numbers</u> of cases

Assuming a causal relationship,

<u>number</u> of cases attributable to exposure =

$$\frac{p.(RR-1).d}{1 + p.(RR-1)}$$

where

d = deaths of a given type and age-group

Estimating the impact

Elements of the calculation:

1. Total number of relevant events in the whole population of interest

2. Fraction of events related to exposure

Populations at risk

WHO database → populations 0-14 and 15+ years

Population aged 20+ estimated as:

Total – [1.33 x population 0-14]

Where population 65+ not known, estimate based on the proportion 65+ in similar EU countries

Equivalent process for numbers employed in indoor occupations and in hospitality

28% of hospitality in pubs and bars (based on UK)

One fifth pub and bar workers lifelong

Data on smokers

WHO database → % of current smokers in 21 countries

Estimates made for neighbouring countries
- e.g. UK figure (26.8%) adopted for Ireland

Age-specific estimates derived on basis of: prevalence <65 = 2x prevalence 65+

Deaths from 4 conditions attributable to active smoking derived using data on risk from English *et al.* (1995)

Relevant cases

- Deaths in persons aged 25+ in the EU and Switzerland in 2002 obtained from WHO database

- Analyses limited to lung cancer, ischaemic heart disease, stroke and chronic respiratory disease

- Events subdivided into age <65, age 65+

- For non-smokers, deaths attributable to active smoking subtracted from total cause-specific deaths

Data on exposures

Only 5 estimates of % of smoke-free workplaces:
- Austrian figure (34% exposed) → west Europe
- Danish figure (85% exposed) → east Europe

Prevalence of exposure:
- 100% in hospitality industry
- % exposed at home corrected for single-person households (published data)

RR = relative risks:
  Woodward. (2001), Law (1996)

Level of exposure in bar staff: Jarvis. (2001)

Relative risks (Woodward *et al*; Law)

Outcome	Domestic	Work
Lung cancer	1.24	1.24
Heart disease	1.30	1.20
Stroke	1.45	1.45
Chronic respiratory	1.25	1.25

Estimating numbers of cases

Assuming a causal relationship,

number of cases attributable to exposure =

$$\frac{p.(RR-1).d}{1 + p.(RR-1)}$$

where

d = deaths of a given type and age-group

Attributable deaths – EU population

Outcome	Domestic	Work
Lung cancer	10,941	2,300
Heart disease	29,898	2,444
Stroke	26,530	2,060
Chronic respiratory	3,531	475
Total	72,170	7,280

Attributable deaths in non-smokers
EU population

Outcome	Domestic	Work
Lung cancer	1,032	521
Heart disease	8,758	1,481
Stroke	5,683	596
Chronic respiratory	970	201
Total	16,443	2,799

Attributable deaths in hospitality workers
EU population

Outcome	All	Non-smokers
Lung cancer	104	16
Heart disease	119	48
Stroke	82	19
Chronic respiratory	21	6
Total	325	89

Critique of assumptions

- Active *vs.* Passive   Assume additive

- % Domestic exposure   Literature

- % Work exposure   Conservative

- Pub and bar staff level   Literature

- Non-pub hospitality staff   Conservative

- Domestic *vs.* work   Double counting?

Conservative estimates

General population of the EU:

- At least 79,000 adults are killed by passive smoking each year

- Domestic exposure is 10x more important than exposure at work

Non-smokers in the EU:

- Passive smoking kills around 19,000 per year

- Around 2,800 killed by exposure at work

Epidemiology at its limits?

- Always start with the science
- Big numbers are better numbers
- Adopt the 'at least' position
- The innocent always work
- Convert the answer to a 'one liner'
- Push the boundaries of public opinion
- Understand what the media want
- Be patient

What will happen if we do not do anything?

- Half of those who continue to smoke will be killed prematurely by their habit

- 1 billion people will be killed by smoking during the 21st Century

- Children will continue to take up smoking

Attributable deaths – EU population <65

Outcome	Domestic	Work
Lung cancer	6,498	2,300
Heart disease	10,025	2,444
Stroke	5,973	2,060
Chronic respiratory	1,269	475
Total	23,765	7,280

Attributable deaths – EU population

Outcome	65+	Total
Lung cancer	4,443	13,241
Heart disease	19,873	32,342
Stroke	20,557	28,591
Chronic respiratory	3,531	5,275
Total	48,404	79,449

Attributable deaths in non-smokers EU population <65

Outcome	Domestic	Work
Lung cancer	403	521
Heart disease	1,781	1,481
Stroke	729	596
Chronic respiratory	155	201
Total	3,068	2,799

Attributable deaths in non-smokers
EU population

Outcome	65+	Total
Lung cancer	629	1,553
Heart disease	6,977	10,239
Stroke	4,954	6,279
Chronic respiratory	815	1,171
Total	13,375	19,242

Evidence of effectiveness

Daube's law:

"The nearer you are to their sensitive spots, the louder the tobacco industry screams."

Koniec!