



Cochrane Work

The Best Evidence in Occupational Safety and Health



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Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel

Consol Serra

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From research to practice...

How do the results of research find their way into practice?

- One study does not make summer
- Replication research needed
- Research synthesis needed: Systematic Reviews
- **Systematic Reviews** should underpin practice and not single studies



Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

Summary

There is increasing concern that most

factors that influence this problem and some corollaries thereof.

Modeling the Frequency of False

is characteristic of the field and can vary a lot depending on whether the field targets highly likely relationships

Systematic Reviews: one important step from research to practice

- **Push research into practice**

with evidence-based...

- ✓ ... guidelines
- ✓ ... training and education
- ✓ ... OSH Law and OSH policy (Ministry)
- ✓ ... Social Partners (Unions, Employers)
- ✓ ... University Incentives



SR2P

- **Pull research into practice**

Occupational Health Services / Hospital Hygiene could be...

- ✓ ... evidence-based
- ✓ ... guideline based
- ✓ ... high professional standards
- ✓ ... beneficial review results

Percutaneous exposure injuries in health care workers

Sharp needles or instruments, and splashes

- Risk of infection:

HIV = 0.32%

HCV = 0.42%

HBV = 25%



Chronic disease, cancer, death

- Anxiety
- Absenteeism, morbidity, mortality
- Patient's quality of care and safety
- Economic burden
- **Multifactorial:** devices and procedures, personal protective equipment (PPE), inexperience, lack of training, management of sharps, safety climate, high workload and fatigue, etc.



How to prevent percutaneous exposure injuries?

- Safe devices
- Double gloves
- Blunt needles
- Education and training
- Safe working practices



Double gloves to prevent percutaneous exposure injuries: the best available evidence today

Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel (Review)

Mischke C, Verbeek JH, Saarto A, Lavoie MC, Pahwa M, Ijaz S

[Cochrane Work](#) + [Finnish Institute of Occupational Health](#) +
[University of Maryland Baltimore](#) + [University of Toronto](#)



**THE COCHRANE
COLLABORATION®**

**Cochrane Database of Systematic Reviews 2014,
Issue 3**

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2014, Issue 3

<http://www.thecochranelibrary.com>

34 RCTs published from 1990 to 2007

6.890 person-operations, 46 intervention-control groups comparisons

Participants, all HCW in surgery:

- surgeons (34), also nurses or other (27)
- obstetr, orthop, abdominal (26), dentistry (6)

Interventions (gloves):

- increased layers of standard gloves: double (17), triple (1)
- special protective material or thicker (14)
- with indicator systems (6)

Exposure to contaminated body fluids:

- glove perforations (innermost or matched) (33)
- blood stains in the skin (7)
- self-reported needlestick injuries (2)

Dexterity:

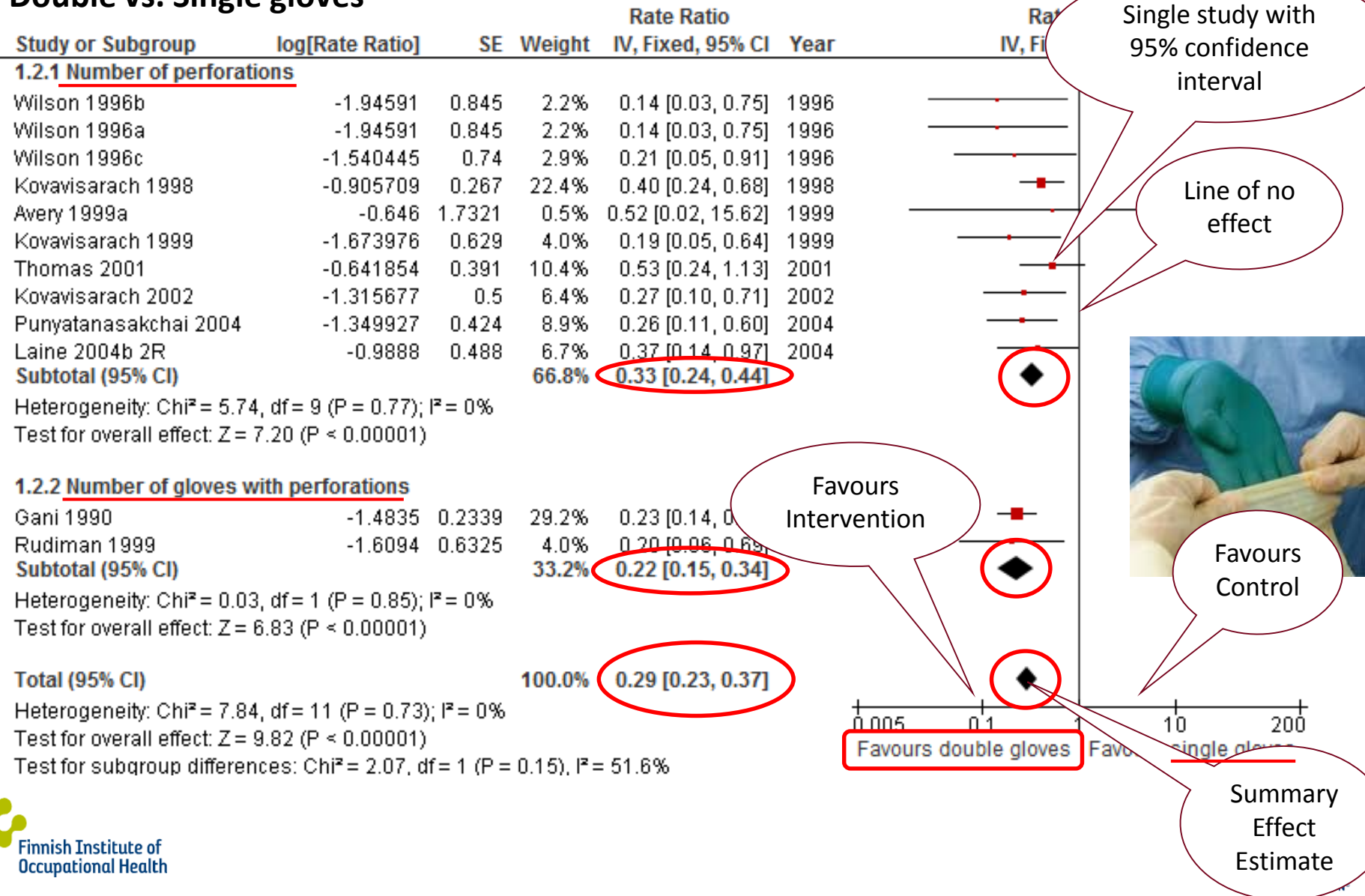
- outer glove perforation (13)

Quality, GRADE: moderate to low



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

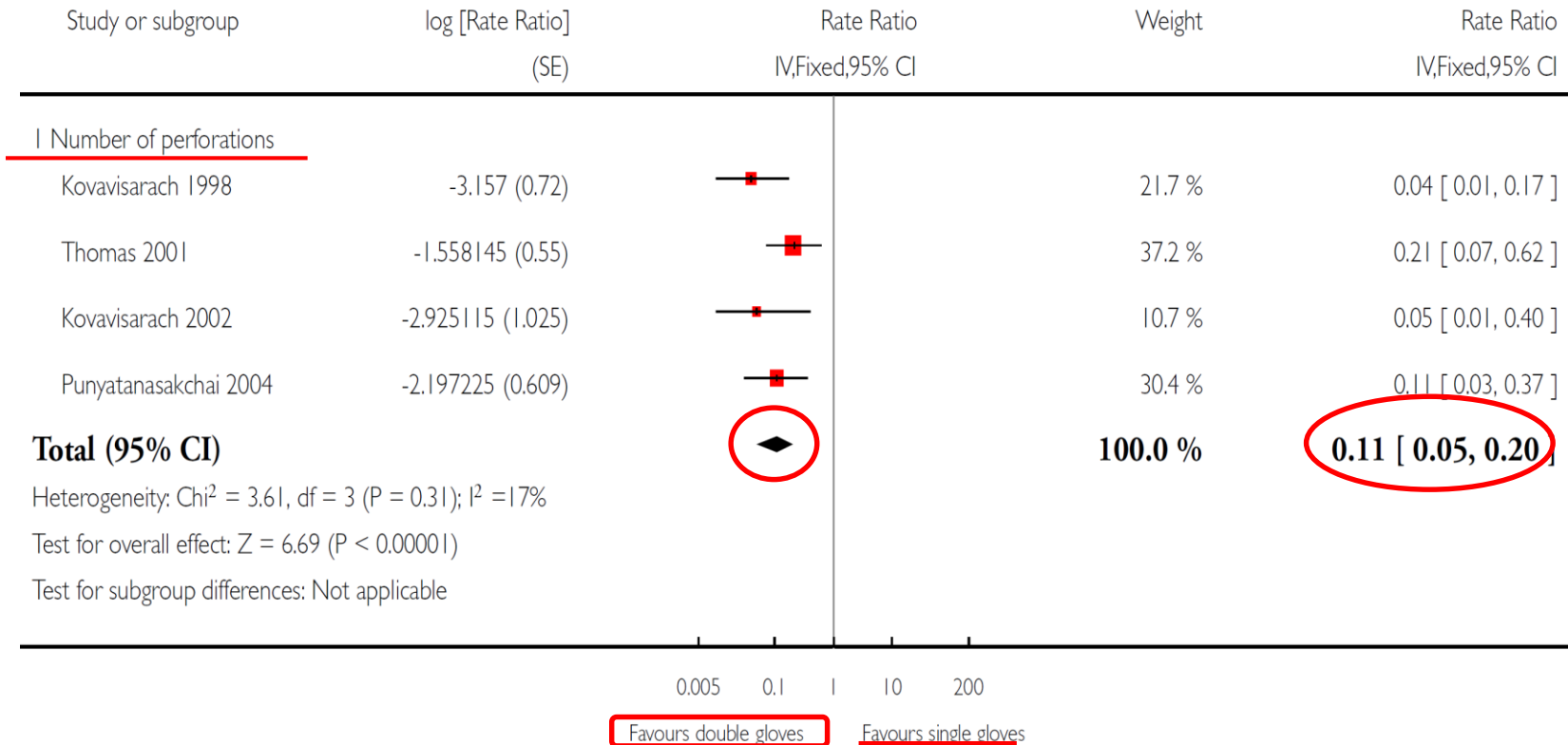
Double vs. Single gloves



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

Double vs. Single gloves

Outcome: matched inner glove perforations



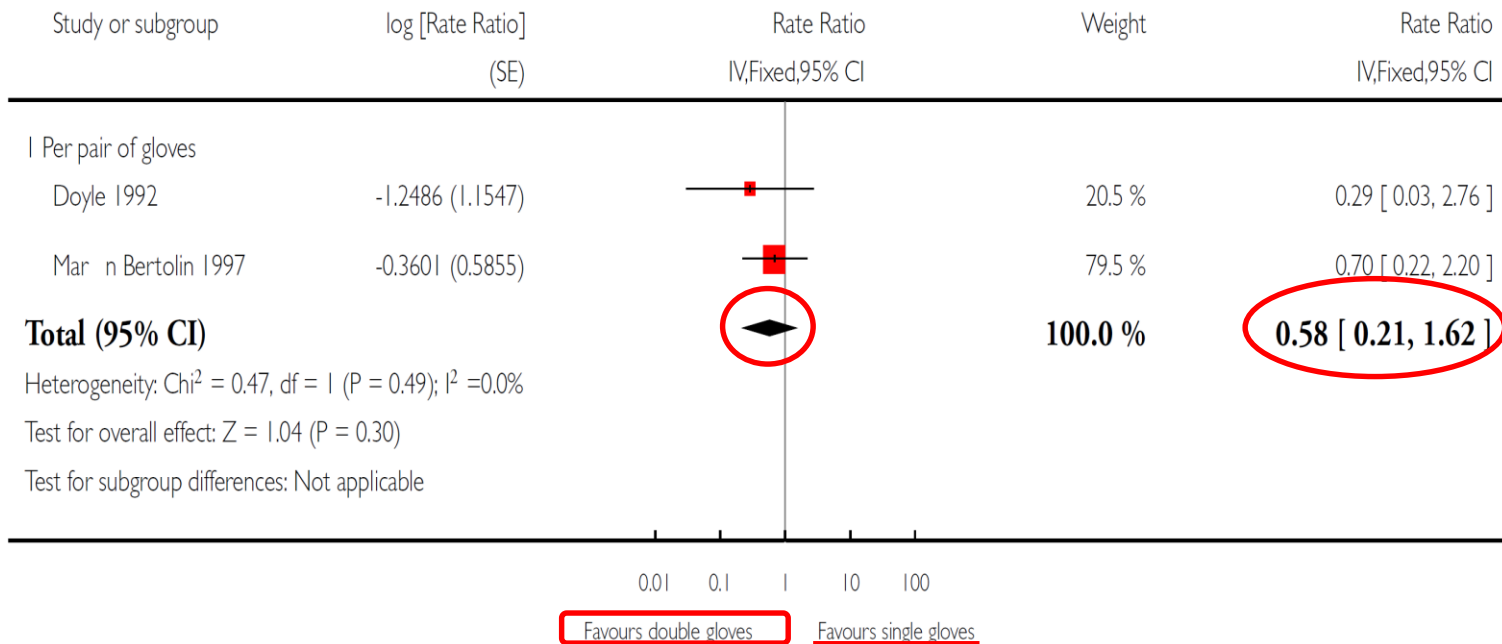
• Blood stains in the skin: **0.35 [0.17, 0.70]**

Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

Double vs. Single gloves

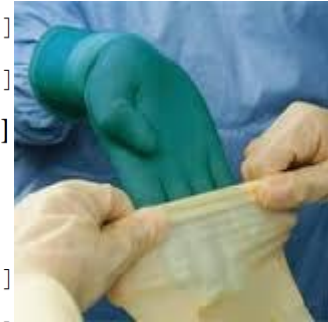
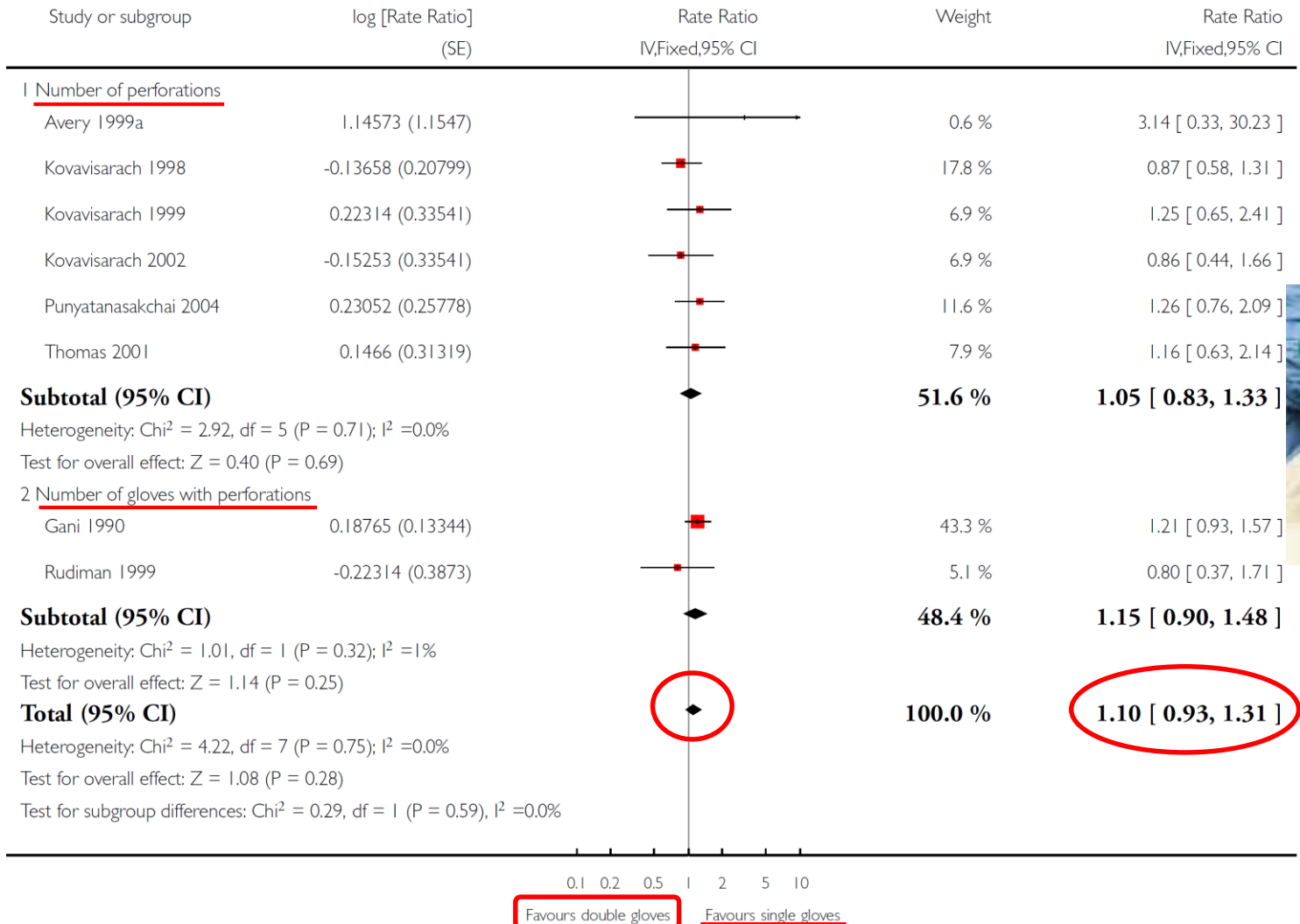
Outcome: Needlestick injuries

Self-reporting bias



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

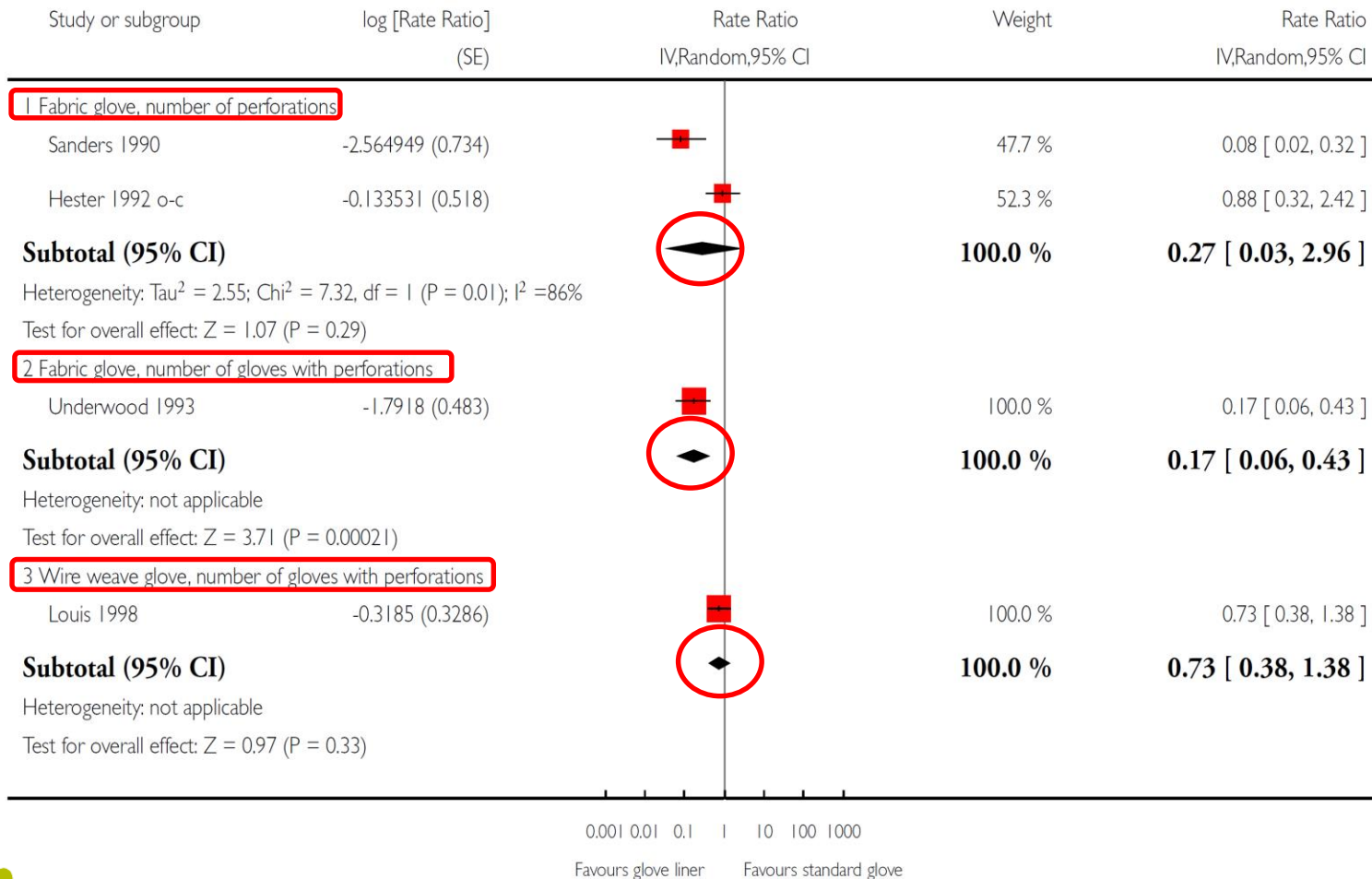
Dexterity: outer gloves perforation



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

Double special vs. double standard glove

Outcome: Inner glove perforation



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

What is clear from this review !

- The prevention of percutaneous exposure incidents can be **successfully achieved** with an increase in the number of glove layers.
- This does not depend on the exposure prevalence.
- No serious impairment of **dexterity** from double gloving.
- **No further studies** are needed to show the preventive effect of **double gloving** during **surgery**.



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

What is less clear from this review ...

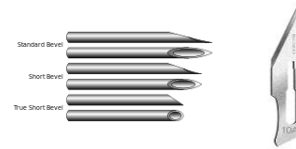
- The preventive effect could be increased when using **more than two layers**: only one study testing 3 vs. 2 layers (RR 0.03; 95%CI 0.00-0.52).
- It could also be increased when using **special material** gloves, such as fabric, Kevlar, steel, spectra polyethylene fiber
 - ... however it is difficult to say which type of special material glove is the best.
 - ... and dexterity could be seriously impaired.
- Double indicator gloves may have a preventive effect.
- Increasing the **thickness** of gloves does not seem to have an effect.



Double gloves to prevent percutaneous exposure injuries, Mischke et al 2014

What does NOT tell us about ...

- The use of gloves or the effect of extra gloves **for other tasks** (i.e. blood collection) than surgery.
- Other than suture needles (50%): hollow-bore needles, scapel blades, bone fragments, etc.
- Cost-effectiveness for other occupational groups and for gloves made from special materials.



Further studies are needed to address these issues

Personal protective equipment for preventing highly infectious diseases due to contact with contaminated body fluids in health care staff

Cochrane Work review: Verbeek et al. 2015 (protocol)

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD011621/abstract>

- Double gloving compared to single gloving: simulation studies
 - Much less contamination but not more errors in compliance with guidance
- Low to very low quality evidence for..
 - protection of *double gloving*, *CDC doffing* to prevent contamination



Double gloving: is it applied in health care practice ?

Survey on the use of DG: 11 Catalan hospital-based OHS

• HIV, HCV, HBV patients	72.7 %
• Orthopaedic surgery	63.6 %
• Standard double gloves	63.6 %
• High compliance	54.5 %
• Loss of dexterity	54.5 %
• DG in procedures	36.4 %

Use of DG in surgery, Hospital del Mar: recorded by surgery nurses

• Vascular	66.6 %
• Orthopaedic	65.0 %
• Cardiothoracic	50.0 %
• ORL	50.0 %

• Urology	15.3 %
• Anaesthetics	0.0 %
• Oral and maxillofacial	0.0 %
• Neurosurgery	0.0 %
• Gynaecology & Obstetrics	0.0 %



Double gloving: is it applied in health care practice ?

Surgeons' and residents' double-gloving practices at 2 teaching hospitals in Ontario

Haines T, et al. Can J Surg. 2011

Overall, **43%** of study participants double-gloved in 75% of procedures (1992, U Toronto: 24%¹).

“This may reflect greater incorporation of research evidence into clinical practice at McMaster, which has been recognized as an originator of “evidence-based medicine”.

¹Wright JG, et al. CMAJ 1995

Table 3. Multiple logistic regression: effect of participant characteristics on double-gloving*

Characteristic	OR (95% CI)
Study site	
McMaster	3.32 (1.35–8.17)
UWO	1
Sex	
Female	2.04 (0.74–5.62)
Male	1
Age, yr	
20–29	1.92 (0.27–13.95)
30–39	2.43 (0.46–12.92)
40–49	2.47 (0.52–11.71)
> 49	1
Status	
Resident	0.65 (0.19–2.24)
Surgeon	1
Specialty	
Orthopedic surgery	48.89 (12.37–192.98)
General surgery	1.98 (0.64–6.07)
Plastic surgery	2.45 (0.70–8.56)
Other	1

CI = confidence interval; OR = odds ratio; UWO = University of Western Ontario. **n* = 154; Nagelkerke *R*² = 0.47; Hosmer–Lemeshow goodness of fit test *p* = 0.74.

Safety climate and percutaneous exposure injuries

Hospital safety climate and its relationship with safe work practices and workplace exposure incidents

Gershon et al. Am J Infect Control 2000

Table 6. Multiple logistical regression of (selected) safety climate sub-factors with percutaneous exposure injuries as the outcome.

	OR	(95% CI)
• Managerial support	0.56	(0.38 - 0.81)
• Feedback and training	0.42	(0.21 - 0.82)

Safety climate refers to the summary of perceptions that employees share about the safety of their work environment.



A systematic review of the effectiveness of occupational health and safety training

Lynda S Robson, Carol M Stephenson, Paul A Shulte, Benjamin C Amick III, et al.

Scand J Work Environ Health. 2012; 38:193-208

Institute of Work and Health, Toronto (Canada). Review team: Canada and USA. Included studies = 22

Table 3. Determination of the strength of evidence for training's effect on each outcome. [IQR=interquartile range; N=number of studies]

Outcome	Summary of body of evidence in table 2			Assessment of body of evidence using evidence synthesis algorithm ^a			Strength of evidence ^b	
	N		IQR	Median of effect sizes	Number of good or fair studies	Consistency		Median of effect sizes
	Good	Fair						
Knowledge	0	2	1.45–3.58	2.52	Too few	Consistent	Large	Insufficient
Attitudes	0	1	0.82–0.87	0.84	Too few	Consistent	Sufficient	Insufficient
Behaviors	2	4	0.33–1.35	1.09 →	Enough	Consistent	Large →	Strong
Health	2	3	-0.25–0.06	-0.04 →	Enough	Inconsistent	Less than sufficient →	Insufficient

^a Descriptors indicate the result of assessing a feature of a body of evidence using the evidence synthesis algorithm shown in table 1.

^b The resulting conclusion about strength of evidence following the assessment of a body of evidence using the algorithm.

- Workplace education and training programs recommended: positive impact on workers' behaviours.
- However, no impact on health was shown (reducing injuries, symptoms).
- Not enough high quality studies to make recommendations about the nature or type of training, such as the level of engagement, computer versus lecture training or the number of sessions.

LETTER TO THE EDITOR

■ Mandating double gloving

In the article “Exploring the benefits of double gloving during surgery” (March 2012, Vol 95, No 3), Korniewicz and El-Masri discussed the effectiveness of double gloving as a means of protection against infection. The study’s results support existing research literature that double gloving minimizes the risk of sharps exposure injuries, glove puncture rates, and blood contamination.¹

Research is limited in the cost analysis of double gloving, efficacy of surgical glove material, and specific glove brands used for studies; however, are these issues relevant? Despite sound evidence to support the practice of double gloving, scrub personnel in the OR still have the option to double glove. Double gloving should be seen as a part of OR safety practices, similar to other measures used to protect against sharps injuries and blood and body fluid exposure. The questions to ask are (1) when do we mandate double gloving as a safety

measure and (2) how do we implement change of this magnitude into practice?

As a perioperative nurse for more than 15 years, a nurse leader, and a graduate student, I fully support and commend AORN’s decision to move towards evidence-rated recommended practices. Double gloving is supported in the research literature and can be readily adopted as an evidence-based recommended practice. I look forward to these exciting changes that will transform OR practice. **AORN**

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doi: 10.1016/j.aorn.2012.04.025

Reference

1. Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Periop Pract.* 2011; 21(1):10-15.



> 1 million needlestick injuries per year in HCW !

European Directive 2010/32/EU:

<https://osha.europa.eu/en/sector/healthcare/prevention-sharp-injuries-workplace>

- Eliminating unnecessary use of sharps
- Medical devices
- Safety-engineered protection mechanisms
- Safe systems of work
- Safe procedures for using and disposing medical sharps
- Banning the recapping
- Personal protective equipment
- Vaccination
- Information and training



• Blunt needles ?

(Parantainen A, et al. CDSR 2011)

• Double gloves ?

(Mischke C, et al. CDSR 2014)



CONCLUSIONS

- Concluding evidence that double gloves are effective to prevent percutaneous exposure injuries in healthcare personnel in surgery, without serious impairment in dexterity (although an adaptation and retraining period is probably required^{1,2}).
- However, poor application in surgical practice
- No evidence base for EU Directive and it misses important information
- More, and more focused, push and pull needed to get evidence into practice:
 - ✓ University/Scientific societies/Government: **create push**
Evidence in Guidelines, Products, Services
 - ✓ Occupational Health / Hospital Hygiene Services: **create pull**
Advertise and use evidence-based services and guidelines
 - ✓ Employers and unions: get involved in **EBM**





Jani Ruotsalainen (left),
Managing Editor

Special thanks to...

Jos Verbeek

Coordinating Editor
Cochrane Work

<http://osh.cochrane.org/>