Strategies for data analysis: case-control studies

Gilda Piaggio

UNDP/UNFPA/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction
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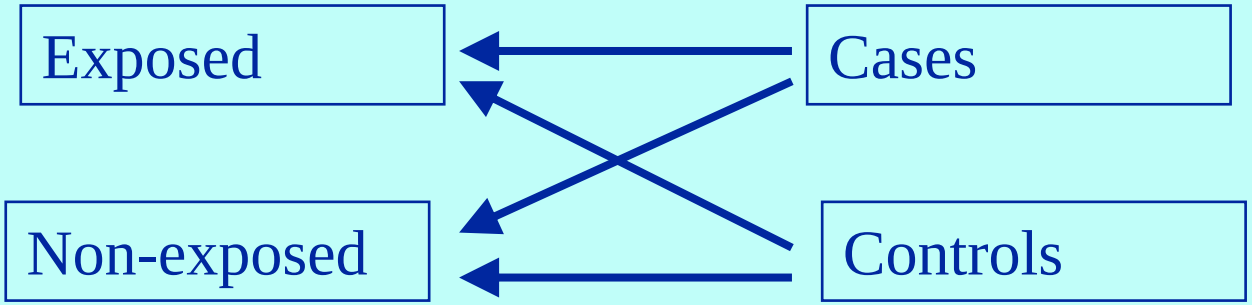
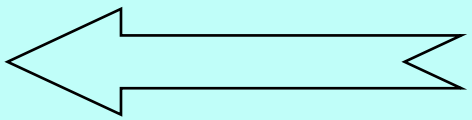
Design of case-control studies: retrospective



Then measure exposure



First select

Prevalence of disease is fixed by design

	Cases	Controls
Exposed	a	b
Non-exposed	c	d

Fixed margins
a+c and b+d

Prevalence of exposure in cases and controls and odds of being exposed

In case-control studies we can calculate:

- Prevalence of exposure in cases and in controls
  a/(a+c) and b/(b+d)

- The odds ratio to measure association between disease and exposure:

The odds of being exposed for a case is a/c
The odds of being exposed for a control is b/d

The odds ratio of exposed vs non-exposed is

$$OR = (a/c)/(b/d) = (a \times d)/(b \times c)$$

We cannot calculate the relative risk (RR)

Interpretation of the odds ratio

- If exposure and disease are not associated, OR=1
- If exposure and disease are positively associated, OR>1
- If exposure and disease are negatively associated, OR<1

The OR is a good estimation of the RR if the disease is rare

Strategy for data analysis for case-control studies

- Describe study profile: number of cases and controls, identified and analyzed
- Baseline characteristics of cases and controls
- Crude ORs for different categories of use and risk factors
- ORs for different categories of use and risk factors, adjusting for confounders

Example
Oral contraceptives and breast cancer

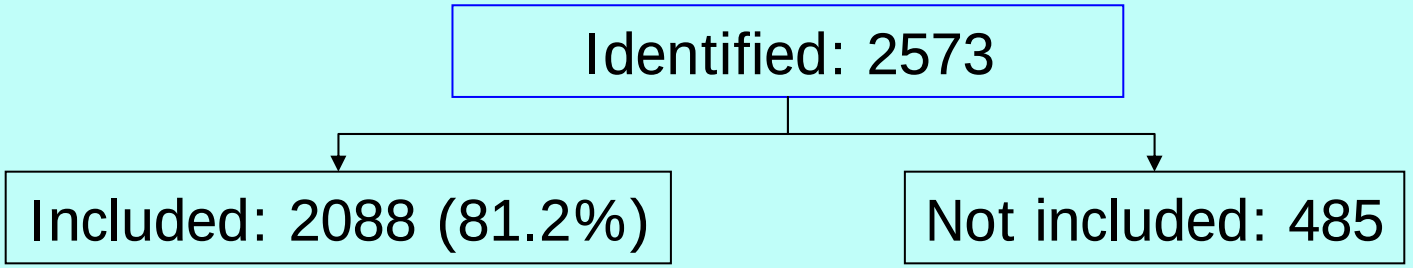
Lancet 1985; 326:970-972

Study aim was to investigate relation between use of oral contraceptives (OCs) by young women and their risk of breast cancer

Cases: women 20-44 years at initial diagnosis of breast cancer, between Dec 1 1980 and Dec 31 1982, resident in 8 regions of the US, identified from population-based cancer registries.

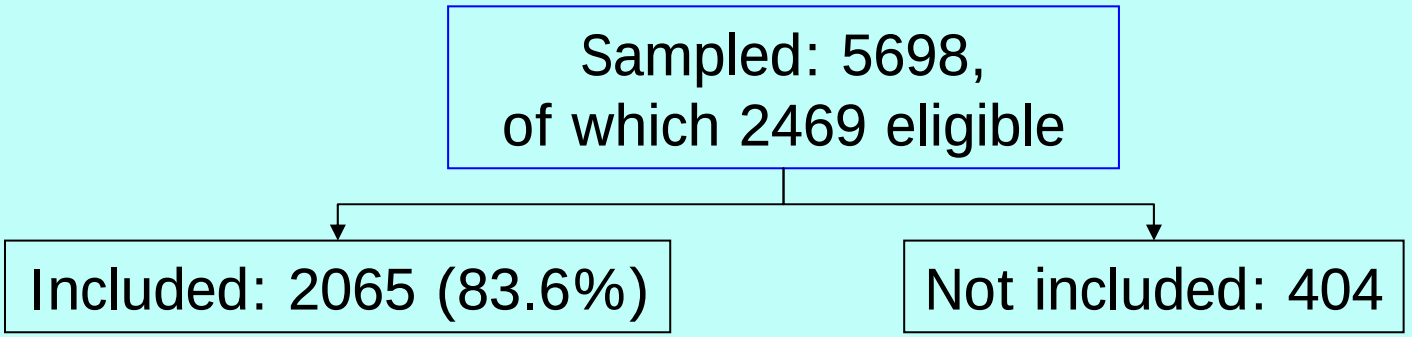
Controls: women 20-44 years selected during same 25 months as the cases were diagnosed, residents of the 8 regions, selected randomly by telephone calls to households.

Oral contraceptives and breast cancer
Study profile: cases



6.4% refused to participate
3.7% died or were too ill
8.7% miscellaneous reasons

Oral contraceptives and breast cancer
Study profile: controls



11.2% refused to participate
2.2% moved out
3.0% miscellaneous reasons

Oral contraceptives and breast cancer
Baseline characteristics of cases and controls

	Cases(%)	Controls(%)
Age		
20-24	0.7	5.1
25-29	6.0	8.2
30-34	18.3	20.8
35-39	33.5	28.6
40-44	41.4	37.3
Family history of breast cancer		
Yes	29.1	18.7
No	42.3	51.4
Unknown	28.6	29.9

Oral contraceptives and breast cancer
Baseline characteristics of cases and controls

	Cases(%)	Controls(%)
Age at first term pregnancy		
Nulliparous	18.2	18.4
<20	19.1	22.1
20-22	23.1	24.7
23-26	22.3	21.6
27-29	9.2	7.6
>29	7.0	4.0
Parous, unknown age	1.1	1.6
Benign breast disease surgery		
Yes	4.5	2.3
No	87.2	91.7
Unknown	8.3	6.0

Oral contraceptives and breast cancer
Results: crude ORs

	Cases	Controls
Exposed	1701	1662
Non-exposed	387	403
All	2088	2065

OR=1.07

Stratification and confounding variables?

Oral contraceptives and breast cancer
Results: crude ORs

Age at diagnosis or selection	Cases(%)		Controls(%)		OR
	N	% ever users	N	% ever users	
20-24	15	100.0	106	69.8	-
25-29	126	86.5	169	87.6	0.91
30-34	382	89.3	429	88.1	1.13
35-39	700	86.4	590	85.1	1.11
40-44	865	73.0	771	72.6	1.02
Total	2088	81.5	2065	80.5	1.07

Oral contraceptives and breast cancer
Results: adjusting

We need to adjust for factors associated with the risk of breast cancer or with the likelihood of diagnosis:

- Age at diagnosis or selection
- Family history of breast cancer
- Age at first term pregnancy
- History of surgery for benign breast disease
- Frequency of breast examination

Techniques to adjust ORs:

- Logistic regression
- Mantel-Haenszel

Oral contraceptives and breast cancer
Results: adjusted ORs

Age at diagnosis or selection	Cases(%)		Controls(%)		OR(95% CI) (adjusted)
	N	% ever users	N	% ever users	
20-24	15	100.0	106	69.8	-
25-29	126	86.5	169	87.6	1.0 (0.5-2.1)
30-34	382	89.3	429	88.1	1.2 (0.7-1.8)
35-39	700	86.4	590	85.1	1.1 (0.8-1.6)
40-44	865	73.0	771	72.6	1.1 (0.9-1.4)
Total	2088	81.5	2065	80.5	

Oral contraceptives and breast cancer
Conclusions

There was no significant increase or decrease in the risk of breast cancer for OC users according to

- Age at diagnosis
- Age at first use
- Duration of use
- Use before first term pregnancy

Use of OCs by young women in the US has no effect on the risk of breast cancer before 45 years of age