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Protocol for Hands Deserve Better: a Systematic Review of Surgical Gloving Practice

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

Conflicts of interest - All study investigators received compensation at fair market value from Mölnlycke Health Care for their research time. Dr. Tod Brindle and Dr Jessica Bah-Rösman were employees of Mölnlycke Health Care during this project. No other conflicts of interest for any of the authors.

INPLASY registration number: INPLASY2025100008

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 3 October 2025 and was last updated on 3 October 2025.

INTRODUCTION

Review question / Objective The objective of the Hands Deserve Better project is to determine the best available evidence to ensure provider and patient safety by describing four key fundamental principles of surgical gloving practice: glove fit, double gloving, the use of glove indicator systems, and glove change frequency. The surgical team includes all healthcare professionals who are engaged in the surgical case at the operating table. Therefore, the recommendations from this review and Delphi expert panel are intended to benefit the entire surgical team, from surgeon to trainee, equally.

Four parallel systematic reviews of the literature were conducted, in accordance with the preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement and following the published checklist for reporting. One over-arching search was used, with four distinct research questions:

- For healthcare providers scrubbed into surgical procedures, what is the association between poor glove fit and provider performance in the operating room? A secondary aim of this research asks, is there an established standard to determine appropriate glove size?
- For healthcare providers scrubbed into surgical procedures, how does the practice of double gloving compare to single gloving impact the risk of provider and patient during surgery?
- For healthcare providers scrubbed into surgical procedures, what is the difference between specialized double-gloving-indicator-systems compared to wearing two standard gloves on identification of glove perforation?

• For healthcare providers scrubbed into surgical procedures, how are rates of glove damage associated with recommendations for glove change frequency during a surgical case?

Condition being studied Fundamental principles of surgical gloving practice: glove fit, double gloving, the use of glove indicator systems, and glove change frequency.

METHODS

Search strategy Databases included: PubMed, Em-base, Cochrane Collaboration of Systematic Reviews and Metanalyses and Google Scholar.
Stage 1 – Initial search terms; Stage 2 – expanded terms based on initial search
Arm 1: Glove fit
Domain 1: Population/setting
Stage 1 terms: Operating theatre; Operating room; Operation; Surgery; Surgical; Surgeon; Hospital; Acute care. Stage 2 terms: Procedure; Perioperative; Scrub tech; 1st Assist; Scrub Nurse; Nurse.
Domain 2: Glove
Stage 1 terms: Surgical glove; Sterile glove; Procedural glove; Attire. Stage 2 terms: Latex; Polyisoprene; Polychloroprene.
Domain 3: Fit
Stage 1 terms: Fitting; Right; Suitable; Adequate; Proper; Size; Sizing. Stage 2 terms: Hand-size; Magnitude; Dimension; Range; Scope; Palm size
Domain 4: Performance
Stage 1 terms: Indicator-system; Identifier; Awareness; Detection; Visual; Exposure; Recogni*; Reveal; See. Stage 2 terms: Ergonomics; Comfort design; Functional design; Human factors.
Identified exclusion topics
Stage 1 terms: Exam glove; Clean glove; Vinyl; Nitrile. Stage 2 terms: Condom.
Arm 2: Double Gloving
Domain 1: Population/setting
Stage 1 terms: Operating theatre; Operating room; Operation; Surgery; Surgical; Surgeon; Hospital; Acute care. Stage 2 terms: Procedure; Perioperative; Scrub tech; 1st Assist; Scrub Nurse; Nurse.
Domain 2: Glove
Stage 1 terms: Surgical glove; Sterile glove; Procedural glove; Attire. Stage 2 terms: Latex; Polyisoprene; Polychloroprene.
Domain 3: Double gloving
Stage 1 terms: Double glove; Double gloves; Gloving; Protective; Single glove. Stage 2 terms: Over glove; Under glove.
Domain 4
Stage 1 terms: Breach; Asepsis; Barrier; Infection; Contamination. Stage 2 terms: Aseptic barrier; Bioburden.
Identified exclusion topics
Stage 1 terms: Exam glove; Clean glove; Vinyl; Nitrile. Stage 2 terms: Condom.
Arm 3: Indicator systems
Domain 1: Population/setting
Stage 1 terms: Operating theatre; Operating room; Operation; Surgery; Surgical; Surgeon; Hospital; Acute care. Stage 2 terms: Procedure; Perioperative; Scrub tech; 1st Assist; Scrub Nurse; Nurse.
Domain 2: Glove
Stage 1 terms: Surgical glove; Sterile glove; Procedural glove; Attire. Stage 2 terms: Latex; Polyisoprene; Polychloroprene.
Domain 3: Puncture
Stage 1 terms: Damage; Breach; Perforation; Microperforation; Hole; Tear; Rip; Injury. Stage 2 terms: Over glove; Under glove; Break; Hurt; Impairment; Destruction.
Domain 4: Indicator
Stage 1 terms: Indicator-system; Identifier; Awareness; Detection; Visual; Exposure; Recogni*; Reveal; See. Stage 2 terms: Guide; Marker; Sign; Find.
Identified exclusion topics
Stage 1 terms: Exam glove; Clean glove; Vinyl; Nitrile. Stage 2 terms: Condom.
Arm 4: Glove damage/failure
Domain 1: Population/Setting
Stage 1 terms: Operating theatre; Operating room; Operation; Surgery; Surgical; Surgeon; Hospital; Acute care. Stage 2 terms: Procedure; Perioperative; Scrub tech; 1st Assist.
Domain 2: Glove
Stage 1 terms: Surgical glove; Sterile glove; Procedural glove; Attire. Stage 2 terms: Latex; Polyisoprene; Polychloroprene.
Domain 3: Damage
Stage 1 terms: Perforation; Failure; Microperforation; Tear; Rip; Shear. Stage 2 terms: Needle stick; Puncture; Cut; Laceration.
Domain 4:
Stage 1 terms: change; replace; don; doff; swap. Stage 2 terms: contamination; colonization; infection; cross contamination; asepsis; contamination.
Identified exclusion topics
Stage 1 terms: Exam glove; Clean glove; Vinyl; Nitrile. Stage 2 terms: Condom.

Participant or population The surgical team, which includes all healthcare professionals who are engaged in the surgical case at the operating table.

Intervention Surgical gloves manufactured of natural rubber latex, polyisoprene, polychloroprene, or a combination thereof.

Comparator Not applicable.

Study designs to be included STUDY OF INCLUSION HIERARCHY (A) Randomized controlled comparison trials (B) Randomized controlled trials compared to standard of care; or when not available: (1) Systematic reviews & meta-analysis (2) Quasi-experimental studies (3) Cohort with control designs (4) Case controlled designs (5) Observational studies (6) Gray literature when demographics, methods and outcomes are clearly reported (C) For Glove Fit only: (1) Mixed methods (2) Qualitative surveys (3) Healthy volunteer studies (4) In vitro studies* (D) For puncture indication only (1) In vitro studies* (2) Healthy volunteer.

Eligibility criteria To meet objective and research question, a pluralistic approach was used to identify best available evidence
1. Articles published between 1st January 1980 through to 1st January 2023
2. Adult and pediatric surgical literature
3. Any surgical specialty and performed in acute-care hospital operating rooms, for example: Ortho, Ob-GYN, Cardiac, Vascular, General/Open, Laparoscopic, Neurosurgery, Urology, Plastic Surgery, ENT, etc.
4. Languages: English abstract available
a. Full text review of all non-English sources will be performed using translation software and or reviewed by team members who are native speakers of the non-English language.

Information sources PubMed, Embase, Cochrane Collaboration of Systematic Reviews and Metanalyses and Google Scholar.

Main outcome(s) Meta-synthesis of study outcomes for each arm of the systematic review; Consensus statements based on the systematic reviews developed using the Delphi Technique for health sciences.

Data management Reviewers assigned to each arm independently screened identified abstracts for eligibility. Inclusion and exclusion designation was discussed verbally, with the primary research rendering a final decision if agreements were not made.

Quality assessment / Risk of bias analysis Reviewers assigned to each arm independently screened identified abstracts for eligibility. Inclusion and exclusion designation was discussed verbally, with the primary research rendering a final decision if agreements were not made.

Strategy of data synthesis Statistical comparison of study outcomes within this systematic review is not possible due to the variation and heterogeneity of the studies. Therefore, data synthesis will focus on reporting findings from studies comparing:
Arm 1: different surgical gloves, or where not available, studies reporting outcomes of individual surgical gloves without a control, summarized by their demographics, functional units, boundaries and limitations which may impact clinical relevancy.
Arms 2, 3, and 4: the risk of provider and patient complications between two types of gloving procedures on rate of aseptic barrier breach, health care provider exposure or injury and reports of SSI or wound complications.

Subgroup analysis Not applicable.

Sensitivity analysis Not applicable.

Language restriction Full text review of all non-English sources will be performed using translation software and or reviewed by team members who are native speakers of the non-English language.

Country(ies) involved Germany, Japan, Netherlands, Norway, United Kingdom, USAUnited States.

Keywords glove fit; double gloving; indicator system; glove damage; glove change; surgical site infection; gloving practice; surgical gloves.

Dissemination plans Five manuscripts were drafted for this project: one for each of the four systematic reviews, and one for a series of consensus statements based on the systematic reviews.

Contributions of each author
Author 1 - Andreas Enz - Systematic reviews: supervision, validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: conceptualization, methodology, validation, formal analysis, investigation, writing (original draft, review and editing), visualization, supervision, project administration, funding acquisition.
Author 2 - Marja Boermeester - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)

Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 3 - Abhishek Chatterjee - Glove fit systematic review (Arm 1): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 4 - Nathan Coombs - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 5 - Louise Dye - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 6 - Paul Johnson - Double gloving systematic review (Arm 2): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 7 - Egil Lingaas - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 8 - Wolfram Mittelmeier - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 9 - Koji Munakata - Glove damage and change systematic review (Arm 4): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing).
Author 10 - Robert Sawyer - Indicator systems systematic review (Arm 3): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing)
Author 11 - Deborah Spratt - Glove fit systematic review (Arm 1): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing)
Author 12 - Kim Stearns - Double gloving systematic review (Arm 2): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing)
Author 13 - Kurt Wharton - Indicator systems systematic review (Arm 3): validation, analysis, investigation, writing (original draft, review and editing)
Consensus recommendations: validation, formal analysis, investigation, writing (original draft, review and editing)
Author 14 - Tod Brindle - Systematic reviews: conceptualization, methodology, software, data curation, original draft preparation, reviewing and editing
Consensus recommendations: conceptualization, methodology, validation, formal analysis, investigation, writing (original draft, review and editing), visualization, project administration, funding acquisition, resources and data curation
Author 15 - Jessica Bah-Rösman - Systematic reviews: conceptualization, methodology, software.