DOUBLE-GLOVING

ARE YOU EXPOSED?

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LEARNER OBJECTIVES

PARTICIPANTS WILL BE ABLE TO:

- Understand the risk factors associated with glove perforations
- Discuss the impact of occupational exposure on healthcare workers today
- Review the role of gloves in patient safety and impact on surgical site infections (SSIs)
- Summarize literature that supports the use of double-gloving for protecting patients and healthcare workers
- Uncover barriers and challenges to adoption of double glove technique
- Discuss recommendations and strategies increasing double-gloving practice

THE OR

A MESSY ENVIRONMENT

- Surgical team members are exposed to percutaneous, infectious materials (including blood/bodily fluids) in as many as **50%** of surgical procedures [1]
- Blood-to-hand contact occurs in at least **HALF** of these exposures [1]

Reference:
1 Childs T. Use of double gloving to reduce surgical personnel's risk of exposure to bloodborne pathogens: an integrative review. *AORN*. 2013;98(6):585-596.

WHY DO YOU GLOVE?

TWO MAIN ROLES FOR GLOVES [1]

Prevent **gross** contamination of healthcare workers from

Blood
Body fluids
Secretions
Excretions
Mucous membranes
Non-intact skin

Reduce risk of contamination of patients

GLOVES PROVIDE PHYSICAL, CHEMICAL, AND BIOLOGICAL PROTECTION [2]

References:

1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5.

2 Maqbali A. Using double gloves in surgical procedures: a literature review. *Br J Nurs*. 2014 Nov 27-Dec 10;23(21):1116-22. doi: 10.12968/bjon.2014.23.21.1116.

EVOLUTION OF GLOVES:

FROM PROTECTING YOU TO PROTECTING YOUR PATIENTS

- Gloves entered healthcare practices more than 250 years ago [1]

1758

Johann Walbaum, *Germany*

Material: Sheep cecum

Purpose: Mechanical protection of the healthcare worker when performing gynecological examinations

End of 1700s

Joseph Plenk, *Australia*

Purpose: Protect midwives from contracting syphilis from infected patients

1889

William Halsted, *Johns Hopkins Hospital*

Material: Rubber

Purpose: Chemical protection of scrub nurse from disinfecting agent

1890

Joseph Colt Bloodgood, *Johns Hopkins Hospital*

Purpose: Noticed reduction in infections after hernia surgery

1914

World War I

Purpose: Widespread adoption

Reference:
1 Walczak DA, Pawelczak D, Grobelski B, Pasieka Z. Surgical gloves-do they really protect us? *Pol Przegl Chir*.2014;86(5):238-43. doi: 10.2478/pjs-2014-0042.

GLOVE PERFORATIONS:

THE STARK TRUTH

GLOVE PERFORATIONS ARE MORE COMMON THAN YOU MAY THINK

- Gloves can be torn, perforated or weakened [1]
- **1 in 10** chance of perforating single layer glove during low-risk surgical procedure [2]
  - Frequency of perforations can range from **3%** to **12%** [3,4]

PERCENT OF GLOVES PERFORATED vs. PERCENT OF SURGERIES THAT ENCOUNTERED PERFORATIONS

2011 STUDY
Total Hip Arthroplasty Surgery (THA) [4]

3.3%
GLOVES
32/979 Gloves

33.3%
OF SURGERIES
19/57 Surgeries

References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5. **2** Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection. *Cochrane Database of Systematic Reviews*. 2006, Issue 3 Art. No.: CD003087. DOI: 10.1002/14651858.CD003087.pub2. **3** Korniewicz D, El-Masri M. Exploring the benefits of double gloving during surgery. *AORN J*. 2012;95:328-336. **4** Kaya I, Ugras AA, Sungur I, et al. Glove perforation time and frequency in total hip arthroplasty procedures. *Acta Orthop Traumatol Turc*. 2012;46(1):57-60.

BEWARE OF COMMON CULPRITS[1-3]

NEARLY **3 OUT OF 4** BLOOD/BODY FLUID EXPOSURES OCCUR DUE TO PERCUTANEOUS INJURY[4]

- Needles
- Scalpel
- Bone fragments

- Sharp surfaces of complex instruments

- Chemicals
- Natural wear and tear

- Glove defects

References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5. **2** Misteli H, Weber WP, Reck S, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg*.2009;144(6):553-8. **3** Walczak DA, Pawelczak D, Grobelski B, Pasieka Z. Surgical gloves-do they really protect us? *Pol Przegl Chir*.2014;86(5):238-43. doi: 10.2478/pjs-2014-0042. 4. Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92.

INCREASING THE LIKELIHOOD FOR GLOVE PERFORATION

- Type of surgery [1-3]
  - Bone vs. soft tissue
  - Emergency vs. scheduled
  - Manual tissue retraction
  - Restricted field
  - Laparoscopic vs. open
- Length of surgery [1]
- Complexity of instrumentation [1]
- Number of instruments used during procedure [1]
- Role of healthcare personnel [1]
- Healthcare personnel experience [1]
- Human fatigue [1]
- Improper fitting gloves [4]

References:
1 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32. **2** Padhye MN, Girotra C, Khosla AR, Gupta KV. Efficacy of double gloving technique in major and minor oral surgical procedures: A prospective study. *Ann Maxillofac Surg*. 2011;1(2):112-9. **3** Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011;21(1):10-5. **4** Misteli H, Weber WP, Reck S, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg*.2009;144(6):553-8.

ALL SURGICAL PROCEDURES RISK PERFORATIONS

RANGE OF PERFORATIONS BY PROCEDURE [1-3]

7%
Urological Surgery

18%
Average for all types of procedures [1]

65%
Cardiac Surgery

- Highest rates: [2]
  - Orthopedic, trauma, and thoracic
- Laparoscopic procedures have rate of perforations **~20%** [1]

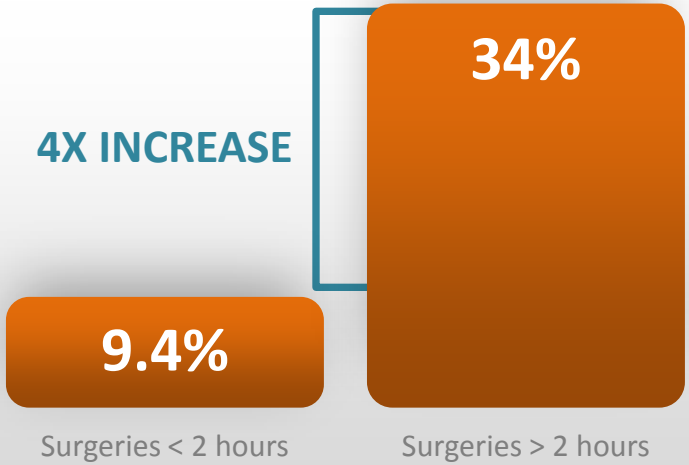
ALL SPECIALTIES HAVE CONSIDERABLE RISK OF PERFORATION

References:
1 Laine T, Aarnio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. *Am J Surg*. 2001;181(6):564-6. **2** Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32. **3** Hubner NO, Goerdt AM, Stanislawski N, et al. Bacterial migration through punctured surgical gloves under real surgical conditions. *BMC Infectious Diseases*. 2010;10:192.

LONGER SURGERIES TRANSLATE TO HIGHER RISK

- Glove puncture rates **AND** bacterial counts increase with increasing operation times [1]
- Mean perforation time was **70 minutes** after initiating operation [2]
- Glove perforation risk increases **1.115 times** for every 10 minutes of surgical time [3]
- Perforation rates significantly lower when gloves were changed at 20 minute intervals[1]

PERCENT OF SURGERIES WITH GLOVE PERFORATIONS [4]



References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011;21(1):10-5. **2** Timler D, Kusinski M, Iltchev P, et al. Glove failure in elective thyroid surgery. A prospective randomized study. *International Journal of Occupational Medicine and Environmental Health*. 2015;28(3):http://dx.doi.org/10.13075/ijomeh.1896.00428. **3** Laine T, Aamio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. *Am J Surg*. 2001;181(6):564-6. **4** Misteli H, Weber WP, Reck S, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg*.2009;144(6):553-8.

IN-USE FAILURE RATE OF SURGICAL GLOVES

- Gloves from different manufacturers have high level of variability
- Failure rate of surgical gloves can vary by brand
  - One study found failure rates from **1%** to nearly **6%** depending on the glove manufacturer (a **3.5 times** difference) [1]
- Impact of in-use failure
  - Increase risk of exposure to pathogens
  - Cost and time needed to replace gloves

FDA ALLOWS 2.5% OF NEW UNUSED STERILE GLOVES TO FAIL STANDARDIZED QUALITY CONTROL TESTING [2]

References:
1 MHC study #G09-005 **2** Berguer R, Heller PJ. Preventing sharps injuries in the operating room. *American College of Surgeons*. 2004:462-467.

PERFORATIONS GO UNRECOGNIZED BY THE NAKED EYE

UP TO 96% OF GLOVE PERFORATIONS MAY GO UNRECOGNIZED [1]

Single glove perforation may go unnoticed since less force is needed to perforate the glove barrier

Bacterial migration discovered in **over half** of micro-perforations [2]

- *Ex. Micrococcus luterus*, *Enterococci*, and *E. coli*

References:
1 Timler D, Kusinski M, Iltchev P, et al. Glove failure in elective thyroid surgery. A prospective randomized study. *International Journal of Occupational Medicine and Environmental Health*. 2015;28(3):http://dx.doi.org/10.13075/ijomeh.1896.00428. **2** Hubner NO, Goerdt AM, Stanislawski N, et al. Bacterial migration through punctured surgical gloves under real surgical conditions. *BMC Infectious Diseases*. 2010;10:192.

SHARPS INJURY

SHARPS INJURIES

- Overall occurrence of sharps injuries: **44.32 per 100** occupied beds per year in teaching hospitals (**16.88 per 100** in non-teaching hospitals) [1]
- **99%** of all surgeons have experienced a needle stick injury at some point according to a large survey [2]
  - Average number of instances was **8 times** over 5 year span [2]
  - More common in emergency settings than elective [3]
- Despite high number, only **½** actually reported their injuries [2]
  - Underreporting due to inconvenience, unnecessary, or considered "part of the job" [4]
- Instruments with infectious material and the quantity of pathogens present will determine risk of pathogen transmission [2]

600,000-800,000 PERCUTANEOUS INJURIES
OCCUR IN U.S. EACH YEAR AMOUNTING TO
$500 MILLION
IN DIRECT MEDICAL COSTS[5]

References:
1 Nassiry A. Adherence to the American College of Surgery (ACS) recommendation on double gloving, free zone and blunt suture needle use among Surgeon ranks. *VCU Theses and Dissertations*. Paper 2221.
2 Wittmann A, Kralj N, Kover J, et al. Study of blood contact in simulated surgical needlestick injuries with single or double latex gloving. *Infect Control Hosp Epidemiol*. 2009 ;30(1):53-6. **3** Laine T, Aamio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. *Am J Surg*. 2001;181(6):564-6. **4** Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92. **5** Kinlin LM, Mittleman MA, Harris AD, et al. Use of gloves and reduction of risk of injury caused by needles or sharp medical devices in healthcare workers: results from a case-crossover study. *Infect Control Hosp Epidemiol*. 2010;31(9):908-17.

FACTORS ASSOCIATED WITH RISK OF PERCUTANEOUS INJURY

CAUSES OF PERCUTANEOUS INJURY [1]

- Types of devices and procedures
- Lack of access to or sub-optimal use of protective equipment
- Professional inexperience
- Subjective perception of risk
- Improper management of sharps
- High workload, fatigue, mental pressure
- Working alternate shifts

16%

of sharps injuries occur during the passing of sharp instruments [2]

References:

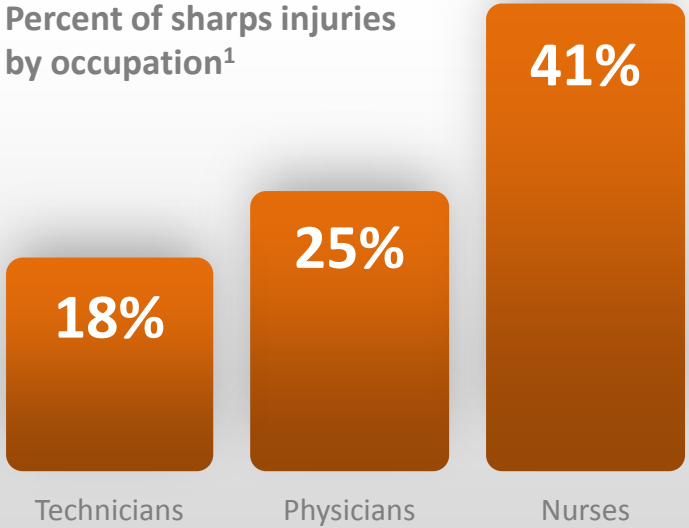
1 Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573.

2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

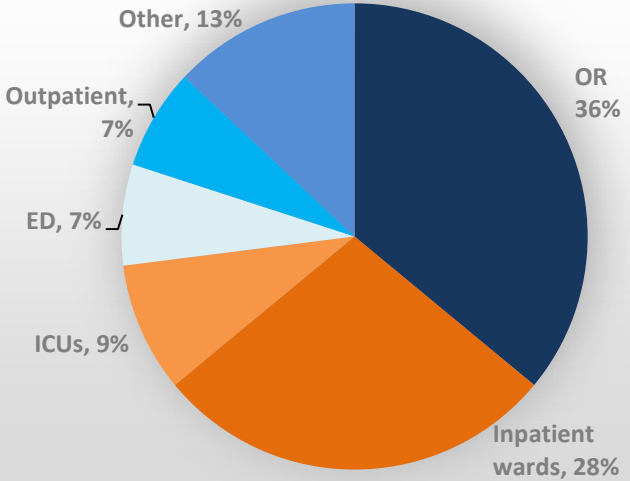
NURSES AT HIGHEST RISK OF SHARPS INJURIES

61% OF SHARPS INJURIES ARE CLASSIFIED AS PREVENTABLE [1]

Percent of sharps injuries by occupation[1]



Percent of sharps injuries by work location[1]

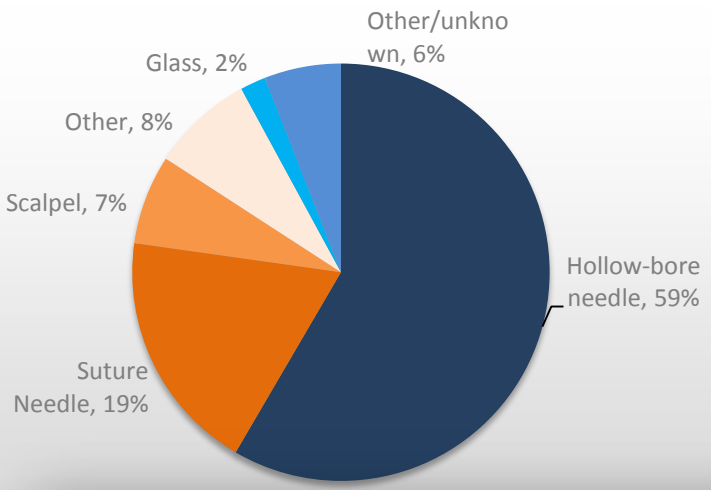


References:

1 Department of Health and Human Services (HHS). Centers for Disease Control and Prevention (CDC). Proceedings of the National Sharps Injury Prevention Meeting. September 12, 2005, Atlanta, GA.

NEEDLESTICK MOST COMMON SHARPS INJURIES

DEVICES INVOLVED IN PERCUTANEOUS INJURIES [1] (N=13,731)



MECHANISMS OF INJURIES [1]

- Manipulating the needle in a patient
- During sharps disposal
- Improper disposal
- During clean-up
- Colliding with worker or sharp
- During recapping
- When accessing an IV line
- When transferring or processing specimens
- While handling or passing equipment
- In transit to disposal

SPECIFICALLY IN THE **OR**, SUTURE NEEDLES ARE THE MOST COMMON CAUSE OF PERCUTANEOUS INJURY (UP TO 43%) [2]

References:
1 Center for Disease Control and Prevention. Sharps Injury Prevention Workbook.
2 Guglielmi C, Ogg MJ. Practical strategies to prevent surgical sharps injuries. Moving the Sharps Safety Agenda Forward. *American Nurse Today*. 2012.8-10.

COMMON LOCATIONS OF NEEDLESTICK INJURIES

MOST OCCUR IN NON-DOMINANT HAND [1,2]

References:

1 Laine T, Aarnio P. How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. *Am J Surg*. 2001;181(6):564-6.

2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

SHARPS STRATEGIES AND AWARENESS PROGRAMS

SHARPS SAFETY AGENDA [1,2]

- Blunt-tip suture needles
- Alternatives to using needles
- Safety-engineered devices
- Hands-free technique
- Neutral passing zone
- Double-gloving
- Multidisciplinary support
- Education
- Adequate staff-to-patient ratio
- Sharps injury log

2 out of 5 (43%) surveyed perioperative staff nurses and unit directors on surgical sharps safety report lack/unaware of sharps education plan[2]

References:
1 Center for Disease Control and Prevention. Sharps Injury Prevention Workbook.
2 Guglielmi C, Ogg MJ. Practical strategies to prevent surgical sharps injuries. Moving the Sharps Safety Agenda Forward. *American Nurse Today*. 2012.8-10.

EXPOSING THE HEALTHCARE WORKER

PERSONAL PROTECTIVE EQUIPMENT:

PROTECTING YOU, YOUR FAMILY, AND SOCIETY

- Caring for patients with communicable diseases places healthcare workers at risk for exposure
- Healthcare workers can further spread infectious agents to other healthcare workers, their families, or other patients
- Personal protective equipment protects healthcare worker's mucous membranes, airways, skin, and clothing from infectious materials
  - Personal protective equipment includes gloves, gowns, eye protection, masks and respirators

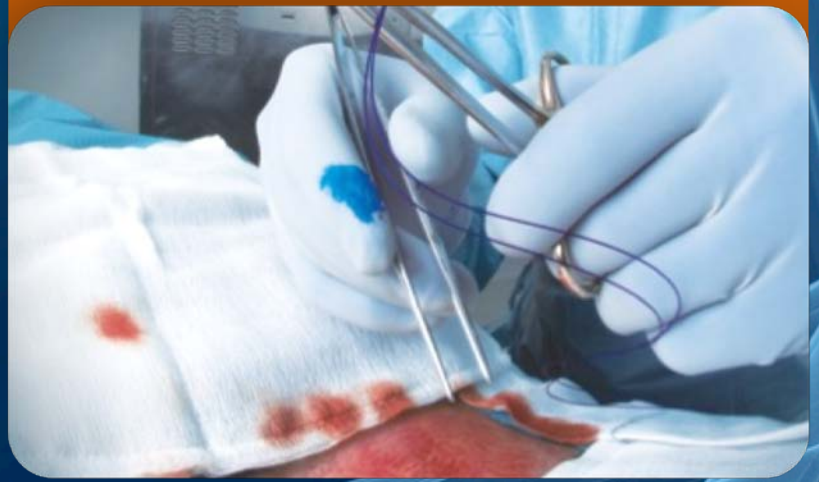
Reference:
1 Casanova LM, Rutala WA, Weber DJ, et al. Effect of single- versus double-gloving on virus transfer to health care worker's skin and clothing during removal of personal protective equipment. *American Journal of Infection Control*. 2012;40:368-374.

TRANSMISSION OF INFECTION TO HEALTHCARE WORKERS

- Sharps injuries increase risk of both bacterial and viral cross infection [1]
  - For example, as many as **18,900** *S aureus* bacteria could pass through a single needle hole in a gloved finger in 20 minutes [1]
- Cuts/grazes in the skin also increases infection risk [2]
  - Skin integration disrupting lesions detected in **13%** of surgical teams prior to surgery [2]

BACTERIAL PASSAGE

From patient to healthcare worker's hand through punctured glove occurred ~5% of all gloves worn [1]



References:

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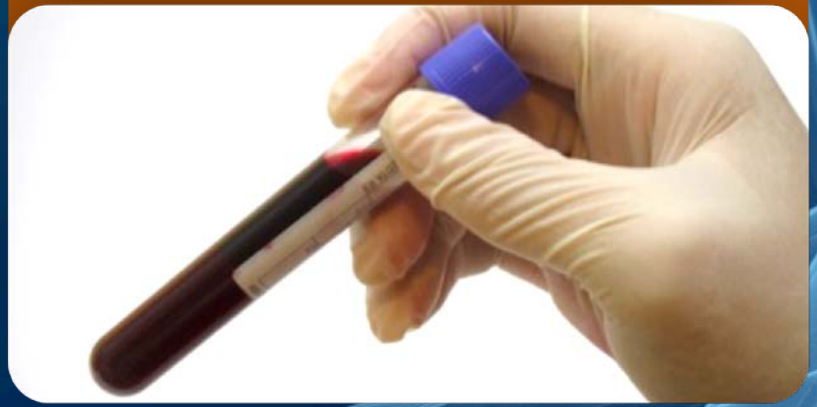
2 Kaya I, Ugras AA, Sungur I, et al. Glove perforation time and frequency in total hip arthroplasty procedures. *Acta Orthop Traumatol Turc*. 2012;46(1):57-60.

NUMEROUS BLOOD-BORNE PATHOGENS REVEALED

- Reports of at least **60** different blood-borne pathogens can be transmitted to healthcare workers due to accidental exposures [1]
  - 26 viruses, 18 bacteria/rickettsia, 13 parasites, and 3 yeasts
- **~1%** of Americans carry at least one type of blood borne infection [2]

2 MILLION

Healthcare workers across the world have experienced percutaneous exposure to infectious disease each year according to world health organization (WHO) [3]



References:
1 Tarantola A, Abiteboul D, Rachline A. Infection risks following accidental exposure to blood or body fluids in health care workers: a review of pathogens transmitted in published cases. *Am J Infect Control*. 2006;34(6):367-75. **2** Korniewicz D, El-Masri M. Exploring the benefits of double gloving during surgery. *AORN J*. 2012;95:328-336. **3** Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573.

ARE YOU PREPARED FOR LONG-TERM CONSEQUENCES?

	HEPATITIS B (HBV)	HEPATITIS C (HCV)	HIV
Consequences of the disease	**100-200** healthcare workers die each year from HBV[1]; can cause prolonged illness, cirrhosis, liver cancer, and/or death [2]	**80%** progress to chronic hepatitis; can cause cirrhosis, liver cancer, and/or death [2]	**1 in 8** Americans with HIV are unaware they are infected; [3] progresses to AIDS within 10 years if not treated [4]
Transmission of virus [2]	Blood and bodily fluids	Blood	Blood and bodily fluids
Number of cases due to percutaneous injuries (2004) [5]	**66,000**	**16,000**	**1,000**
Risk of infection with sharps injury [6,7]	**UP TO 30%**	**UP TO 10%**	**~0.4%**

References:

1 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32. **2** Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5 **3** Pager T. CDC report: 1 in 8 Americans don't know they have HIV . USA Today. June 27, 2015. http://www.usatoday.com/story/news/nation/2015/06/27/hiv-undiagnosed-cdc/29290667/. Accessed June 28, 2015. **4** HIV/AIDS. Mayo Clinic. http://www.mayoclinic.org/diseases-conditions/hiv-aids/basics/definition/con-20013732. Accessed June 28, 2015. **5** Nassiry A. Adherence to the American College of Surgery (ACS) recommnedation on double gloving, free zone and blunt suture needle use among Surgeon ranks. *VCU Theses and Dissertations*. Paper 2221. **6** Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92. **7** Timler D, Kusinski M, Iltchev P, et al. Glove failure in elective thyroid surgery. A prospective randomized study. *International Journal of Occupational Medicine and Environmental Health*. 2015;28(3):http://dx.doi.org/10.13075/ijomeh.1896.00428.

ECONOMIC IMPACT OF HEALTHCARE WORKER EXPOSURE

- **$188.5 million** in combined medical and work productivity in 2004 [1]
  - Direct and indirect costs associated with sharps injuries can range from hundreds to thousands of dollars per exposure [2]
- Impact on: [2,3]
  - ✓ Morbidity
  - ✓ Mortality
  - ✓ Productivity
  - ✓ Lost time from work
  - ✓ Quality of life
  - ✓ Emotional
  - ✓ Litigation
  - ✓ Drug toxicity
  - ✓ Further virus spread
- Economic burden on hospitals to manage occupational exposure (blood tests, treatments, outpatient visits, lost working hours) [3]
  - Occupational exposure management alone can be up to **$5,000** per case [4]

References:

1 Nassiry A. Adherence to the American College of Surgery (ACS) recommendation on double gloving, free zone and blunt suture needle use among Surgeon ranks. *VCU Theses and Dissertations*. Paper 2221.

2 Department of Health and Human Services (HHS). Centers for Disease Control and Prevention (CDC). Proceedings of the National Sharps Injury Prevention Meeting. September 12, 2005, Atlanta, GA.

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4 Maqbali A. Using double gloves in surgical procedures: a literature review. *Br J Nurs*. 2014 Nov 27-Dec 10;23(21):1116-22. doi: 10.12968/bjon.2014.23.21.1116.

EXPOSING THE PATIENT

HOW SAFE ARE YOUR PATIENTS?

- **Over half** of surgical procedures are contaminated at the end of procedure [1]
  - **42%** of these incidents were not due to patient's flora
- **33%** of devices that cause injuries come in contact with the patient after injury to the healthcare worker [2]

References:

1 Kulkarni AV, Drake JM, Lamberti-Pasculli M. Cerebrospinal fluid shunt infection: a prospective study of risk factors. *J Neurosurg*. 2001;94(2):195-201.

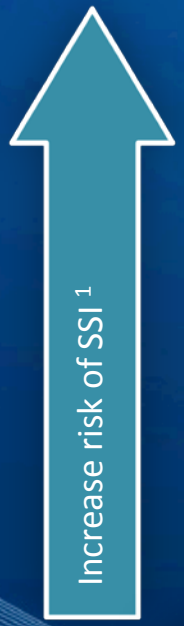
2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

SURGICAL SITE INFECTIONS POSE SEVERE CONSEQUENCES

- **1 in 20** surgical patients will suffer from an SSI [1]
- Impact of SSIs
  - ✓ **60%** more likely to be admitted to ICU [2]
  - ✓ Up to **6x** higher risk for 30-day readmission [3]
  - ✓ Longer hospital stays and higher risk of mortality [1]
  - ✓ Nearly **$100,000** per patient in direct and indirect costs [4]
- SSIs are directly correlated to wound contamination from patient, surgical team, and surgical intervention factors [5]
  - Approximately **60%** of SSIs are preventable amounting to up to **$6 billion** in potential cost savings [1]

References:
1 SHEA/IDSA Practice Recommendations. Anderson DJ, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol*. 2014 Sep;35 Suppl 2:S66-88. **2** de Mestral C and Nathens AB. Prevention, diagnosis, and management of surgical site infections. *Crit Care Clin*. 2013;29(4):887-94. **3** Herwaldt LA, Cullen JJ, Scholz D, et al. A prospective study of outcomes, healthcare resource utilization, and costs associated with postoperative nosocomial infections. *Infect Control Hosp Epidemiol*. 2006;27(12):1291-8. **4** Alfonso JL, Pereperez SB, Canoves JM, et al. Are we really seeing the total costs of surgical site infections? A Spanish study. Wound Repair Regen. 2007;15(4):474-481. **5** McHugh SM, Corrigan MA, Hill AD, Humphreys H. Surgical attire, practices and their perception in the prevention of surgical site infection. *Surgeon*. 2014 Feb;12(1):47-52.

GLOVE PERFORATIONS RE-CLASSIFY WOUND STATUS



Class IV
Dirty or infected

- Old trauma wounds with retained devitalized tissue
- Existing clinical infection or perforated viscera

Class III
Contaminated

- Open, fresh accidental wounds
- Major breaks in sterile technique or gross spillage from GI tract
- Acute, non-purulent inflammation is encountered

Class II
Clean-contaminated

- No infection or major break in technique
- Respiratory, alimentary, genital, or urinary tract are entered under control conditions without unusual contamination

Class I
Clean

- Not infection/inflammation, no entry into respiratory, alimentary, genital, or urinary tract
- Closed and drained with closed drainage, if necessary

GLOVE PERFORATION → BREACH IN STERILE TECHNIQUE → INCREASE RISK OF SSI

Reference:
1 CDC. Mangram AJ, Horan TC, Pearson ML, et al. Guideline for prevention of surgical site infection.1999;20(4):247-278.

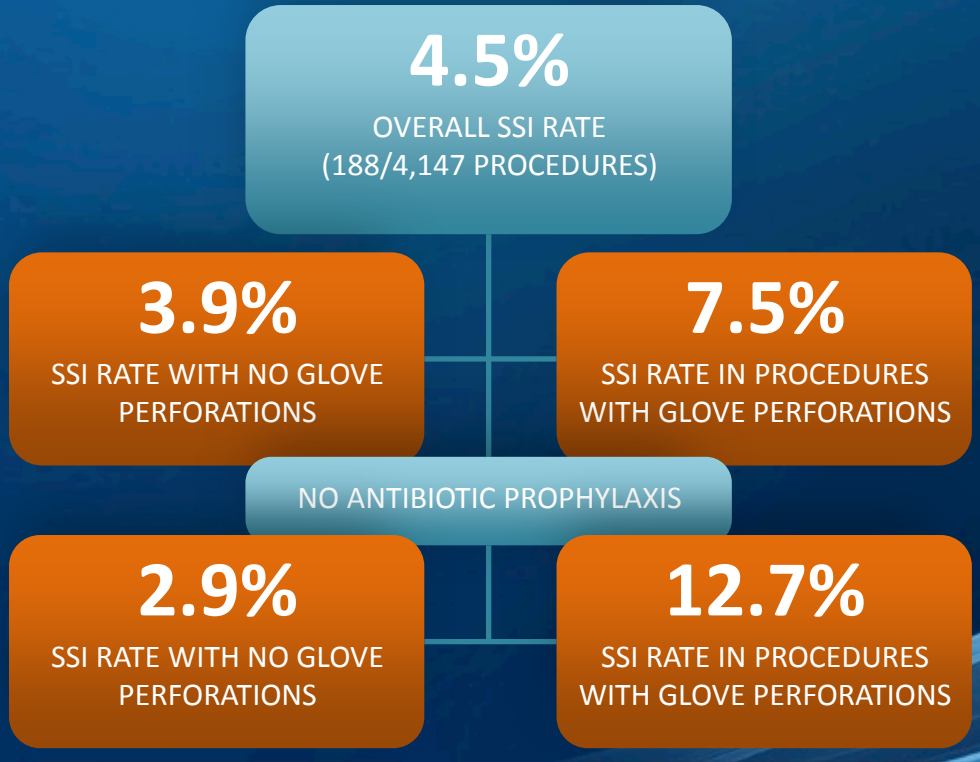
ELEVATED RISK OF SSIs WITH GLOVE PERFORATION

GLOVE PERFORATIONS AND SSIs [1]

- Glove leakage occurred in **16.3%** of all cases
- Glove perforations increased risk of SSI by **2x** overall, and over **4x** when antibiotic prophylaxis is not administered

Reference:
1 Misteli H, Weber WP, Reck S, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg*.2009;144(6):553-8.

ELEVATED RISK OF SSIs WITH GLOVE PERFORATION



Reference:
1 Misteli H, Weber WP, Reck S, et al. Surgical glove perforation and the risk of surgical site infection. *Arch Surg*.2009;144(6):553-8.

CASE STUDY: SURGEON INFECTS CARDIAC PATIENTS

CEDARS SINAI MEDICAL CENTER [1]

- Surgeon infected 5 patients during valve replacement due to tears in surgical gloves

IMPACT ON PATIENTS

4 out of 5 required second valve replacement

IMPACT ON HOSPITAL

Hospital covered total cost of care of affected patients

- Hospital-wide changes were implemented
  - Change gloves more frequently and use of double gloves

Reference:
1 Surgeon infected patients during heart procedure, Cedars-Sinai admits. Los Angeles Times. December 8, 2012.

ACA STRIPS HOSPITALS OF REIMBURSEMENT OF SSIs

- The Affordable Care Act (ACA) initiative is to align payment with healthcare quality [1]
- As of October 2008, CMS will **not reimburse** hospitals for the additional expenses of treating certain hospital acquired infections (HAIs), including SSIs [2]
- Currently, all acute care hospitals must report SSI data for selected surgical procedures to receive full annual reimbursement [3]
- In 2016, CMS instituted a **1%** payment reduction on hospitals in lowest **25%** rank for SSIs compared to national standards [4]

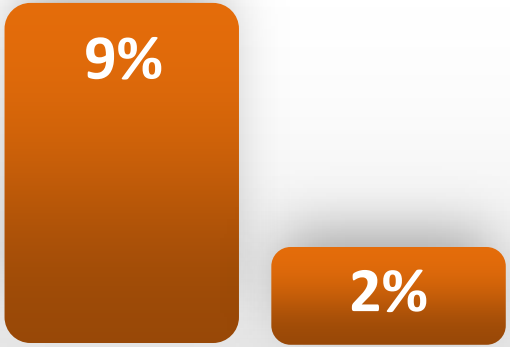
References:
1 The Affordable Care Act. www.hhs.gov/healthcare/rights/law/. Accessed 12/18/14. **2** Hospital-Acquired Conditions. CMS. www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions.html. Accessed 12/18/14. **3** Guide to the Elimination of Orthopedic Surgical Site Infections. An APIC Guide 2010. **4** CMS to Improve Quality of Care during Hospital Inpatient Stays. CMS. http://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2014-Fact-sheets-items/2014-08-04-2.html. Accessed 12/18/14.

DOUBLE-GLOVING:

COVERING YOU AND YOUR PATIENTS

DOUBLE GLOVES SIGNIFICANTLY REDUCES RISK OF PERFORATION

PERFORATION RATES [1]



2006 meta-analysis of 14 low-risk surgical trials utilizing total of 8,885 gloves

ODDS RATIO [1]

4x

LOWER RISK OF PERFORATIONS WITH DOUBLE GLOVES

2006 meta-analysis of 14 low-risk surgical trials utilizing total of 8,885 gloves

RISK REDUCTION [2]

Healthcare worker risk is significantly decreased by

71%

when using double gloves vs. single gloves

2014 meta-analysis of 12 surgical trials including 3,437 patient procedures

CUMULATIVE EVIDENCE SUPPORTS THE PRACTICE OF 'DOUBLE-GLOVING'

References:

1 Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection. *Cochrane Database of Systematic Reviews*. 2006, Issue 3. Art. No.: CD003087. DOI: 10.1002/14651858.CD003087.pub2.

2 Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573.

DOUBLE GLOVES LOWERS PASSAGE OF BLOOD/BODILY FLUID

- Double layers of gloves wipe off substantial amount of blood/ bodily fluid that may reside on penetrating object [1]
- Double gloves reduced risk of blood exposure by **85%** when outer glove was punctured [2]

95% reduction in blood volume if sharps injury caused perforation in both inner and outer glove layers [2]

DOUBLE GLOVES REDUCE VIRAL LOAD IN THE EVENT THAT INNER AND OUTER GLOVE PERFORATIONS OCCUR

References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5 **2** Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92.

DOUBLE-GLOVING DECREASE VIRUS TRANSFER WITH GLOVE REMOVAL

FREQUENCY OF VIRUS TRANSFER [1]

Single-gloves significantly transferred virus more frequently to participants' hands during protective equipment removal than double gloves (78% vs. 23%)

AMOUNT OF VIRUS TRANSFER [1]

Single gloves significantly transferred more virus to participants' hands than with double-gloving

CDC RECOMMENDS DOUBLE-GLOVING FOR HANDLING CONFIRMED AND SUSPECTED CASES OF EBOLA[2]

Reference:
1 Casanova LM, Rutala WA, Weber DJ, et al. Effect of single- versus double-gloving on virus transfer to health care worker's skin and clothing during removal of personal protective equipment. *American Journal of Infection Control*. 2012;40:368-374. 2. Guidance on Personal Protective Equipment (PPE) To Be Used By Healthcare Workers during Management of Patients with Confirmed Ebola or Persons under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE http://www.cdc.gov/vhf/ebola/healthcare-us/ppe/guidance.html. Accessed November 12, 2015.

DOUBLE-GLOVING MAY INFLUENCE CAUTIOUS BEHAVIOR

- 2014 Cochrane meta-analysis[1]
  - Double gloves reduced the number of reported needlestick injuries by **42%** in two studies
  - Overall outer glove perforation rate did not significantly differ between single versus double gloves

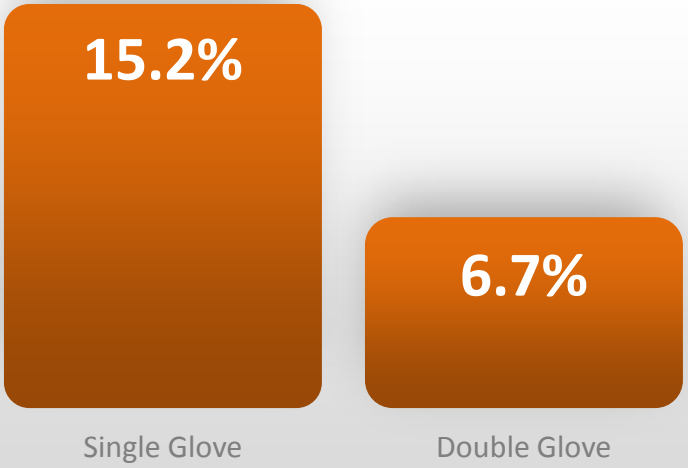
DOUBLE-GLOVING MAY INCREASE AWARENESS AND INFLUENCE BEHAVIOR IN PERFORMING THE TASK MORE SAFELY THUS HAVING ADDITIONAL PROTECTIVE EFFECT

Reference:
1 Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573.

CASE STUDY:

DOUBLE-GLOVING SUBSTANTIALLY REDUCES SHUNT INFECTIONS

- 2006 retrospective study Vanderbilt University Medical Center
  - Purpose: determine effect of double-gloving on cerebrospinal fluid (CSF) shunt infections
- Overall infection rate: **11.8%** (102/863 shunts)
- **2.3x greater risk** of shunt infection when single gloves are used compared to double gloves



Reference:
1 Tulipan N, Cleves MA. Effect of an intraoperative double-gloving strategy on the incidence of cerebrospinal fluid shunt infection. *J Neurosurg*. 2006;104(1 Suppl):5-8.

CASE STUDY:

DOUBLE-GLOVING REDUCES INNER GLOVE PERFORATIONS

- 2007 prospective, cohort study at University of Florida College of Medicine OB/GYN Department [1]
  - Purpose: compare frequency of glove perforations in double vs. single glove
  - Tested 1000 sets of gloves (675 sets were double glove and 325 sets were single glove)

RESULTS

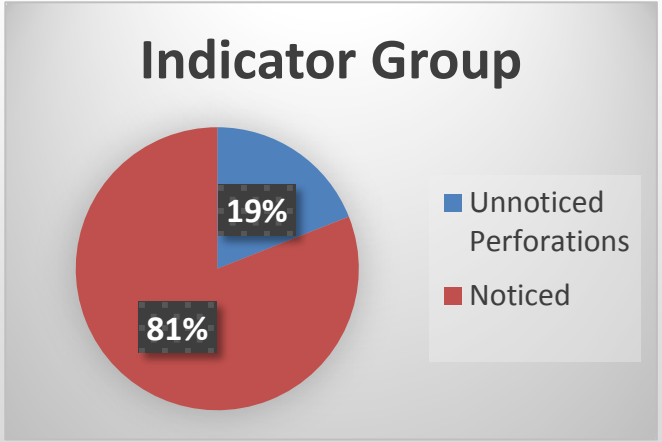
- No difference in total perforation rate of outer gloves (10% double-glove vs 11% single glove)
- Potential for blood-skin exposure was significantly greater for single gloves ($p<.01$)
  - **11%** of single gloves vs. **2%** of double gloves with both inner and outer perforations

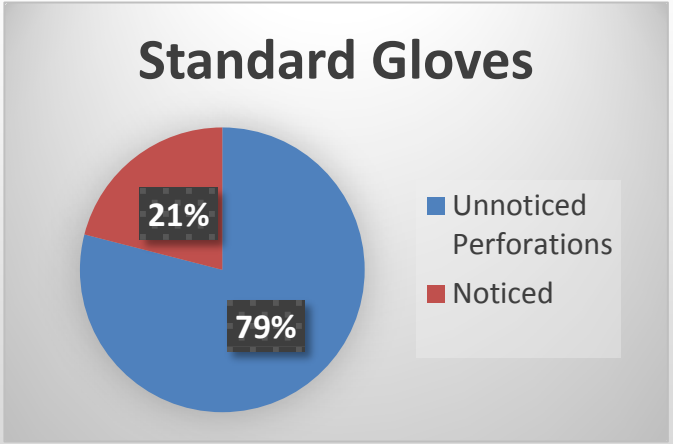
Reference:
1 Lancaster C, Duff P. Single versus double-gloving for obstetric and gynecologic procedures. *Am J Obstet Gynecol*. 2007 ;196(5):e36-7.

ENHANCED PROTECTION WITH INDICATOR GLOVES

ACCURACY

- Use of indicator glove allows punctures to outer glove to be more visually revealed when they occur[1,2]





References:

1. Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.
2. Walczak DA, Pawelczak D, Grobelski B, Pasieka Z. Surgical gloves-do they really protect us? *Pol Przegl Chir*.2014;86(5):238-43. doi: 10.2478/pjs-2014-0042.

EARLIER IDENTIFICATION WITH INDICATOR GLOVES

RAPID IDENTIFICATION [1]

Latex Indicator Glove	Latex Standard Glove	Synthetic Indicator Glove	Synthetic Standard Glove
84% OF HOLES IN **22** SECONDS	**8%** OF HOLES IN **47** SECONDS	**56%** OF HOLES IN **42** SECONDS	**12%** OF HOLES IN **67** SECONDS

EVIDENCE SUPPORTS USE OF COLOR INDICATOR SYSTEM FOR DETECTING PERFORATIONS WHEN DOUBLE-GLOVING

References:
1 Florman S, Burgdorf M, Finigan K, et al. Efficacy of double gloving with an intrinsic indicator system. *Surgical Infections*. 2005;6(4): 385-395.

UNCLEAR EFFECTS OF OTHER GLOVE BEHAVIORS

THICKER GLOVES

- Significantly less fluid was transmitted and more force was required to puncture with double, thin glove layer compared with single thick layer [1]

TRIPLE GLOVES

- May further reduce risk, but more research is necessary [2]

SPECIAL MATERIAL GLOVES

- May further reduce risk, but more research is necessary [2]

RESEARCHERS CONCLUDED THAT

"prevention of percutaneous exposure incidents can be successfully achieved with an increase in the number of glove layers, rather than by increasing the thickness of gloves" [2]

References:

1 Din SU, Tidley MG, Needlestick fluid transmission through surgical gloves of the same thickness. *Occupational Medicine*. 2014;64:39-44.

2 Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573.

A RECOMMENDED PRACTICE ACROSS SOCIETIES

AAOS
American Academy of Orthopaedic Surgeons

American College of Surgeons
Inspiring Quality: Highest Standards, Better Outcomes

AfPP
Progressing Safer Surgery

AORN

AST
Association of Surgical Technologists

CDC
Centers for Disease Control and Prevention

DOUBLE GLOVE ADOPTION IS LOW DESPITE SUPPORTIVE DATA

- Fewer than 1/3 of surgeons report using double-gloving in >75% of cases [1]

	ATTENDINGS	RESIDENTS
Use double-gloving in >75% of the time	29%	36%
Aware of ACS guideline for double-gloving	68%	58%
Agree double-gloving reduces injuries	55%	62%

Reference:
1 Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92.

WHY HEALTHCARE WORKERS CHOOSE NOT TO DOUBLE GLOVE

- Discomfort and/or too tight [1-3]
- Perceived restriction of dexterity [2,3]
- Habit of not using [1]
- Impaired sensation of touch/tingling [2,3]
- Uninformed about consequences of blood and body fluid contamination [4]

ONE STUDY FOUND OVER **50%** OF HEALTHCARE RESPONDENTS DON'T BELIEVE DOUBLE-GLOVING PROVIDES ADDED PROTECTION[1]

References:
1 Maqbali A. Using double gloves in surgical procedures: a literature review. *Br J Nurs*. 2014 Nov 27-Dec 10;23(21):1116-22. doi: 10.12968/bjon.2014.23.21.1116. **2** Yang L, Mullan B. Reducing needle stick injuries in healthcare occupations: an integrative review of the literature. *ISRN Nursing*. 2011:1-11. **3** Korniewicz D, El-Masri M. Exploring the benefits of double gloving during surgery. *AORN J*. 2012;95:328-336. **4** Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

BAD HABITS CAN BE BROKEN

- One study showed **88%** of study participants accepted wearing double gloves when asked [1]
- Double-gloving becomes instinctive to those exposed in the beginning their training [2]

TYPICALLY TAKES 2 DAYS
(RANGE 1-120 DAYS) TO BECOME
USED TO DOUBLE-GLOVING [2]

References:
1 McNeilly L. Double gloving: myth versus fact. *Infection Control Today*. 2011;1-4.
2 Walczak DA, Pawelczak D, Grobelski B, Pasieka Z. Surgical gloves-do they really protect us? *Pol Przegl Chir*.2014;86(5):238-43. doi: 10.2478/pjs-2014-0042.

TACTILE SENSITIVITY IS PERCEIVED BUT UNSUBSTANTIATED

- Several studies concluded double-gloving has similar tactile sensitivity to single gloves as shown by: [1-4]
  - ✓ Similar dexterity performance scores
  - ✓ Ability to tie surgical knots
  - ✓ "Dice test"
  - ✓ 2-point discrimination test compared to single gloves
- Overall outer glove perforation rate did not significantly differ between single versus double gloves [5]
- One study reported **88%** of the study participants who reported double gloves as acceptable did not perceive any decrease in tactile sensitivity [6]
- Double-gloving also does not impede with **"feeling"** a needlestick [7]

References:
1 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32. **2** Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92. **3** Fry DE, Harris WE, Kohnke EN, Twomey CL. Influence of double-gloving on manual dexterity and tactile sensation of surgeons. *American College of Surgeons*. 2010;1-6. **4** Wittmann A, Kralj N, Kover J, et al. Study of blood contact in simulated surgical needlestick injuries with single or double latex gloving. *Infect Control Hosp Epidemiol.* 2009 ;30(1):53-6. 5 Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573 **6** McNeilly L. Double gloving: myth versus fact. *Infection Control Today*. 2011;1-4. **7** Korniewicz D, El-Masri M. Exploring the benefits of double gloving during surgery. *AORN J*. 2012;95:328-336.

IMPLEMENTING A DOUBLE GLOVE PROTOCOL

KNOW THE BARRIERS TO CHANGE

- A 2015 study found that risk perception and healthcare culture are more influential in in determining gloving practice rather than personal characteristics[1]
  - Knowledge and training gaps [2]
  - Misperception of risk [2,3]
  - Concerns of decreased tactile sensation [2]
  - Lack of promotion by leadership [2]
  - Hospital/healthcare culture [2,3]
  - Availability and access to supplies [3]

References:
1 Kinlin LM, Mittleman MA, Harris AD, et al. Use of gloves and reduction of risk of injury caused by needles or sharp medical devices in healthcare workers: results from a case-crossover study. *Infect Control Hosp Epidemiol*. 2010;31(9):908-17. **2** Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt)*. 2013;14(3):288-92. **3** Mischke C, Verbeek JH, Saarto A, et al. Gloves, extra gloves or special types of gloves for preventing percutaneous exposure injuries in healthcare personnel. *Cochrane Database Syst Rev*. 2014;3:CD009573

SUCCESSFULLY IMPLEMENTING DOUBLE GLOVE PROTOCOL

CHECKLIST [1,2]

- ✓ Obtain “buy-in” from leadership
- ✓ Provide education on rationale for change (i.e. risks, consequences)
- ✓ Promotion of relevant literature to disprove misconceptions (i.e. tactile sensitivity)
- ✓ Train on safety techniques and proper glove selection
- ✓ Preoperative checklist
- ✓ Ensure gloving resources are available
- ✓ Institutional policy change, mandating adoption
- ✓ Monitor personnel compliance and implement quality improvement strategies when needed

NEED MULTIMODAL APPROACH TO ENHANCE AND PROMOTE CHANGE

References:
1 Welc CM, Nassiry A, Elam K, et al. Continued non-compliance with the American College of Surgeons recommendations to decrease infectious exposure in the operating room: why? *Surg Infect (Larchmt).* 2013;14(3):288-92. **2** Childs T. Use of double gloving to reduce surgical personnel’s risk of exposure to bloodborne pathogens: an integrative review. *AORN*. 2013;98(6):585-596.

ENCOURAGEMENT IN GLOVE SELECTION

- Choosing the right glove [1]
  - Primary factors: strength, durability, and glove thickness
- Try different combinations to find what feels right [2]
  - Study found wearing larger glove on outside was more comfortable than wearing the larger glove on inside; however, some prefer the reverse

References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5.
2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

BEST PRACTICES TO CONSIDER

- Regard all patients as potentially infections and implement standard precautions with every patient [1]
- Protect both patients and yourself from risk of cross infection [1]
- Nurses play a key role in implementation of evidence-based practices [1]
- Provide effective care that is current and of best practice [1]
- Wear properly sized gloves [2]
- If perforations occur, prudent to change both inner and outer gloves as soon as possible once noted [2]
- Change gloves frequently[2]
- Employ good hand hygiene both pre- and post- operative [1]
- Implement sharps safety practices

References:
1 Phillips S. The comparison of double gloving to single gloving in the theatre environment. *J Perioper Pract*. 2011 Jan;21(1):10-5.
2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.

SUMMARY

- Glove perforations can lead to direct contact between healthcare workers and patients resulting in transmission of infection [1]
- Both healthcare workers and patients are at risk of detrimental effects that glove perforation can impose [1]
- Double-gloving protects both the health care provider and patient [2]
- Double-gloving is the simplest, most effective, and cost-beneficial method of reducing risk of infection [3]
- Evidence supports the use of color indicator system for detecting perforations when double-gloving [2]

YOU ARE EXPOSED, BARE, WITHOUT UNIVERSAL ADOPTION OF DOUBLE-GLOVING

References:
1 Maqbali A. Using double gloves in surgical procedures: a literature review. *Br J Nurs*. 2014 Nov 27-Dec 10;23(21):1116-22. doi: 10.12968/bjon.2014.23.21.1116.
2 Thomas-Copeland J. Do Surgical Personnel Really Need to Double-Glove? *AORN J*. 2009;89(2):322-8; quiz 329-32.
3 Walczak DA, Pawelczak D, Grobelski B, Pasieka Z. Surgical gloves-do they really protect us? *Pol Przegl Chir*.2014;86(5):238-43. doi: 10.2478/pjs-2014-0042.

QUESTIONS?

Following the Q & A session, the webinar will adjourn, and you will be directed to the course evaluation and printable certificate

Thank you for attending this continuing education presentation.