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Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis

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Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis

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  Smith, J. D., MacDougall, C. C., Johnstone, J., Copes, R. A., Schwartz, B., & Garber, G. E. ***(2016)***
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  4/154 Medicine, General & Internal

Background

- Personal Protective Equipment (PPE)
  - The use of a **surgical mask**, **eye protection**, **gown** and **gloves** should be considered when providing routine care for a patient with a transmissible acute respiratory infection.
- Conflicting recommendations exist related to which facial protection should be used by health care workers to prevent transmission of acute respiratory infections.

Endpoints

- **Primary outcome**

  Laboratory-confirmed respiratory infection: respiratory infections diagnosed by means of PCR, serology, respiratory virus culture and Bordetella pertussis bacterial culture

- **Secondary outcomes**

  Influenza-like illness, and workplace absenteeism due to hospital-acquired respiratory infections.

- The outcomes extracted from surrogate exposure studies were filter penetration, face-seal leakage and total inward leakage.

步驟1　研究探討的問題為何？

研究族群 (P)	Health care workers
介入措施 (I)	N95 respirators
比較 (C)	Surgical masks
結果 (O)	The efficiency of preventing transmissible acute respiratory infections in clinical settings

(治療型PICO)

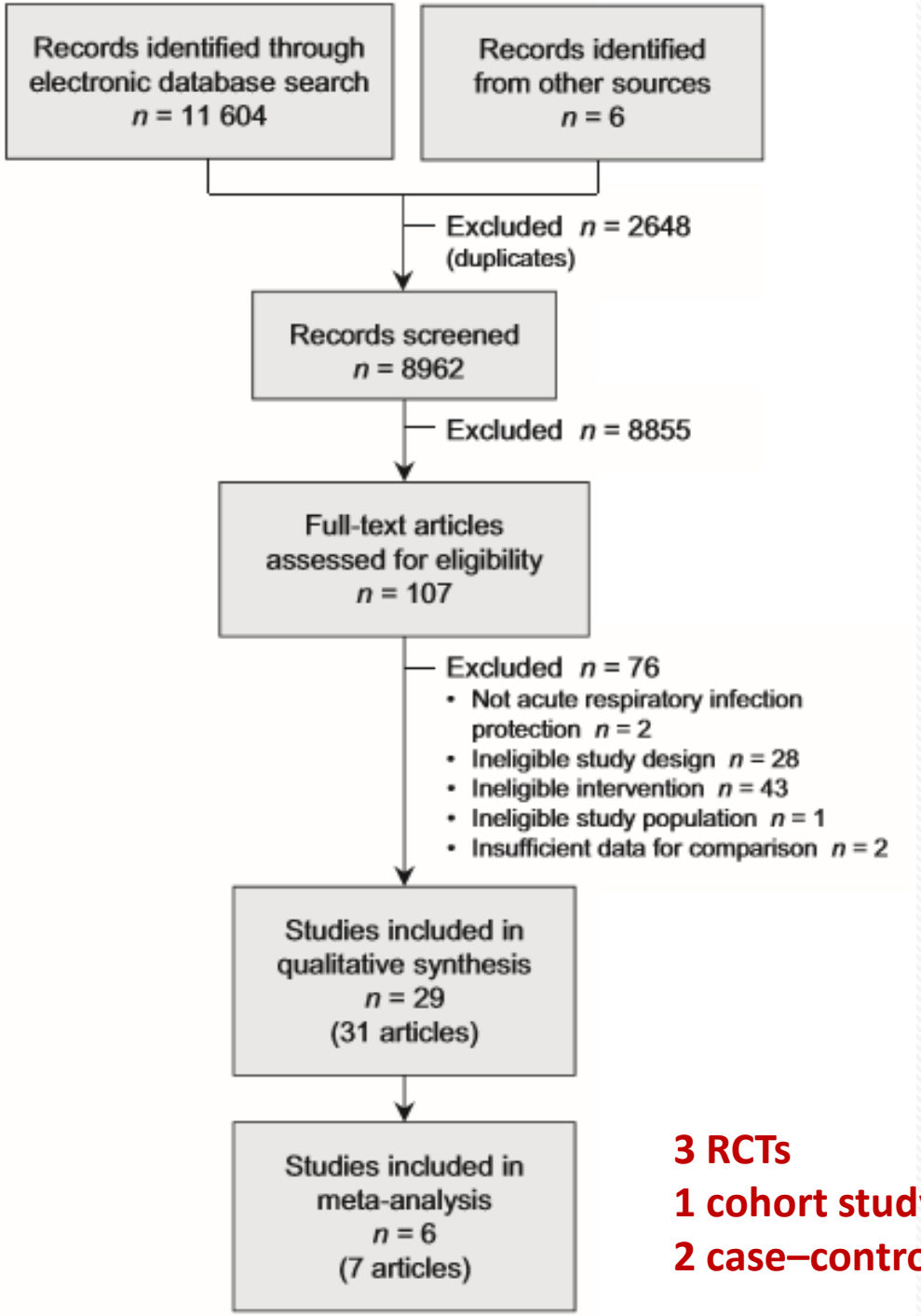
步驟2 系統性文獻回顧的品質如何？(FAITH)

Find－研究是否找到所有的相關證據

良好的文獻搜尋至少應包括二個主要的資料庫，並且加上文獻引用檢索(參考文獻中相 關研究、Web of Science, Scopus 或 Google Scholar)、試驗登錄資料等。文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及一般檢索詞彙(text words)。

We searched MEDLINE, Embase, the Database of Abstracts of Reviews of Effects, the Cochrane Central Register of Controlled Trials, the Cochrane Database of Systematic Reviews, Health Technology Assessment, the Collective Index of Nursing and Allied Health Literature, PsycINFO and Scopus for pertinent **English language** studies published from Jan. 1, 1990, to Dec. 9, 2014.

評讀結果： □是✓否□不清楚



3 RCTs
1 cohort study
2 case–control studies

Appraisal－文獻是否經過嚴格評讀

應根據不同臨床問題的文章類型，選擇適合的評讀工具，並說明每篇研究的品質(如針對治療型的臨床問題，選用隨機分配、盲法、及完整追蹤的研究類型)

- Randomized controlled trials were explicitly assessed for bias according to the Cochrane risk of-bias tool.
- Cohort and case–control studies were assessed for risk of design-specific bias using the relevant Newcastle–Ottawa Scale

評讀結果：✓是□ 否□不清楚

Included－是否只納入具良好效度的文章

僅進行文獻判讀是不足夠，系統性文獻回顧只納入至少要有一項研究結果是極小偏誤的試驗。

S12 Table. Newcastle-Ottawa Scale summary of risk of bias for cohort and case-control studies[20]

Study	Selection				Comparability	Exposure/Outcome		
Cohort								
Loeb 2004[21]		*	*	*		*	*	*
Case-Control								
Seto 2003[22]			*	*			*	
Zhang 2013[23]		*	*	*	**		*	

S13 Table. GRADE quality of evidence summary[1]

Quality assessment							№ of patients*		Effect		Quality	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	N95 respirators	surgical masks	Relative (95% CI)	Absolute (95% CI)		
Laboratory-confirmed respiratory infection (follow up: mean 5 weeks; assessed with: PCR, serology, and culture.)												
3	randomized trials	serious [1,2,3]	not serious	not serious	serious [4,5]	none	94/1349 (7·0%)	84/805 (10·4%)	OR 0·89 (0·64 to 1·24)	10 fewer per 1000 (from 22 more to 35 fewer	⊕⊕◯◯ LOW	CRITICAL
Laboratory-confirmed respiratory infection (Cohort) (assessed with: Case definitions and serology)												
1	observational studies	serious [6,7]	not serious [8]	not serious	serious [4,5]	none	2/16 (12·5%)	1/4 (25·0%)	OR 0·43 (0·03 to 6·41)	125 fewer per 1000 (from 240 fewer to 431 more	⊕◯◯◯ VERY LOW	IMPORTANT
Laboratory-confirmed respiratory infection (Case-control) (assessed with: PCR)												
2	observational studies	very serious [9,10]	not serious	not serious	serious [4,5]	none	40 cases 302 controls		OR 0·91 (0·25 to 3·36)	-	⊕◯◯◯ VERY LOW	IMPORTANT

評讀結果： □是✓否□不清楚

Total up－作者是否以表格和圖表「總結」試驗結果

應該用至少 1 個摘要表格呈現所納入的試驗結果。若結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析

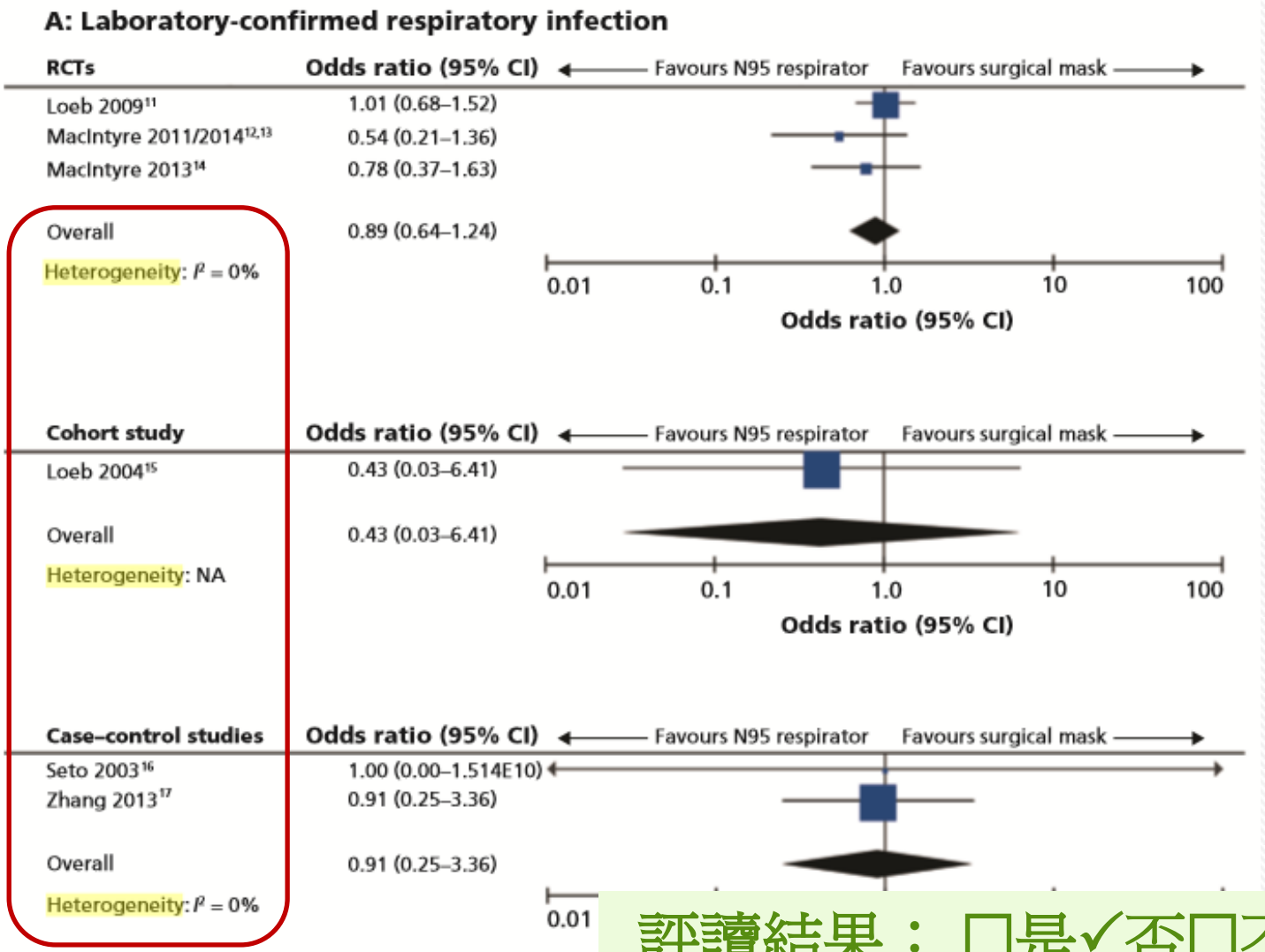
Table 1: Characteristics of studies included in the meta-analysis[11–17]

Study	Setting	Participants	Outcomes	Interventions	Notes
Randomized controlled trials					
Loeb et al., 2009[11]	8 hospitals in Ontario, Canada: emergency departments, acute medical units and pediatric units	446 nurses; individual-level randomization	• Laboratory-confirmed respiratory infection, influenza-like illness, workplace absenteeism • 5-wk follow-up	• Intervention: targeted use, fit-tested N95 respirator • Control: targeted use, surgical mask	• Noninferiority trial • Detection of influenza A and B, respiratory syncytial virus metapneumovirus, parainfluenza virus, rhinovirus–enterovirus, coronavirus and adenovirus
MacIntyre et al., 2011/2014[12,13]	15 hospitals in Beijing: emergency departments and respiratory wards	1441 nurses, doctors and ward clerks; cluster randomization by hospital	• Laboratory-confirmed respiratory infection, influenza-like illness • 5-wk follow-up	• Intervention 1: continual use, fit-tested N95 respirator • Intervention 2: continual use, non–fit-tested N95 respirator • Control: continual use, surgical mask	Detection of influenza A and B, respiratory syncytial virus metapneumovirus, parainfluenza virus, rhinovirus–enterovirus, coronavirus, adenovirus, *Streptococcus pneumoniae*, *Bordetella pertussis*, *Chlamydophila pneumoniae*, *Mycoplasma pneumoniae* and *Haemophilus influenzae* type B
MacIntyre et al., 2013[14]	19 hospitals in Beijing: emergency departments and respiratory wards	1669 nurses, doctors and ward clerks; cluster randomization by ward	• Laboratory-confirmed respiratory infection, influenza-like illness • 5-wk follow-up	• Intervention 1: continual use, fit-tested N95 respirator • Intervention 2: targeted use, fit-tested N95 respirator • Control: continual use, surgical mask	Detection of influenza A and B, respiratory syncytial virus metapneumovirus, parainfluenza virus, rhinovirus–enterovirus, coronavirus, adenovirus, *S. pneumoniae*, *B. pertussis*, *C. pneumoniae*, *M. pneumoniae* and *H. influenzae* type B

評讀結果：✓是□ 否□不清楚

Heterogeneity異質性－試驗的結果是否相近

在理想情況下，各個試驗的結果應相近或具同質性，若具有異質性，作者應評估差異是否顯著(卡方檢定)。根據每篇個別研究中不同的**PICO**及研究方法，探討造成異質性的原因。



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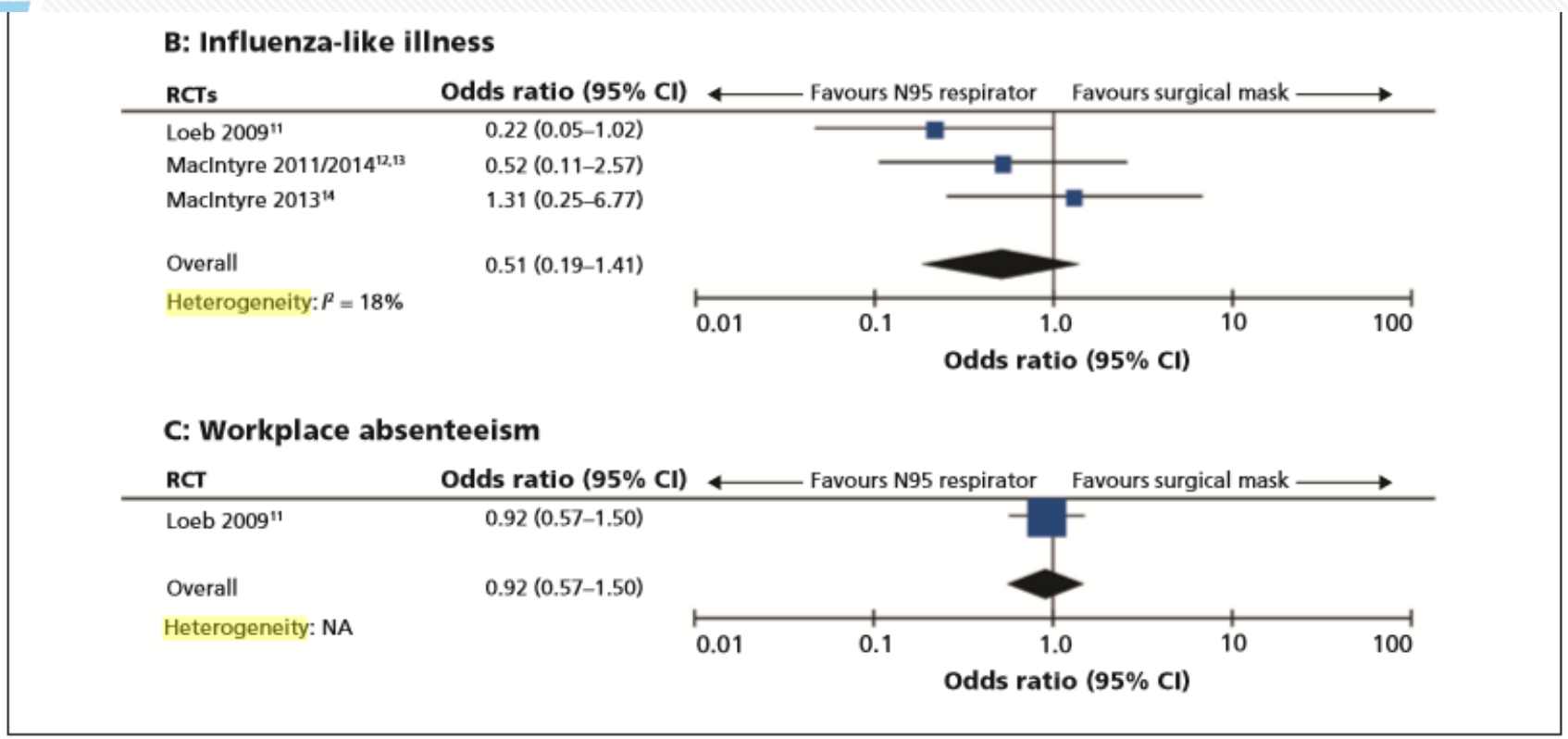

Figure 2: Results of meta-analysis to determine effectiveness of N95 respirators versus surgical masks in protecting health care workers against acute respiratory infection. Outcomes were (A) laboratory-confirmed respiratory infection, (B) influenza-like illness and (C) workplace absenteeism. Values less than 1.0 favour N95 respirator. CI = confidence interval, NA = not applicable, RCT = randomized controlled trial.

結果爲何？
使用何種評估方式，療效有多大（是否來自隨機效果）？

- In the meta-analysis of the clinical studies, no significant difference between N95 respirators and surgical masks in associated risk of
  - (a) laboratory-confirmed respiratory;
  - (b) influenza-like illness; or
  - (c) reported workplace absenteeism.
- In the surrogate exposure studies, N95 respirators were associated with less filter penetration, less face-seal leakage and less total inward leakage under laboratory experimental conditions, compared with surgical masks.

Cochrane Library

Cochrane Database of Systematic Reviews

Results

- Simple surgical masks were non-inferior to N95 respirators.
- N95 respirators are more expensive, uncomfortable and irritating to skin.

Physical interventions to interrupt or reduce the spread of respiratory viruses (Review)

Jefferson T, Del Mar CB, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, van Driel ML, Nair S, Jones MA, Thorning S, Conly JM

2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

Respiratory protection

- Respiratory protection currently requires the use of a respirator with N95 or higher filtration to prevent inhalation of infectious particles.
- Two mask types are available for use in healthcare settings: surgical masks that are cleared by the FDA and required to have fluid-resistant properties, and procedure or isolation masks. No studies have been published that compare mask types to determine whether one mask type provides better protection than another.

討論

照護急性呼吸道感染病人是否僅須戴外科口罩即可?

不同意 6票

不同意 25票

同意 19票


thank you
thank you
thank you