A SYNERGISTIC EFFECT OF ASBESTOS AND SMOKING IN LUNG CANCER

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Overview

- **Introduction to asbestos**
  - Type → Chemical/physical properties
  - Found → place, product
  - Trends of asbestos use
- **Smoking prevalence**
- **Synergism asbestos exposure and cigarette smoke and developing lung cancer**
  - Objective
  - Research methodology
  - Results

Chrysotile
(white)

Asbestos

Crocidolite
(blue)

Armosite
(brown)

Serpentine

Type

chrysotile

Chemical formula

$Mg_3(Si_2O_5)(OH)_4$

amphibole

Type

amosite

crocidolite

actinolite

tremolite

anthophyllite

Chemical formula

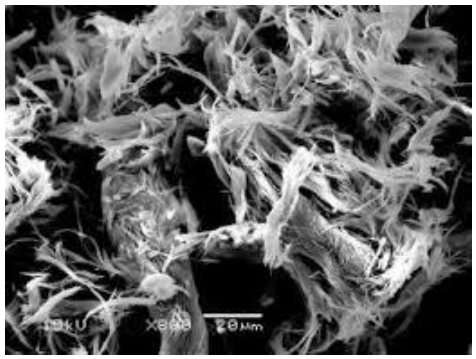
$Fe_7Si_8O_{22}(OH)_2$

$Ca_2(Mg, Fe)_5(Si_8O_{22})(OH)_2$

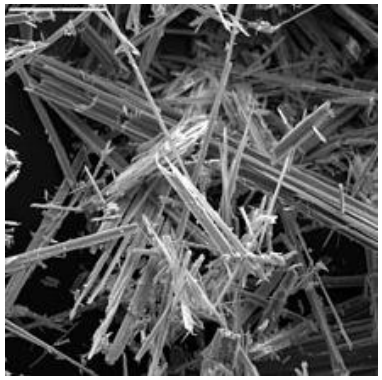
$Na_2Fe^{2+}{}_3Fe^{3+}{}_2Si_8O_{22}(OH)_2$

$Ca_2Mg_5Si_8O_{22}(OH)_2$

$(Mg, Fe)_7Si_8O_{22}(OH)_2$



Serpentine



Amphibole

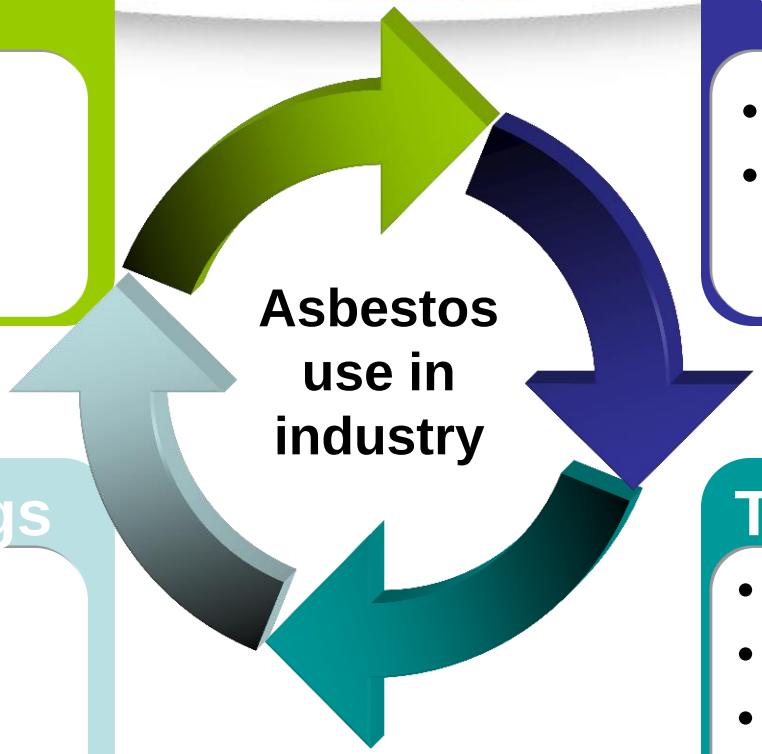
Asbestos use in industry

Buildings

- insulators
- pipes
- tiles
- roofs

Ship industry

- ship building
- shipyards



Break/linings

- break blocks
- lining
- gaskets

Textile industry

- blanket
- fire resistant
- insulating suit

Asbestos as carcinogen

Agents Classified by the *IARC Monographs*, Volumes 1–111

CAS No	Agent	Group	Volume	Year
000313-67-7	Aristolochic acid (NB: Overall evaluation upgraded to Group 1 based on mechanistic and other relevant data)	1	82, 100A	2012
000313-67-7	Aristolochic acid, plants containing	1	82, 100A	2012
007440-38-2	Arsenic and inorganic arsenic compounds	1	23, Sup 7, 100C	2012
064436-13-1	Arsenobetaine and other organic arsenic compounds that are not metabolized in humans	3	100C	2012
	Art glass, glass containers and pressed ware (manufacture of)	2A	58	1993
001332-21-4 013768-00-8 012172-73-5 017068-78-9 012001-29-5 012001-28-4 014567-73-8	Asbestos (all forms, including actinolite, amosite, anthophyllite, chrysotile, crocidolite, tremolite) (NB: Mineral substances (e.g. talc or vermiculite) that contain asbestos should also be regarded as *carcinogenic to humans*.)	1	14, Sup 7, 100C	2012
001912-24-9	Atrazine (NB: Overall evaluation downgraded to Group 3 with supporting evidence from other relevant data)	3	53, 73	1999

http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf

Smoking

- Compounds → Benzo(a)pyrene, PAHs, nicotine(addiction), benzene, cadmium, N-Nitrosamine Derivative
- Diseases → emphysema, COPD, heart diseases, cancers (lung, esophagus, pharynx, larynx)
- Secondhand smoke (also called environmental tobacco smoke, involuntary smoke, and passive smoke) is the smoke given off by a burning tobacco product and the smoke exhaled by a smoker.
- Secondhand smoke causes lung cancer in nonsmokers.

Smoking as carcinogen

Agents Classified by the *IARC Monographs*, Volumes 1–111

CAS No	Agent	Group	Volume	Year
000079-34-5	1,1,2,2-Tetrachloroethane	2B	20, Sup 7, 71, 106	2014
000127-18-4	Tetrachloroethylene (Perchloroethylene)	2A	Sup 7, 63, 106	2014
022248-79-9	Tetrachlorvinphos	3	30, Sup 7	1987
000116-14-3	Tetrafluoroethylene (NB: Overall evaluation upgraded to Group 2A)	2A	19, Sup 7, 71, 110	in prep
	Tetrakis(hydroxymethyl)phosphonium salts	3	48, 71	1999
000509-14-8	Tetranitromethane	2B	65	1996
	Textile manufacturing industry (work in)	2B	48	1990
000083-67-0	Theobromine	3	51	1991
000058-55-9	Theophylline	3	51	1991
000062-55-5	Thioacetamide	2B	7, Sup 7	1987
000139-65-1	4,4'-Thiodianiline	2B	27, Sup 7	1987
000052-24-4	Thiotepa	1	Sup 7, 50, 100A	2012
000141-90-2	Thiouracil	2B	Sup 7, 79	2001
000062-56-6	Thiourea	3	Sup 7, 79	2001
000137-26-8	Thiram	3	Sup 7, 53	1991
007440-29-1	Thorium-232 and its decay products	1	78, 100D	2012
013463-67-7	Titanium dioxide	2B	47, 93	2010
	Tobacco, smokeless	1	Sup 7, 89, 100E	2012
	Tobacco smoke, second-hand	1	83, 100E	2012
	Tobacco smoking	1	83, 100E	2012

http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf

- **Smoking is not causing of mesothelioma.**
- **Most lung cancer cases are exposed to asbestos and also smoking.**

Synergism between Asbestos and Smoking in Lung Cancer risk: A Systematic Review and Meta-analysis

Hypothesis

Co-exposure to asbestos and smoking will increase the risk of lung cancer in a synergistic interaction.

Objective of this study

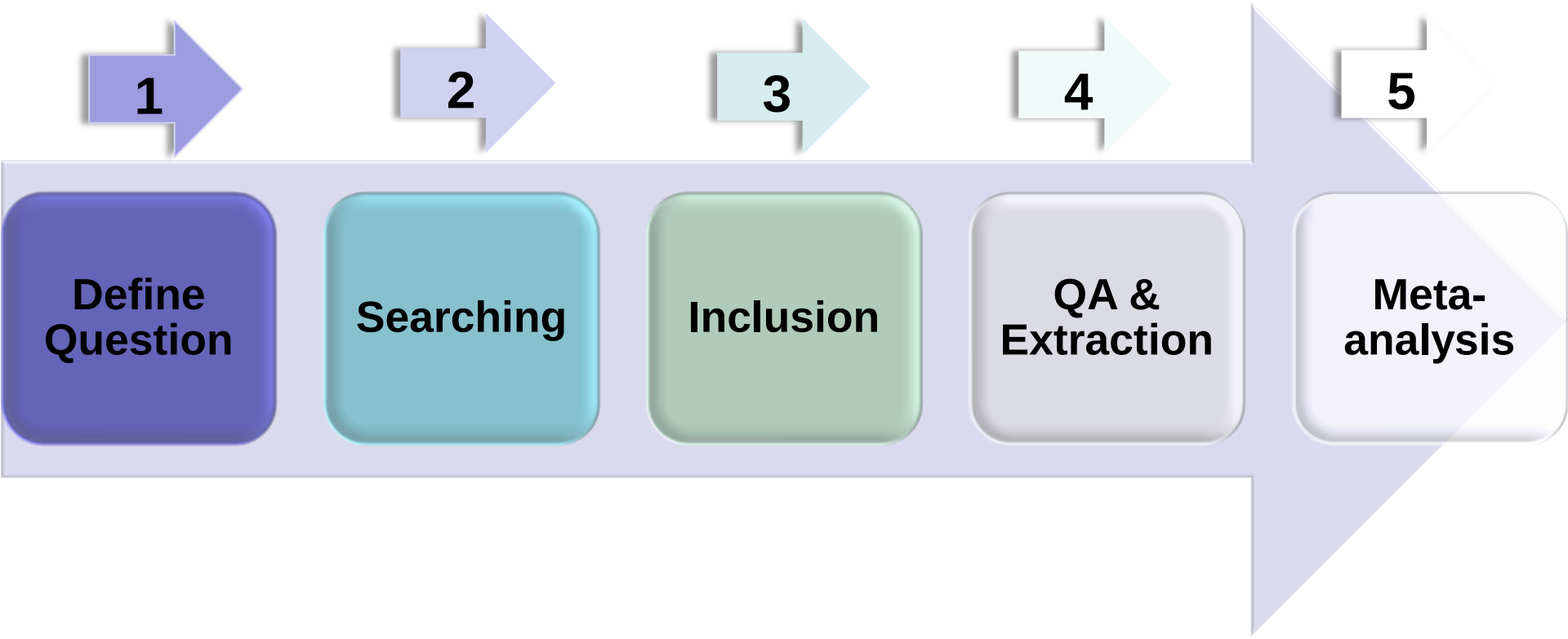
To reconcile and combine these results, we conducted a systematic review and meta-analysis to provide a quantitative estimate of the increased risk of lung cancer associated with asbestos exposure and cigarette smoking and to classify the interaction.

SYNERGISTIC EFFECT

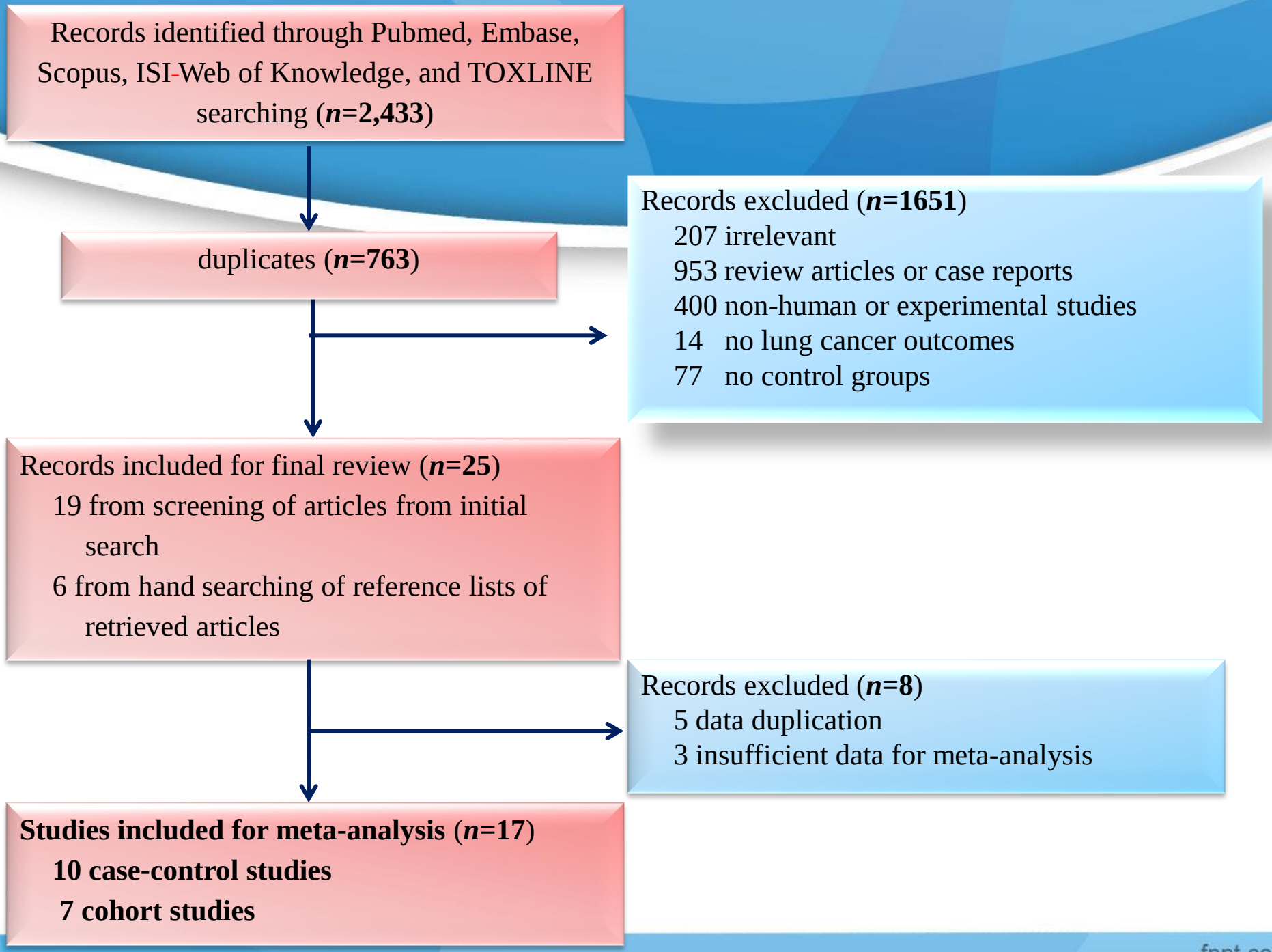
Synergistic effect or synergism or synergy

An effect arising between two or more agents, factors, or substances that produces an effect greater than the sum of their individual effects.

Research methodology



SEARCHING AND SELECTION METHOD


Records identified through Pubmed, Embase, Scopus, ISI-Web of Knowledge, and TOXLINE searching (*n*=2,433)
duplicates (*n*=763)
Records excluded (*n*=1651)
207 irrelevant
953 review articles or case reports
400 non-human or experimental studies
14 no lung cancer outcomes
77 no control groups
Records included for final review (*n*=25)
19 from screening of articles from initial search
6 from hand searching of reference lists of retrieved articles
Records excluded (*n*=8)
5 data duplication
3 insufficient data for meta-analysis
Studies included for meta-analysis (*n*=17)
10 case-control studies
7 cohort studies

Synergism between Asbestos and Smoking in Lung Cancer risk: A Systematic Review and Meta-analysis

- Searching and comprehensive review (5 databases)
- Observational studies on asbestos exposure and cigarette smoking are developed lung cancer
- Found 10 case-control studies and 7 cohort studies were met criteria

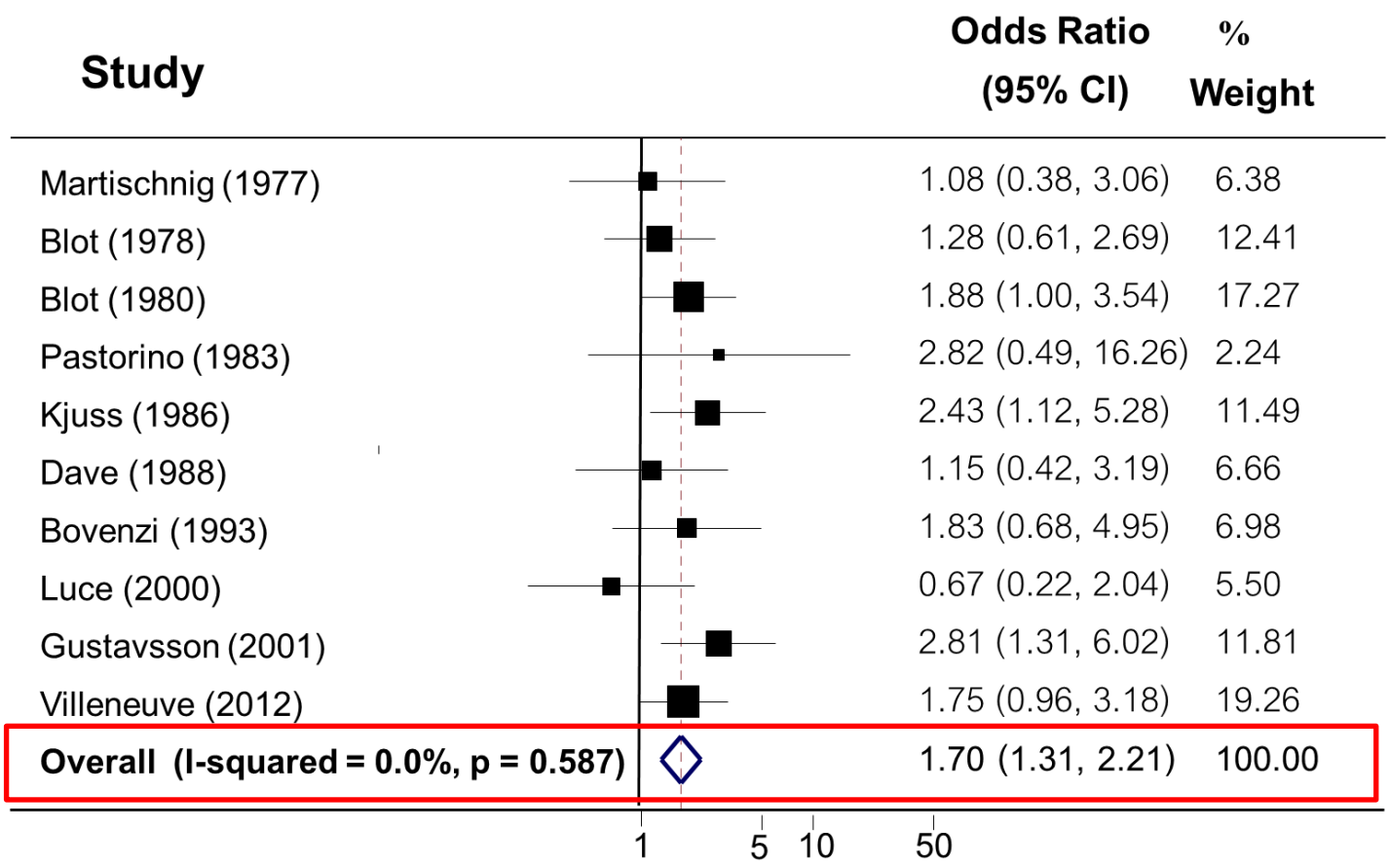
Classification of exposure

Subjects were characterized into four groups:

- non-exposure to asbestos and non-smoking (A-S-),
- asbestos-exposed and non-smoking (A+S-),
- non-exposed asbestos and smoking (A-S+), and
- asbestos-exposed and smoking (A+S+)

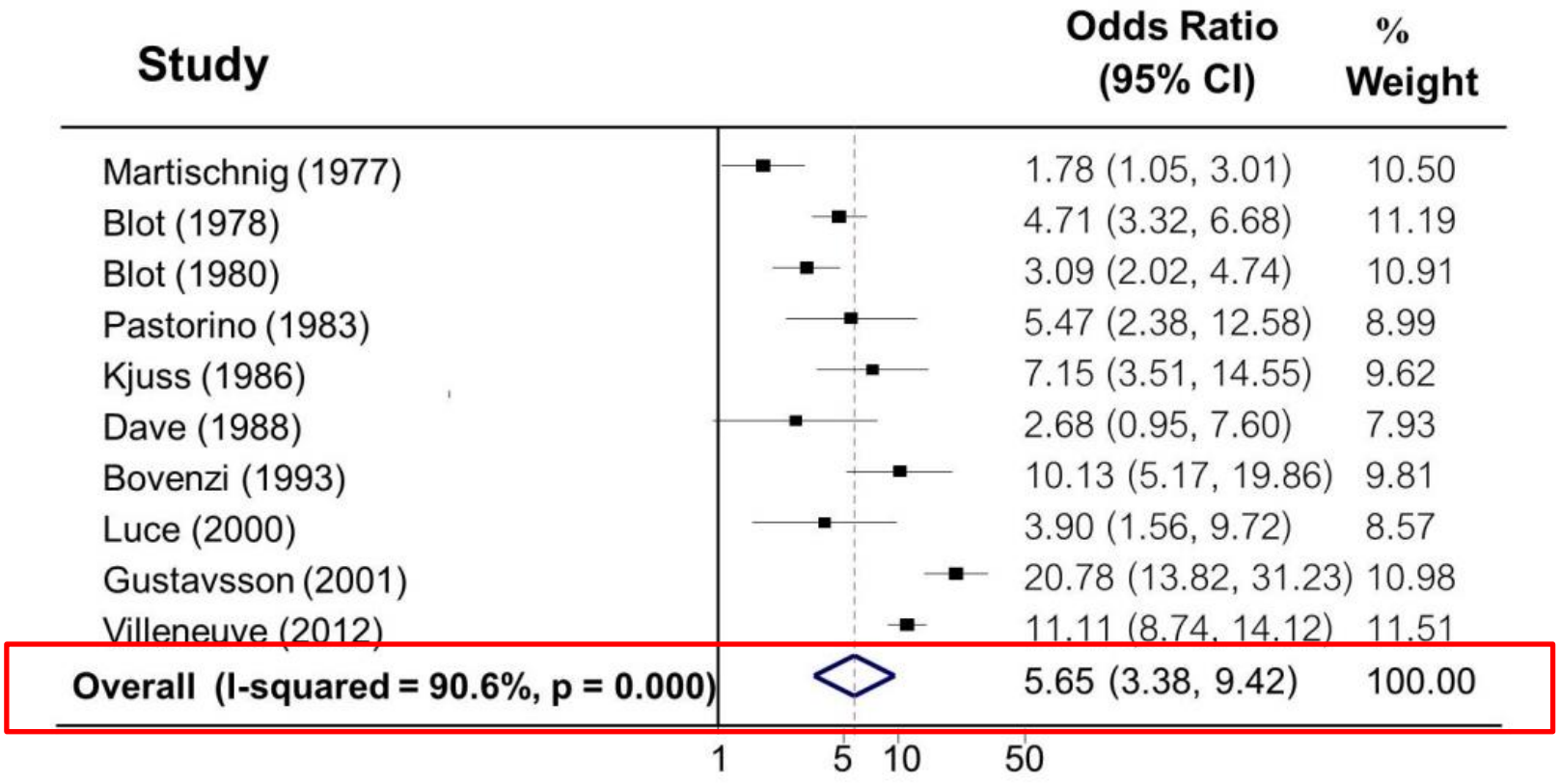
Asbestos and lung cancer risk:

Case-control studies



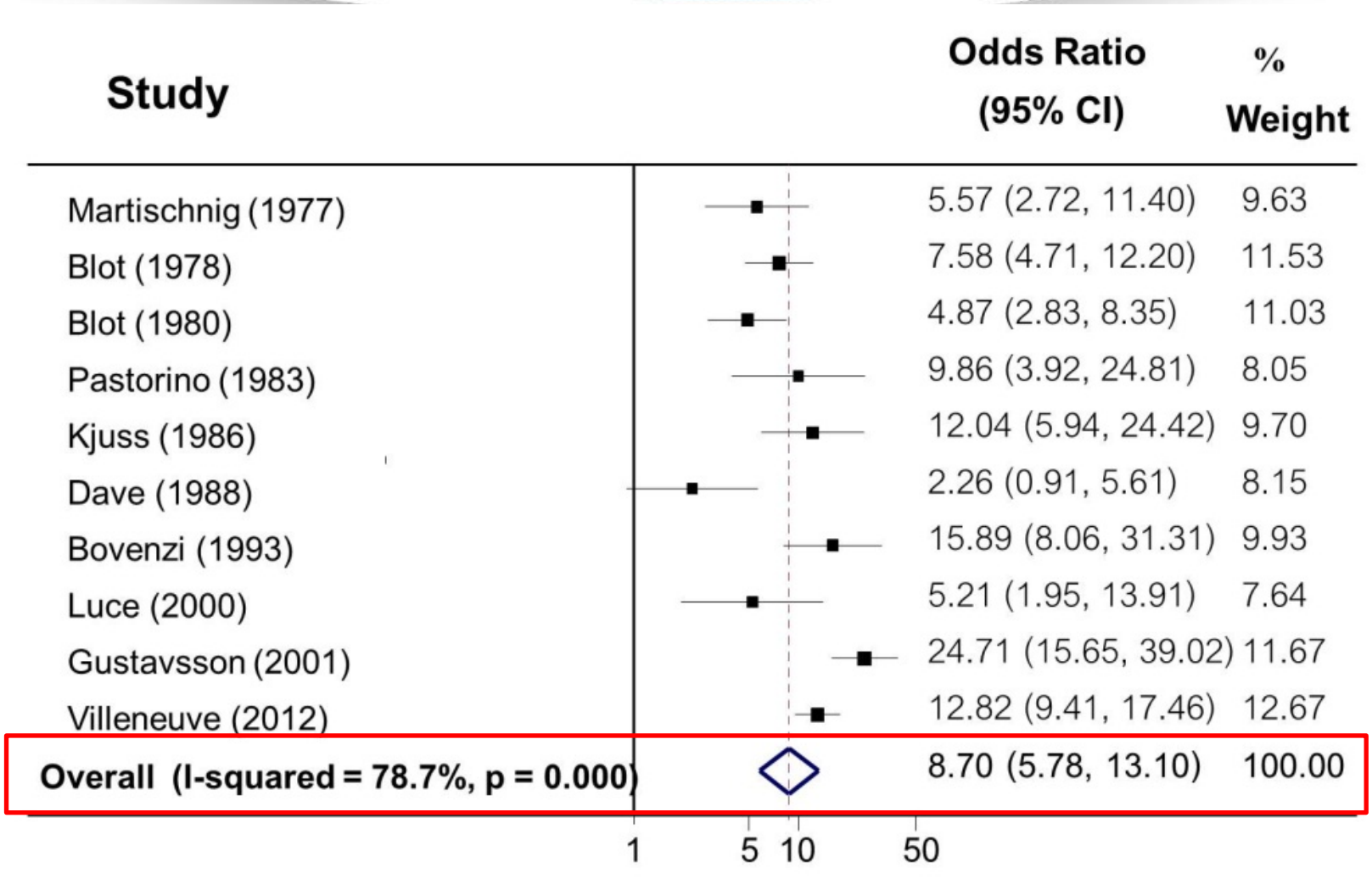
Cigarette smoking and lung cancer risk:

Case-control studies



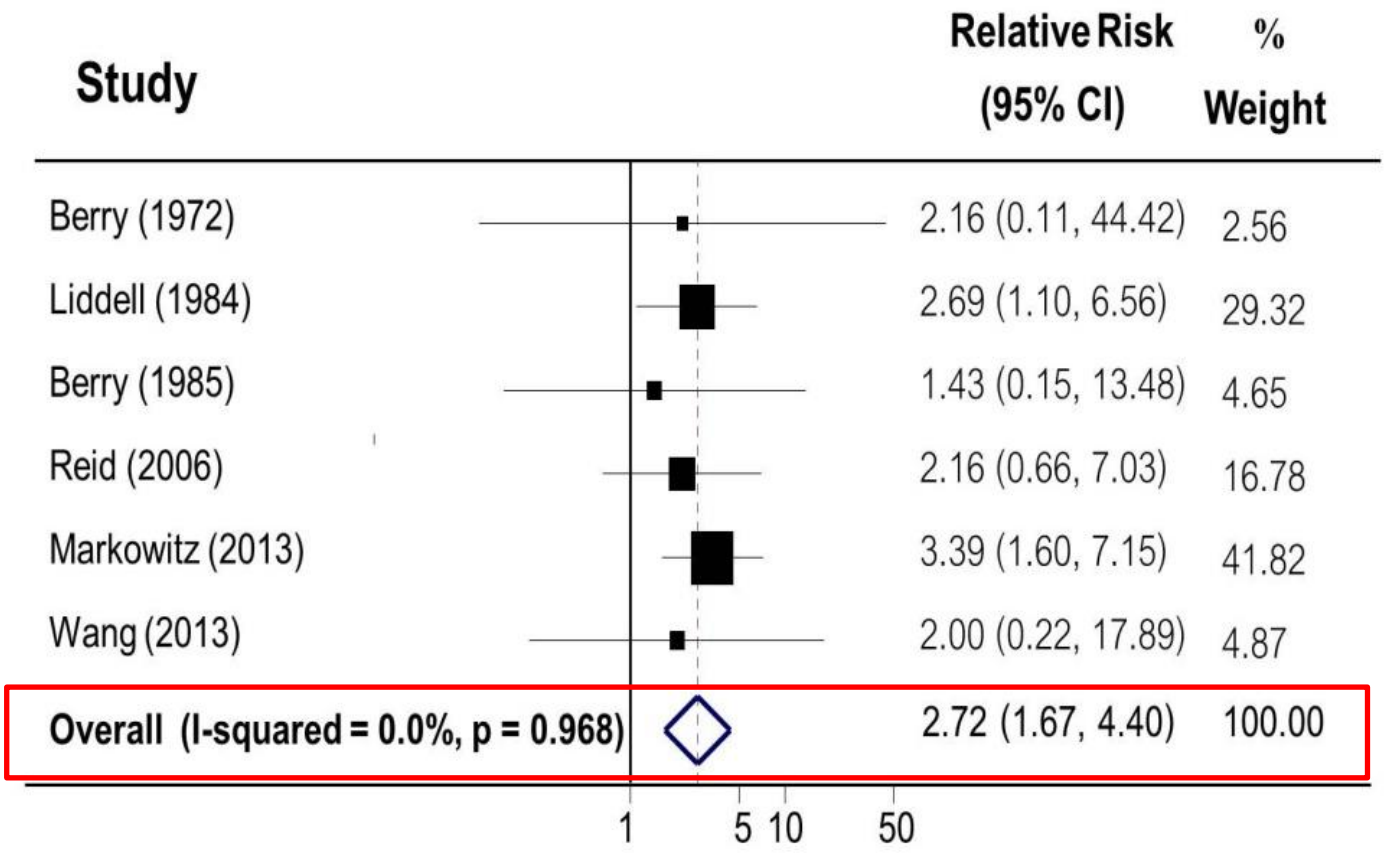
Asbestos and smoking on lung cancer risk:

Case-control studies



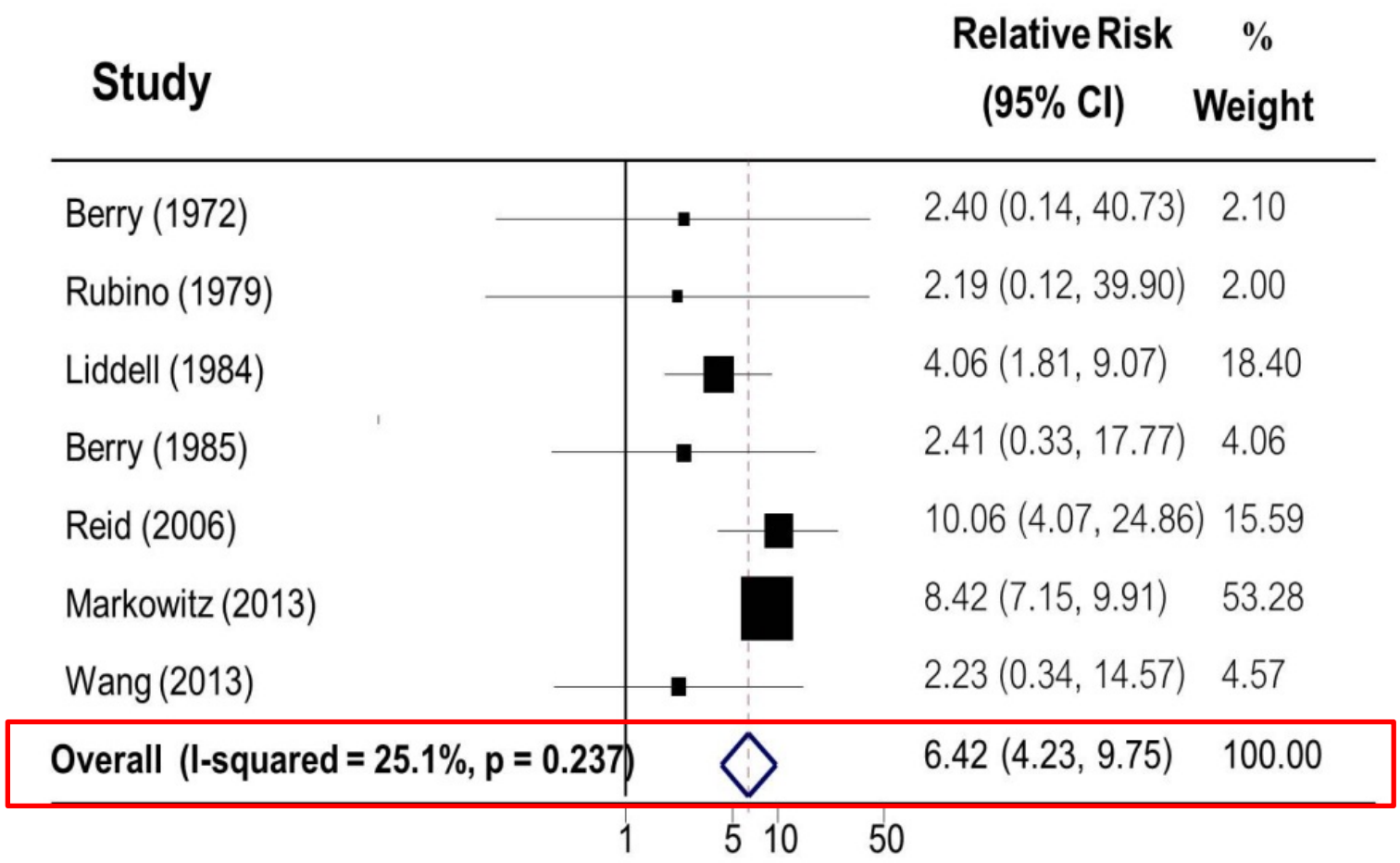
Asbestos and lung cancer risk:

Cohort studies



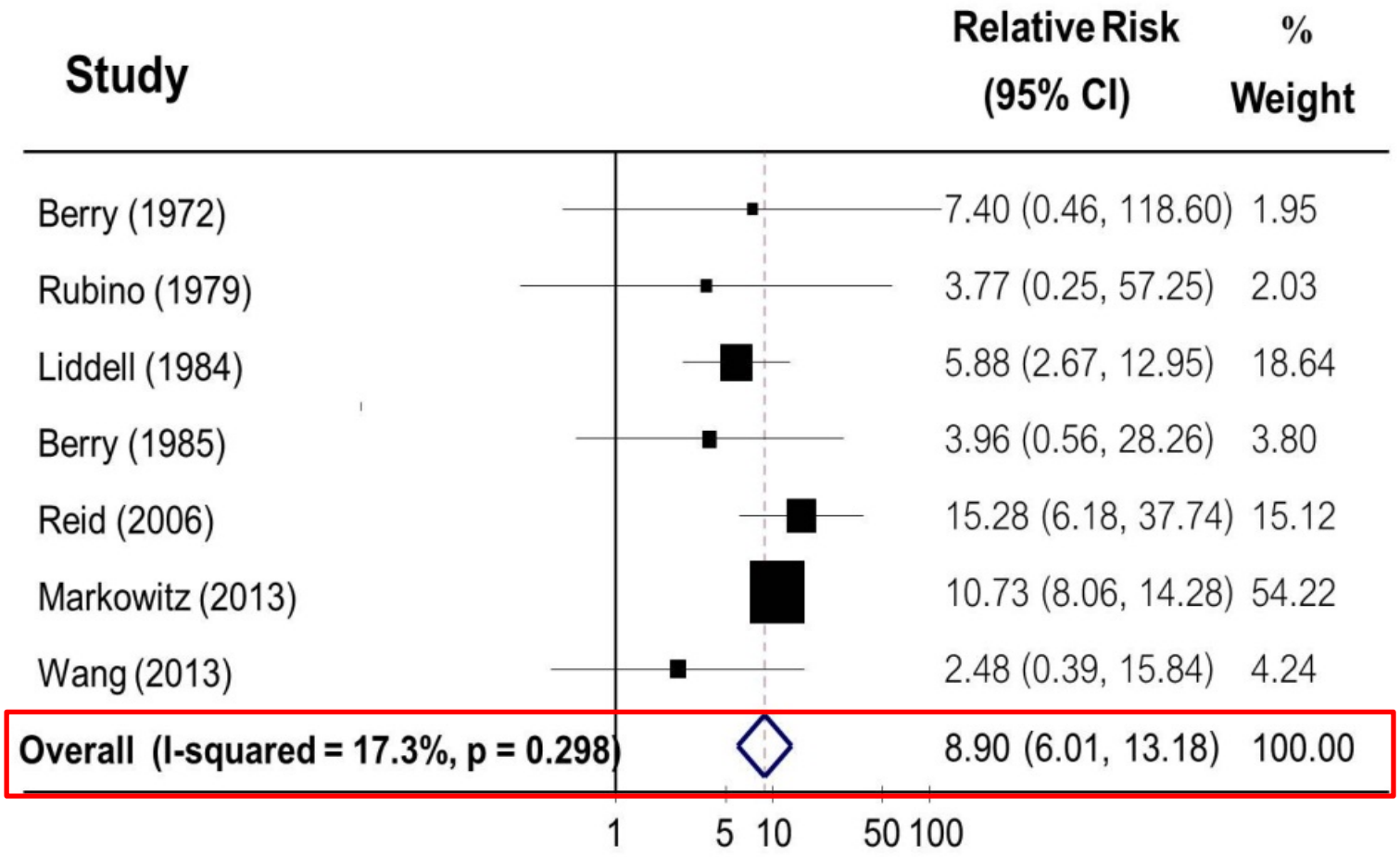
Cigarette smoking and lung cancer risk:

Cohort studies

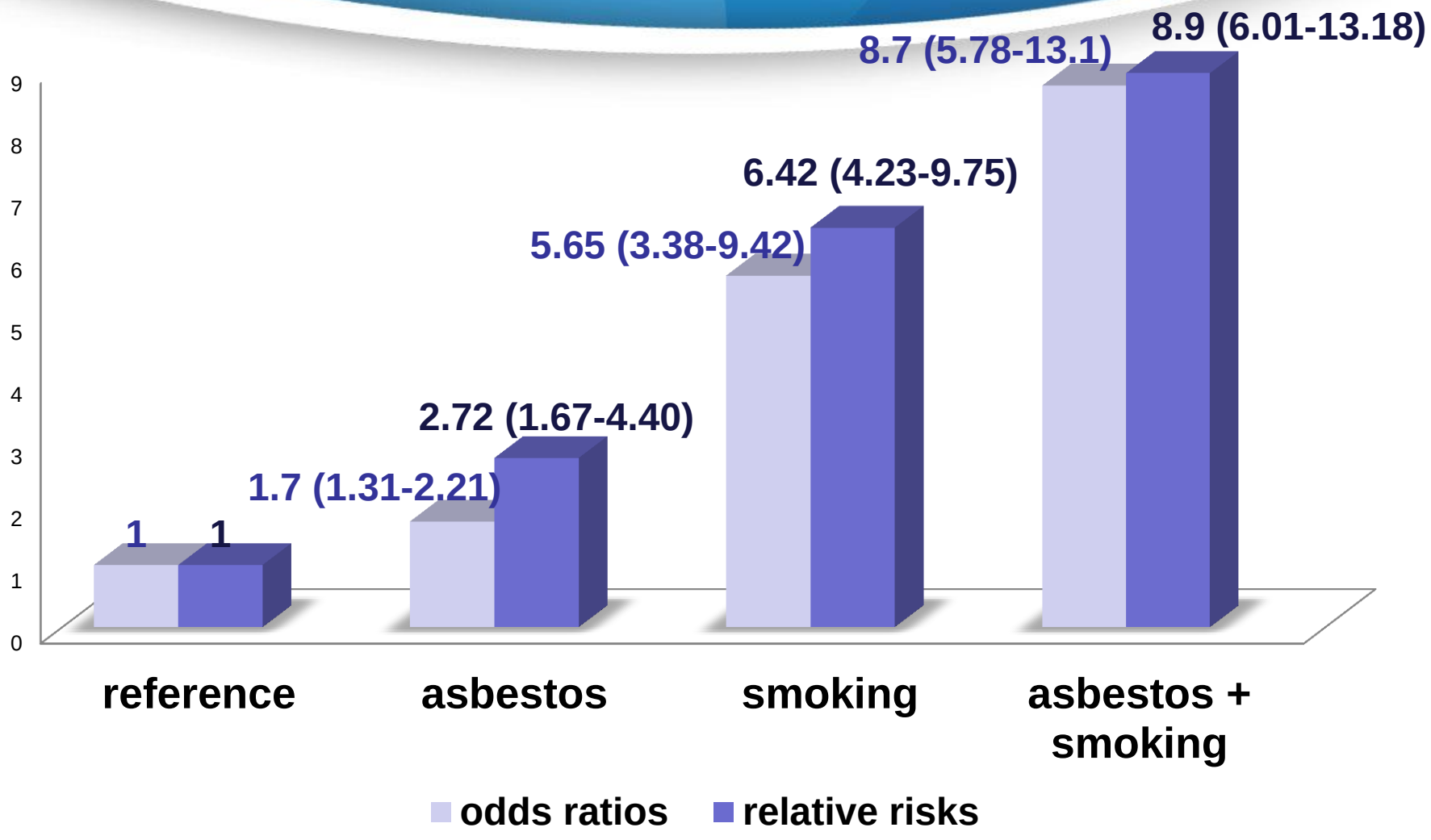


Asbestos and smoking on lung cancer risk:

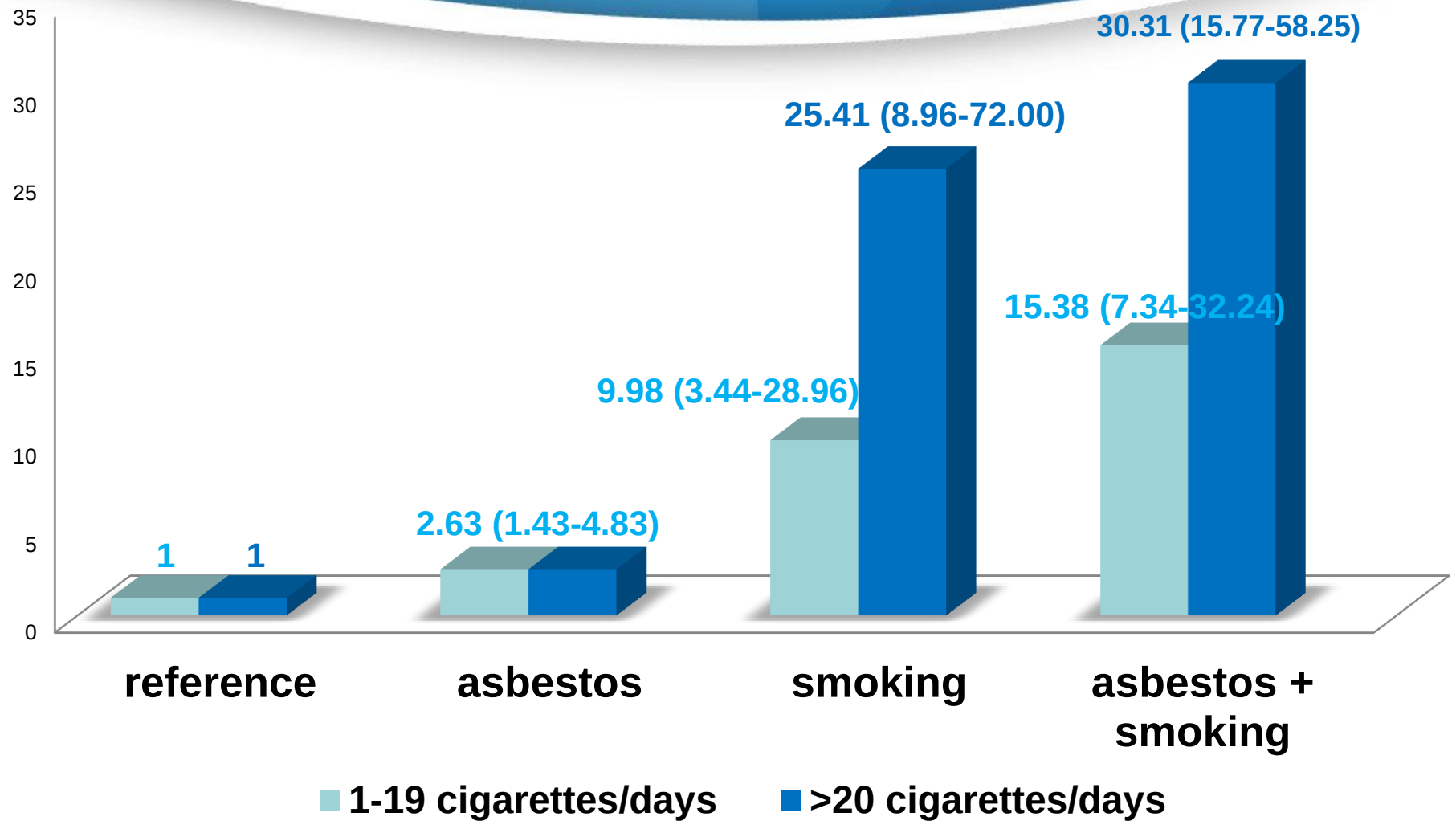
Cohort studies



Interaction between exposure to asbestos and smoking



Cigarette smoking status in asbestos-workers



Conclusion

- The results show a synergism between asbestos exposure and cigarette smoking in workers developing lung cancer.
- Employees exposed to asbestos and having a history of smoking have a higher risk of developing lung cancer than those only exposed to one risk (either smoking or asbestos alone).

Limitations

- Some observational studies did not report the types of asbestos.
- The methods used to quantitate exposures to asbestos and cigarette smoke were varied across studies.

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