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Clinical evidence for surgical glove fit

Glove fit is critical for clinical performance and safety – not just comfort.

Evidence shows fit is the primary factor influencing surgical glove choice, yet many clinicians still compromise.

44%

Around 44% of women report poor fit¹, and 1 in 5 glove users are dissatisfied with finger length², highlighting a clear mismatch between standard sizing and real-world needs.

While surgical gloves are available in different sizes, hands come in different shapes.

Current glove designs and sizing models are based on the palm and do not account for natural variation in finger dimensions. As a result, many clinicians are forced to choose between a glove that fits the palm and one that fits the fingers. This compromise can lead to excess material at the fingertips (and reduced tactile sensitivity) for gloves that fit the palm, or tightness across the palm (and discomfort and fatigue) for gloves that fit the fingers.

In practice, glove fit is not a simple matter of preference – it is a measurable ergonomic challenge grounded in anatomical variation and diversity.



Poor fit has measurable clinical consequences: studies have shown reduced dexterity and tactile sensitivity, increased pain and fatigue, and increased procedure times when surgical gloves do not fit well³.



Poor fit affects safety: poorly fitting gloves are associated with significantly higher perforation rates compared to gloves that fit well, potentially compromising both clinician safety and patient outcomes⁴.



The burden is not evenly distributed: clinicians with smaller hands, particularly women, report greater discomfort and performance limitations⁵.

Fit for all! Surgical glove fit is critical to performance and needs improvement

Dziak K, Otterhed K, Vigmo J. Presented at the Association for Perioperative Registered Nurses (AORN) Global Surgical Conference & Expo: 2026 April 11-14, New Orleans (LA), USA.
<https://doi.org/10.1002/aorn.70104>

Study type

Electronic survey

Objective

Understand user perceptions of surgical glove fit with respect to hand size

Methods

- An online survey was conducted in USA, UK, Germany, Sweden, and Japan to understand surgeon and scrubbed surgical staff perspectives on various aspects of surgical gloving practice
- Survey was conducted in August and September 2023
- Responses were anonymous
- Data was aggregated, segmented, and analyzed by glove size
- Respondents with glove size ≥ 7.5 were classified as large handed, while respondents with glove size ≤ 7 were classified as small handed

Key results

- Demographics of n = 300 survey respondents
 - 195 (65%) surgeons and 104 (35%) scrubbed staff
 - 192 (64%) male and 107 (36%) female
 - 174 (58%) large handed and 124 (41%) small handed

#1

feature when choosing a surgical glove is fit

91%

have taken action to improve surgical glove fit

32%

of small handed clinicians want improved glove sizing



small handed clinicians said loose fingertip fit is a specific issue

Conclusions

- Glove fit was the most important factor when choosing a surgical glove
- Despite most respondents trying available options to achieve better glove fit, a large portion still reported the need for improved sizing and areas of their gloves being too tight or too loose
- Surgical glove users with small hands more often rate fit as their top priority, identify issues specific to loose finger areas, and more often suggest the improvement of customized sizing

Hands Deserve Better: Global clinical consensus recommendations on surgical gloving practice

Enz A, Boermeester MA, Chatterjee A, et al. Journal of Hospital Infection. 2026 Jun 1;172:115-28.
<https://doi.org/10.1016/j.jhin.2026.03.025>

Study type

Consensus recommendations

Objective

Determine the best available evidence for key fundamental principles of surgical gloving practice and to inform operating room staff on the importance of optimal gloving practice to ensure provider and patient safety

Methods

- Four parallel systematic reviews of literature published between 1 January 1980 and 1 January 2023 were performed for
 - Glove fit
 - Double gloving
 - Indicator gloves
 - Glove damage and change frequency
- The 13-member expert panel included clinicians from 6 countries and 7 specialties
- The Delphi technique for health sciences was used to develop consensus statements based on the systematic reviews

Key results

- A total of 10,137 records were identified, and 7,979 abstracts were screened
- 411 full text articles were assessed, and 258 articles were included in the reviews
- 12 potential statements were drafted, and the expert panel reached consensus on 10 clinical practice recommendations regarding glove use during surgical procedures

Consensus recommendations relating to glove fit

Statement 1:

All members of the surgical team should undergo a glove fitting (glove size and type) before scrubbing into the operating room for the first time.

Grade IB, Expert opinion

Statement 2:

Additional glove fitting should occur in the event of a manufacturer change and/or when elements of comfort or performance are impacted.

Grade IB, Change practice

Statement 3:

Appropriately fitting gloves of variable sizes and styles should be available to members of the surgical team, regardless of sex or race.

Grade V, Expert opinion

Additional consensus recommendations were made for double gloving, surgical glove indicator systems, and glove damage and change frequency.

Conclusions

- This comprehensive systematic review on surgical gloving may contribute to the discussion regarding best practice for glove selection and use during surgery

Hands Deserve Better: A systematic review on surgical glove fit and provider performance

Chatterjee A, Spratt DL, Enz A, Bah-Rösman J, Brindle CT. Journal of Clinical Medicine. 2025 Oct 30;14(21):7695.
<https://doi.org/10.3390/jcm14217695>

Study type

Systematic review and meta-synthesis

Objective

Assess the presence and quality of the available literature that investigates the critical association between glove fit and provider performance in the operating theatre and ascertain whether there is an established standard to determine appropriate glove size

Methods

- Systematic search of literature published between 1 January 1980 and 1 January 2023
- Studies were excluded if they reported testing of non-sterile medical exam gloves, or if they involved dental or orthodontic procedures outside of an operating theatre setting

Key results

- A total of 1188 records were identified
- After removal of duplicates (n = 1129), 59 unique titles and abstracts were screened
- 38 studies were excluded due and 3 were unable to be retrieved
- A total of 18 studies were eligible for inclusion in the review and were assessed for level of evidence, quality, and risk of bias

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Studies identified and reviewed

Key findings

Poor glove fit impairs surgical performance

- **Undersized gloves** may improve tactile sensitivity but cause pain, restricted hand motion, and fatigue
- **Oversized gloves** reduce tactile sensitivity and cause fingertip “extra material”, clumsiness, and decreased precision
- **Thicker gloves** slow performance and reduce tactile sensitivity, although familiarization reduces some negative effects over time
- **Proper fit** improves comfort, reduces fatigue, and may help prevent musculoskeletal injury
- Anatomical variation suggests one-size systems are inadequate

No standard for determining surgical glove fit

- **No practical or validated method exists** to reliably determine optimal glove size
- Glove sizing today is typically based on **clinician preference**, not measurable criteria
- **Manufacturers differ widely** in glove shape, thickness, and former design, all of which affect fit

Glove fit affects glove integrity and safety

- Ill fitting gloves – especially oversized ones – were linked to **higher perforation rates**
- One study showed **perforation rates increased** from 72% to 100% when the correct size gloves were not available

Opportunities for future research

- Develop **standardized glove fitting protocols** for surgical teams
- Encourage glove manufacturers to create gloves with **variable finger lengths** and improved anatomical tailoring using anthropometric data in design
- Recognize ergonomic differences, especially for **female surgeons**, who experience higher rates of upper extremity musculoskeletal pain

Conclusions

- Poorly fitting gloves—whether too small or too large—significantly affect surgical performance, comfort, and safety
- Glove sizing remains subjective and unstandardized
- There is a critical need for better research, more anatomically informed glove design, and consistent methods to determine optimal fit for surgical teams

The ergonomics of women in surgery

Sutton E, Irvin M, Zeigler C, Lee G, Park A. Surgical endoscopy. 2014 Apr;28(4):1051-5.
<https://doi.org/10.1007/s00464-013-3281-0>

Study type

Electronic survey

Objective

Assess the physical impact of minimal access techniques, specifically at the interaction of women and surgical ergonomics

Methods

- A 23-item web-based survey was distributed to 2,000 laparoscopic surgeons and fellows
- The survey addressed four key categories:
 - Demographics
 - Physical symptoms
 - Ergonomics
 - Environment/equipment
- Questions were structured to allow for identification of which body part experienced which symptoms

Key results

- Survey had a 15.7% overall response rate
 - 54 female respondents (17%)
 - 260 male respondents (83%)
- Women were significantly younger, shorter, had a smaller glove size, and fewer years in practice compared to men ($p < 0.0001$)
- Compared to men, women were more likely to receive treatment for their hands, including the wrist, thumb, and fingers (odds ratio 3.5; $p = 0.028$)
- Comparing men and women with the same glove size
 - Women with a larger glove size (7-8.5) reported more cases of treatment for their hands (21% vs 3%; $p = 0.016$)
 - Women with a smaller glove size (5.5-6.5) reported more discomfort in their:
 - shoulders (77% vs 27%; $p < 0.004$)
 - neck (62% vs 18%; $p < 0.016$)

3.5×

Female surgeons were 3.5 times more likely to receive treatment for their hands compared to male surgeons

Women 11% (6/54) vs men 3% (9/261)

Odds ratio 3.5; $p = 0.028$

Conclusions

- More women surgeons, often smaller than men with respect to height and hand size, are entering the laparoscopic work environment
- Although they have spent significantly less time in practice, they report more pain and treatment for work-related hand injuries than their male counterparts

Effects of wearing the wrong glove size on shoulder and forearm muscle activities during simulated assembly work

Yoo IG, Lee J, Jung MY, Lee JH. Industrial Health. 2011;49(5):575-81.
<https://doi.org/10.2486/indhealth.MS1235>

Study type

Non-clinical benchtop test

Objective

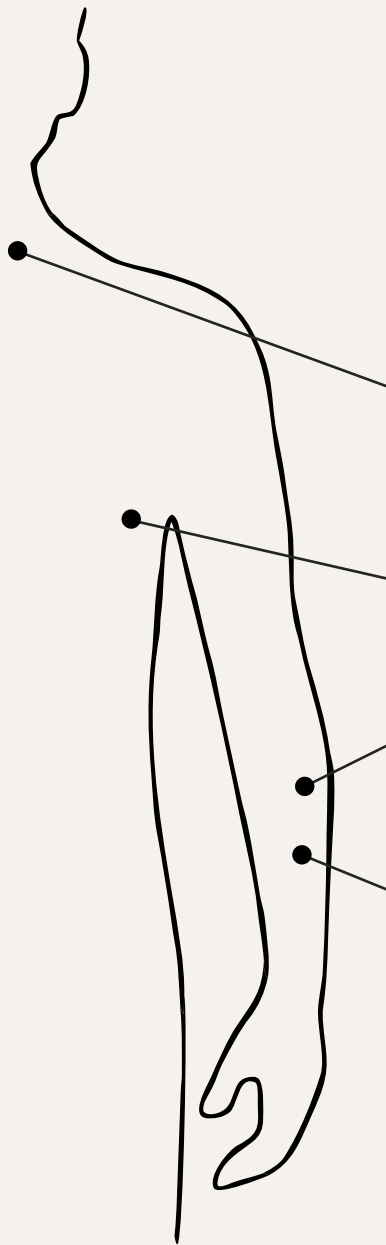
Use electromyography (EMG) to assess the effects of wearing the wrong size glove on shoulder and forearm muscle activation during simulated assembly tasks

Methods

- 16 healthy subjects were recruited for the study, and their hands were measured to determine glove size
- Participants were provided nitrile exam gloves in their preferred size (well-fitting) as well as one size larger and smaller
- Participants completed the Valpar Component Work Sample assessment #204 which simulates assembly, laboratory, and healthcare related tasks requiring manual dexterity, including
 - Grasping, lifting, and holding small objects with tweezers
 - Threading nylon wire through pins and holes
- The assessment was performed four times (with bare hands and each of the glove sizes) in random order
- Surface EMG measurements were collected from electrodes placed at the upper trapezius, serratus anterior, flexor digitorum superficialis, and extensor digitorum of test subjects
- Data was expressed as mean percentages $\pm$ standard deviation relative to reference voluntary contractions (RVCs) and normalized to minimize interindividual differences

Key results

Muscle activation (normalized EMG) compared to well-fitting gloves



	Too small gloves	Too large gloves
Upper trapezius	↑ 18.8%	↑ 10.9%
Serratus anterior	↑ 19.6%	↑ 14.9%
Extensor digitorum	↓ 15.9%	↓ 17.9%
Flexor digitorum superficialis	NS	NS

All differences are $p < 0.01$ or $p < 0.05$ except NS = not significant.

Conclusions

- There was no significant difference in EMG measurements between bare hands and well-fitting gloves
- Wearing the wrong glove size during tasks requiring manual dexterity may lead to inefficient use of the forearm and shoulder muscles, leading to myofascial pain syndrome
- Selection of the appropriate glove size is important for the prevention of disorders resulting from shoulder muscle overuse

Note: Relative differences in normalized EMG measurements were calculated by Mölnlycke Health Care based on values reported in the original article.

Does size affect the rate of perforation? A cross-sectional study of medical gloves

Zare A, Choobineh A, Jahangiri M, Seif M, Dehghani F. Annals of Work Exposures and Health. 2021 Aug 5;65(7):854-61.
<https://doi.org/10.1093/annweh/wxab007>

Study type

Prospective, cross-sectional study

Objective

Compare the rate and location of glove perforation between well-fitted and ill-fitted gloves to assess the value of fitting in preventing glove damage

Methods

- 45 midwives in maternity ward had hands measured to determine glove size
- Participants also reported preferred glove size and were provided 9 pairs of surgical gloves
 - 3 pairs in their preferred size (good fit)
 - 3 pairs one size smaller (tight fit)
 - 3 pairs one size larger (loose fit)
- Each participant performed 9 episiotomy repairs, one with each pair of gloves
- A total of 810 gloves (n = 270 per group) were collected and tested for perforations using the standard water leak method EN 455-1
- The number and location of leaks (perforations) on each glove was noted

Key results

Perforation rates for each group were as follows

Group	Perforated gloves	Gloves with a single perforation	Gloves with multiple perforations
Good fit	54 (20%)	43 (15.9%)	11 (4.1%)
Loose fit	102 (37.8%)*	63 (23.3%)**	39 (14.4%)**
Tight fit	94 (34.8%)*	71 (26.3%)**	23 (8.5%)**

Number of gloves n (%); * p < 0.05 compared to good fit;
** p-value not reported

Correlation of hand size, glove fit, and perforation rates

- **Small handed clinicians** (size 6.5 glove) had increased perforation rates in loose fitting gloves compared to good fitting gloves (33% vs 20.4%; p = 0.021)
- **Large handed clinicians** (size 8 glove) had increased perforation rates in tight fitting gloves compared to good fitting gloves (34.3% vs 14.8%; p = 0.030)
- The difference in perforation rates in intermediate glove sizes (7 and 7.5) was not statistically significant

Perforation patterns (highest perforation rates)

- **Good fit:** non-dominant hand and index finger
- **Loose fit:** dominant hand and index finger
- **Tight fit:** non-dominant hand and thumb

89%

more glove perforations with tight fit (38%; 102/270) vs good fit (20%; 54/270) (p = 0.008)

74%

more glove perforations with loose fit (35%; 94/270) vs good fit (20%; 54/270) (p = 0.037)

Conclusions

- Wearing poorly fitting gloves led to an increased perforation rate of 75% or more
- Poorly fitting gloves often had multiple perforations per glove
- Inappropriately sized gloves present a multiplier risk of exposure to biological agents

Note: Relative differences in glove perforation rates were calculated by Mölnlycke Health Care based on values reported in the original article.

Wearing the wrong size latex surgical gloves impairs manual dexterity

Drabek T, Boucek CD, Buffington CW. Journal of Occupational and Environmental Hygiene. 2010 Mar;7(3):152-5.
<https://doi.org/10.1080/15459620903481660>

Study type

Non-clinical benchtop test

Objective

Test whether wearing the wrong size gloves impairs manual dexterity

Methods

- 20 healthcare workers were administered a standard grooved pegboard test which consisted of inserting metal pegs into slotted keyholes angled in different directions on a 5x5 matrix
- The test was performed 3 times each under the following conditions, with the order randomized to minimize the combined effect of time, practice, and fatigue on results
 - barehanded
 - preferred glove size (just right)
 - one full size smaller (too small)
 - one full size larger (too large)
- Gloves used in the study were standard latex surgical gloves with 10 mil (0.256 mm) thickness in the fingers and “anti-slip” finish for a firm grip
- Time to complete peg insertion and removal was recorded separately, as were the numbers of pegs dropped for each task

Key results

Peg insertion time

Group	Time (s)
Barehanded	57.9 ± 12.9
Just right	60.7 ± 15.1
Too small	64.2 ± 17.7**
Too large	64.6 ± 18.5**

* $p < 0.05$ vs just right; ** $p < 0.001$ vs barehanded

Pearson correlation analysis revealed a significant correlation ($r = 0.6969$; $p = 0.006$) between the increases in insertion time (vs preferred size) for subjects when they wore too small or too large gloves

There was no statistically significant difference between the groups for peg removal time or peg drops

Qualitative feedback from test subjects

- **Too small gloves** restricted hand motion and caused pain
- **Too large gloves** felt sloppy due to additional material in the glove finger tips

Task completion took longer when wearing poor fitting gloves

5.8%

longer task completion time when gloves were too small compared to right fit (64.2s vs 60.7s; $p < 0.05$)

6.4%

longer task completion time when gloves were too large compared to right fit (64.6s vs 60.7s; $p < 0.05$)

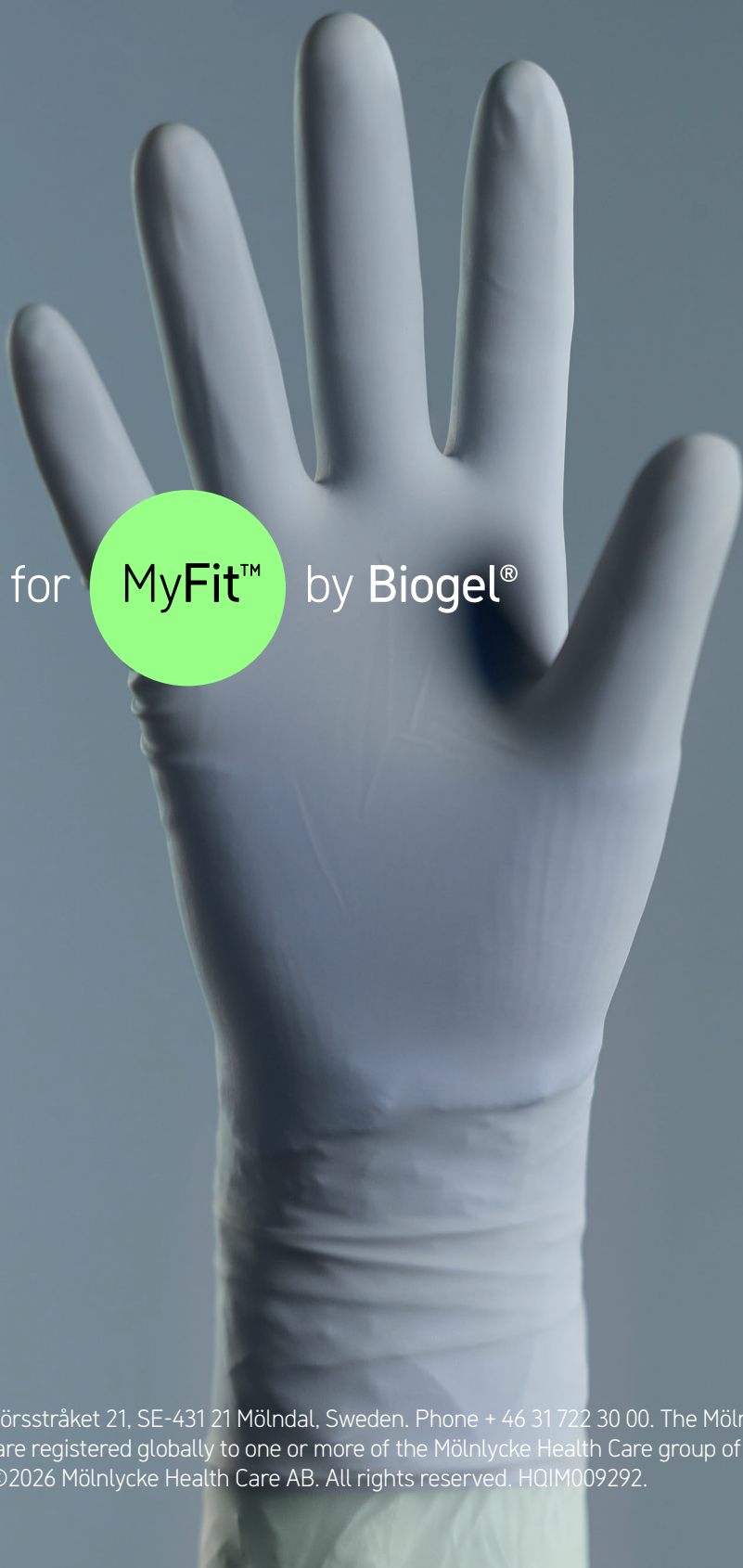
Conclusions

- Wearing poorly fitting gloves impairs manual dexterity and increased task completion time by 6% or more
- Performance was impaired both with gloves that were too small and too large, but for different reasons
- Health care workers should wear gloves that fit properly when doing tasks that require manual dexterity

Note: Relative differences in task completion times were calculated by Mölnlycke Health Care based on values reported in the original article.

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