

How-to Guide: Improving Hand Hygiene

A Guide for Improving Practices among Health Care Workers

This guide was prepared in collaboration with the Centers for Disease Control and Prevention (CDC), the Association for Professionals in Infection Control and Epidemiology (APIC), and the Society of Healthcare Epidemiology of America (SHEA), and has been endorsed by APIC and SHEA. Valuable input also was provided by the World Health Organization's World Alliance for Patient Safety through the Global Patient Safety Challenge.



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Acknowledgments

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The purpose of this guide is to help organizations reduce health-care-associated infections, including infections due to antibiotic-resistant organisms, by improving hand hygiene practices and use of gloves among health care workers.

The Case for Improving Hand Hygiene and Use of Gloves among Health Care Workers

Health-care-associated infections are an important cause of morbidity and mortality among hospitalized patients worldwide. Such infections affect nearly 2 million individuals annually in the United States and are responsible for approximately 80,000 deaths each year. Transmission of health-care-associated pathogens most often occurs via the contaminated hands of health care workers. Accordingly, hand hygiene (i.e., handwashing with soap and water or use of a waterless, alcohol-based hand rub) has long been considered one of the most important infection control measures for preventing health-care-associated infections. However, compliance by health care workers with recommended hand hygiene procedures has remained unacceptable, with compliance rates generally below 50% of hand hygiene opportunities.

- Jarvis WR. Selected aspects of the socioeconomic impact of nosocomial infections: Morbidity, mortality, cost, and prevention. *Infect Control Hosp Epidemiol.* 1996 Aug;17(8):552-557.
- Pittet D, Mourouga P, Perneger TV. Compliance with handwashing in a teaching hospital. *Ann Intern Med.* 1999;130:126-130.
- Lankford MG, Zemblower TR, Trick WE, Hacek DM, Noskin GA, Peterson LR. Influence of role models and hospital design on hand hygiene of healthcare workers. *Emerg Infect Dis.* 2003;9:217-23.

Many factors have contributed to poor handwashing compliance among health care workers, including a lack of knowledge among personnel about the importance of hand hygiene in reducing the spread of infection and how hands become contaminated, lack of understanding of correct hand hygiene technique, understaffing and overcrowding, poor access to handwashing facilities, irritant contact dermatitis associated with frequent exposure to soap and water, and lack of institutional commitment to good hand hygiene.

- Pittet D, Boyce JM. Hand hygiene and patient care: Pursuing the Semmelweis legacy. *Lancet Infect Dis.* 2001;1:9-20.

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To overcome these barriers, the Centers for Disease Control and Prevention's (CDC's) Healthcare Infection Control Practices Advisory Committee (HICPAC) published a comprehensive *Guideline for Hand Hygiene in Health-Care Settings* in 2002. One of the principal recommendations of this guideline was that waterless, alcohol-based hand rubs (liquids, gels or foams) are the preferred method for hand hygiene in most situations due to the superior efficacy of these agents in rapidly reducing bacterial counts on hands and their ease of use. Alcohol preparations also rapidly kill many fungi and viruses that cause health-care-associated infections. The guideline recommended that health care facilities develop multidimensional programs to improve hand hygiene practices.

- Boyce JM, Pittet D, et al. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbidity and Mortality Weekly Report*. 2002;51(RR16):1-45.

Recognizing a worldwide need to improve hand hygiene in health care facilities, the World Health Organization (WHO) launched its *Guidelines on Hand Hygiene in Health Care (Advanced Draft)* in October 2005. These global consensus guidelines reinforce the need for multidimensional strategies as the most effective approach to promote hand hygiene. Key elements include staff education and motivation, adoption of an alcohol-based hand rub as the primary method for hand hygiene, use of performance indicators, and strong commitment by all stakeholders, such as front-line staff, managers and health care leaders, to improve hand hygiene.

- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary*. World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

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Wearing gloves during patient care is an additional intervention to help reduce transmission of infectious agents in high-risk situations. Gloves protect patients by reducing contamination of the health care worker's hands and subsequent transmission of pathogens to other patients. In addition, when gloves are worn in compliance with CDC's Standard Precautions, gloves protect health care workers from exposure to bloodborne infections such as HIV and hepatitis B and C.

However, gloves must be used properly. Gloves can become contaminated during care and must be removed or changed when moving from a contaminated site to a clean site on the same patient. Gloved hands can also become contaminated due to tiny punctures in the glove material or during glove removal; therefore, hand hygiene must be performed immediately after glove removal. Consequently, use of gloves is an important adjunct to, but not a replacement for, proper hand hygiene practice.

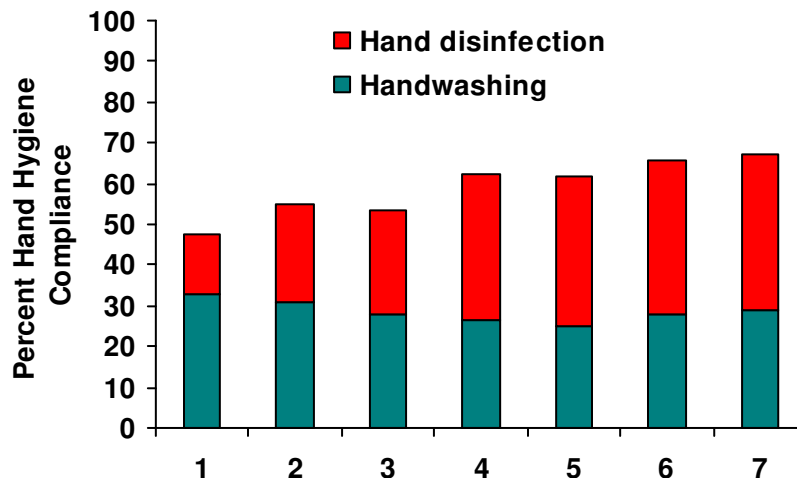
- Pittet D, et al. Bacterial contamination of the hands of hospital staff during routine patient care. *Arch Intern Med.* 1999;159:821-826.
- Pessoa-Silva CL, Richtmann R, Calil et al. Dynamics of bacterial hand contamination during routine neonatal care. *Infect Control and Hosp Epidemiol.* 2004;25:192-197.
- Tenorio AR, Badri SM, Sahgal NB, et al. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant Enterococcus species by health care workers after patient care. *Clin Infect Dis.* 2001;32:826-829.
- Johnson S, Gerding DN, et al. Prospective, controlled study of vinyl glove use to interrupt Clostridium difficile nosocomial transmission. *Am J Med.* 1990;88:137-140.
- Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol.* 1996;17:53-80. [Available online at http://www.cdc.gov/ncidod/dhqp/gl_isolation.html]

The Potential Impact of Improving Hand Hygiene

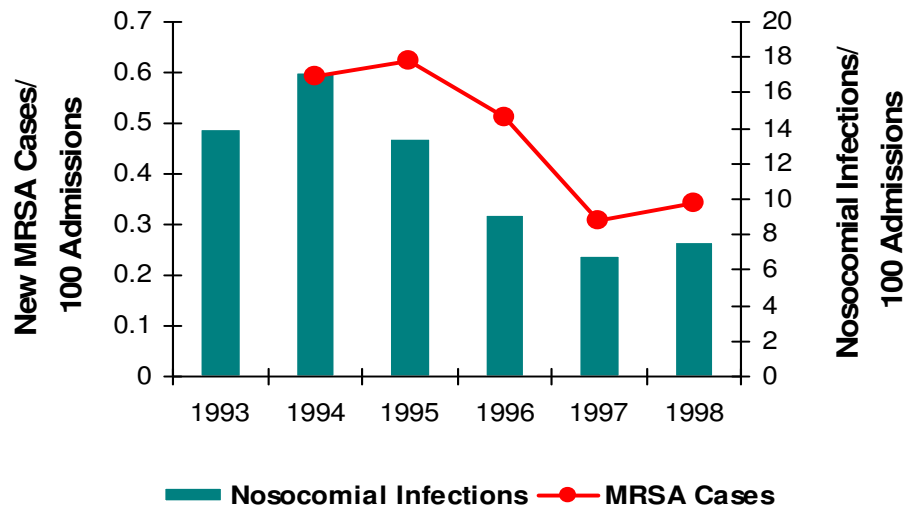
Numerous studies have suggested that hand hygiene compliance can be improved, at least modestly, by a variety of interventions, introduction of alcohol-based hand rub and educational and behavioral initiatives. Most authorities believe that multidimensional interventions are more effective. For example, Pittet et al. implemented a multidisciplinary, multimodal hand hygiene improvement program featuring promotion of alcohol-based hand rub and achieved substantial improvement in hand hygiene compliance. Much of the improvement in compliance was attributed to increased use of the alcohol-based hand rub. As hand hygiene compliance improved, both the incidence of nosocomial infections and new methicillin-resistant *Staphylococcus aureus* (MRSA) cases decreased, although the authors did not assert that they had rigorously demonstrated a causal link (see figures below).

- Pittet D, Hugonnet S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet*. 2000;356:1307-1312.

Impact of Interventions on Handwashing and Hand Disinfection with an Alcohol-Based Hand Rub



Impact of Hand Hygiene on Incidence of Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Nosocomial Infections



The Hand Hygiene Intervention Package

The hand hygiene intervention package is a group of best practices that individually improve care, but when applied together should result in substantially greater improvement. The science supporting each intervention is sufficiently established to be considered a standard of care.

The following four components of the hand hygiene intervention package are critical aspects of a multidimensional hand hygiene program. Glove use is included in this package because proper glove use is inextricably linked to effective hand hygiene.

1. Clinical staff, including new hires and trainees, understand key elements of hand hygiene practice (demonstrate knowledge)
2. Clinical staff, including new hires and trainees, use appropriate technique when cleansing their hands (demonstrate competence)
3. Alcohol-based hand rub and gloves are available at the point of care (enable staff)

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4. Hand hygiene is performed at the right time and in the right way and gloves are used appropriately as recommended by CDC's Standard Precautions (verify competency, monitor compliance, and provide feedback)

1. Clinical staff, including new hires and trainees, understand key elements of hand hygiene practice (demonstrate knowledge)

Health care workers' hands can become contaminated by touching the body secretions, excretions, nonintact skin, and wounds of patients; however, they can also become contaminated by touching intact skin of patients and environmental surfaces in the immediate vicinity of the patients. Health care workers should demonstrate accurate knowledge that their hands can become contaminated during all of these activities.

- Pittet D, Dharan S, Touveneau S, Savan V, Perneger TVI. Bacterial contamination of the hands of hospital staff during routine patient care. *Arch Intern Med.* 1999;159:821-826.
- Duckro AN, Blom DW, Lyle EA, Weinstein RA, Hayden MKI. Transfer of vancomycin-resistant enterococci via health care worker hands. *Arch Intern Med.* 2005;165:302-307.

Compared to handwashing, alcohol-based hand rubs have been shown to be more effective in reducing the number of viable bacteria and viruses on hands, require less time to use, can be made more accessible at the point of care, and cause less hand irritation and dryness with repeated use. Handwashing is required when hands are visibly contaminated and is also appropriate after caring for patients with diarrhea, including patients with *Clostridium difficile* associated diarrhea, before eating, and after use of the restroom. Health care workers should demonstrate accurate knowledge of the advantages of the use of hand rubs in most situations as well as the specific indications for handwashing.

- Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbidity Mortality Weekly Report.* 2002;51:1-45.

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- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary*. World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

»What changes can we make that will result in improvement?

Hospital teams across the United States and in other countries around the world have developed and tested change strategies that allowed them to improve knowledge of key elements of hand hygiene practice. Successful strategies include:

- Discussing the types of patient care activities that result in hand contamination as a supplement to educational material provided to health care workers
- Discussing with clinical staff the relative advantages and disadvantages of handwashing and use of alcohol-based hand rubs at the point of care
- Emphasizing the important role that contaminated hands play in transmission of health-care-associated pathogens, including multidrug-resistant pathogens and viruses
- Informing clinical staff of the morbidity and mortality caused by health-care-associated infections

2. Clinical staff, including new hires and trainees, use appropriate technique when cleansing their hands (demonstrate competency)

To be optimally effective, an appropriate volume of alcohol-based hand rub or soap must be applied to all surfaces of the hands and fingers for a sufficient length of time. Failure to do so will reduce the efficacy of the hand hygiene regimen. Accordingly, clinical staff should demonstrate competency in performing hand hygiene correctly. Competent hand rubbing requires that a sufficient volume of an alcohol-based rub is applied to cover all surfaces of the hands and fingers and that at least 15 seconds of rubbing is necessary before the hands are dry. Competent handwashing requires that a sufficient volume of soap is applied to cover all surfaces of the hands and fingers, and that at least 15 seconds of scrubbing with friction is performed before rinsing. Care should be taken to avoid contamination of hands after handwashing (paper towels or

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single use cloth towels should be used; if the faucet is hand-operated, the towel should be used to turn of the spigot).

- Larson EL, Eke PI, Wilder MP, Laughon BE. Quantity of soap as a variable in handwashing. *Infect Control*. 1987;8:371-375.
- Widmer AE, Dangel M. Alcohol-based hand rub: Evaluation of technique and microbiological efficacy with international infection control professionals. *Infect Control Hosp Epidemiol*. 2004;25:207-209.

»What changes can we make that will result in improvement?

Hospital teams have developed and tested change strategies that allow them to improve competence with hand hygiene practices. Some of these changes include:

- Conducting live demonstrations of correct techniques for using an alcohol-based hand rub and handwashing during educational sessions for health care workers
- Providing videotape presentations of correct handwashing and hand rubbing technique in educational material for health care workers
- Emphasizing that an appropriate volume of hand rub or soap must be used if hand hygiene is to be effective
- Using fluorescent dye-based training methods to demonstrate correct hand hygiene techniques to clinical staff
- Periodically monitoring the adequacy of hand hygiene technique among clinical staff, and giving them feedback regarding their performance

3. Alcohol-based hand rub and gloves are available at the point of care (enable staff)

Placing alcohol-based hand rub dispensers near the point of care has been associated with increased compliance by health care workers with recommended hand hygiene procedures.

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For example, Bischoff et al. found that compliance by health care workers was significantly greater when dispensers for alcohol-based hand rub were adjacent to each patient's bed than when there was only one dispenser for every four beds. In critical care, availability of alcohol-based hand rub at the point of care proved to minimize the time constraint associated with hand hygiene during patient care and to predict better compliance. In a study of hand hygiene among physicians, Pittet et al. found that easy access to an alcohol-based hand rub was an independent predictor of improved hand hygiene compliance.

- Bischoff WE, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP. Handwashing compliance by health care workers: The impact of introducing an accessible, alcohol-based hand antiseptic. *Arch Intern Med.* 2000;160:1017-1021.
- Pittet D, Hugonnet S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet.* 2000;356:1307-1312.
- Hugonnet S, Perneger TV, Pittet D. Alcohol-based hand rub improves compliance with hand hygiene in intensive care units. *Arch Int Med.* 2002;162:1037-1043.
- Pittet D, Simon A, Hugonnet S, et al. Hand hygiene among physicians: Performance, beliefs, and perceptions. *Ann Intern Med.* 2004;148:1-8.

Availability of alcohol-based products at the point of care should be supplemented by availability of gloves in appropriate sizes for use in the high-risk situations described previously for which barrier technique is indicated. Sterile gloves are not required for this purpose; studies have shown that clean single-use gloves have negligible numbers of non-pathogenic microorganisms when cultured.

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Hospital teams that have developed and tested change strategies to make alcohol-based hand rub and clean gloves readily available to health care workers saw improved hand hygiene compliance. Some of these changes include:

- Placing dispensers for alcohol-based hand rub and boxes of clean gloves of various sizes near the point of care, such as:
 - Next to each patient's bed
 - Attached to the frame of patient beds

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- Near the door to each patient's room (either adjacent to the door in the corridor or just inside the door)
- At nursing stations or on medication carts
- Supplied as portable (pocket or belt) individual dispensers for personal use
- Installing alcohol-based hand rub dispensers in locations that are compliant with local and federal fire safety regulations
- Assigning responsibility for checking alcohol-based hand rub dispensers and glove boxes on a regular basis to assure that:
 - Dispensers and glove boxes are not empty
 - Dispensers are operational
 - Dispensers provide the correct amount of the product
- Evaluating the design and function of dispensers before selecting a product for use since poorly functioning dispensers may adversely affect hand hygiene compliance rates

4. Hand hygiene is performed and gloves are used appropriately as recommended by CDC's Standard Precautions (verify competency, monitor compliance, and provide feedback)

Clinical staff should clean their hands according to recommendations listed in the CDC *Guideline for Hand Hygiene in Health-Care Settings*. These recommendations include:

- Washing hands with plain soap or with antimicrobial soap and water, as follows:
 - When hands are visibly dirty or contaminated with proteinaceous material or with blood or other body fluids
 - Before eating
 - After using the restroom
 - After caring for patients colonized with *Clostridium difficile*
- If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in the following situations:

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- Before direct contact with patients
- Before donning sterile gloves when inserting a central intravascular catheter
- Before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices
- After direct contact with a patient's skin
- After contact with body fluids, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled
- When moving from a contaminated body site to a clean body site during patient care
- After contact with inanimate objects in the immediate vicinity of the patient
- After removing gloves
- If there has been any contact with the patient or the patient's environment, hands should be decontaminated when leaving the patient's bedside or room
- Boyce JM, Pittet D, et al. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbidity and Mortality Weekly Report*. 2002;51(RR16):1-45.
- *WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary*. World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

Clinical staff should wear gloves according to recommendations listed in CDC's Standard Precautions. These recommendations include:

- Wearing gloves when contact with blood or other potentially infectious body fluids, excretions, secretions (except sweat), mucous membranes, and nonintact skin could occur
- Removing gloves after caring for a patient — personnel should not wear the same pair of gloves for the care of more than one patient
- Changing gloves during patient care when moving from a contaminated body site to a clean body site
- Performing hand hygiene immediately after removal of gloves

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- Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol*. 1996;17:53-80. [Available online at http://www.cdc.gov/ncidod/dhqp/gl_isolation.html]
- WHO Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary. World Health Organization; 2005. [Available online at http://www.who.int/patientsafety/events/05/HH_en.pdf]

»What changes can we make that will result in improvement?

Hospital teams have developed and tested change strategies that allow them to improve hand hygiene practice and use of gloves by health care workers. Some of these changes include:

- Incorporating the indications for hand hygiene and use of gloves in educational material presented to health care workers. Examples of educational materials include:
 - Periodic lectures given by knowledgeable personnel, including interactive, audience-response software, if possible
 - Videotapes and PowerPoint presentations that demonstrate the importance of proper hand hygiene techniques in health care settings
 - Interactive, computer-assisted learning available to clinical staff via the hospital's Intranet
- Conducting educational programs for personnel that include instructions for proper technique when washing hands with soap and water, or when using an alcohol-based hand rub
- Ensuring that providers understand the rationale for hand hygiene and gloves and can comply with best practices and improve patient outcomes (self-efficacy)
- Initiating a multi-component publicity campaign (e.g., posters with photos of celebrated hospital doctors/staff members recommending hand hygiene and use of gloves; drawings by children in pediatric hospitals; screen savers with targeted messaging)
- Using opinion leaders as role models and educators (“academic detailing”)
- Creating a culture where reminding each other about hand hygiene and use of gloves is encouraged and makes compliance the social norm

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- Enabling health care workers to comply with best hand hygiene and glove practices by creating reliable systems that ensure alcohol-based hand hygiene products and gloves in appropriate sizes are always readily available at the point of care
- Engage patients and families in hand hygiene efforts by providing patient safety “tip sheets” outlining appropriate hand hygiene and glove practices, and encouraging them to remind health care providers to comply with these standards
- Monitoring compliance by health care workers with recommended indications for hand hygiene and use of gloves, including real-time feedback to personnel and trending compliance over time

How to Begin Improvement in Your Organization

Forming the Team

The Institute for Healthcare Improvement (IHI) recommends a multidisciplinary team approach to improving hand hygiene among health care workers. Improvement teams should be heterogeneous in make-up, but unified in mindset. The value of bringing diverse personnel together is that all members of the care team are given a stake in the outcome and work together to achieve the same goal.

Including all stakeholders in the process to implement proper hand hygiene techniques will help gain buy-in and cooperation of all parties. For example, teams without nurses are bound to fail. Teams led by nurses and therapists may be successful, but often lack leverage; physicians must also be part of the team. The team should include, at a minimum, an administrator or senior leader who can help remove barriers to implementation, as well as a member of the department that supplies hand hygiene agents to clinical areas. Involve the team in designing or selecting hand hygiene posters or other motivational and educational materials.

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Some suggestions for attracting and retaining excellent team members include: using data to define and solve the problem; finding champions and opinion leaders within the hospital to lend the effort immediate credibility; and engaging individuals who want to work on the project rather than trying to convince those who do not.

Commitment of institutional leadership is a key determinant of success. There must be alignment of leadership, including the board, executives, heads of clinical departments, and the infection control team. Leadership should give encouragement, set expectations, remove barriers, and celebrate success. Concrete, “raise-the-bar” goals (i.e., those that strive to achieve unprecedented levels of performance) set the stage for achieving rates of compliance well beyond historical levels. An “all-or-none” mentality for compliance (i.e., performing all elements of good practice) is necessary to achieve the highest possible levels of reliable performance. From the patient’s perspective, compliance with all elements of appropriate hand hygiene and glove practice is a reasonable expectation.

Once high levels of compliance are achieved, a “process owner” must be identified — the person who will ensure that high levels of performance are maintained and help to troubleshoot key aspects of the hand hygiene program if the compliance rate falls.

Setting Aims

Dramatic improvement requires setting clear aims and quantitative time-specific improvement targets. An organization will not improve without a firm commitment and measurable goals. Teams are more successful when they have unambiguous, focused aims. Setting numerical goals clarifies the aims, creates tension for change, directs measurement, and focuses initial changes. Once aims have been established, the team needs to be careful not to back away from the aims deliberately or “drift” away unconsciously. Appropriate resources and personnel time must be allocated to achieve raise-the-bar targets.

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An example of an appropriate aim for improving hand hygiene compliance can be as modest as, “Increase hand hygiene compliance by 25% within one year.” However, more aggressive targets are desirable. Consistent with the JCAHO’s National Patient Safety Goal #7, a raise-the-bar aim would be to improve hand hygiene compliance to greater than 90%. This latter goal helps change the focus from hand hygiene as a laudable practice to hand hygiene as a mandatory procedure. Regardless of the exact numeric target, the aim should be endorsed completely and enthusiastically by institutional leadership and opinion leaders.

Using the Model for Improvement

In order to move this work forward in your organization, IHI recommends using the Model for Improvement. Developed by Associates in Process Improvement, the Model for Improvement is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organizations to improve many different health care processes and outcomes.

The model has two parts:

- Three fundamental questions that guide improvement teams to: 1) set clear aims; 2) establish measures that will tell if changes are leading to improvement; and 3) identify changes that are likely to lead to improvement.
- Plan-Do-Study-Act (PDSA) cycles — small-scale tests of change in real work settings. Teams plan a test, try it, observe the results, and act on what is learned. It is critical for tests to be small and rapid (e.g., a test with two intensive care unit patients tomorrow). This is the scientific method applied to action-oriented learning.

Implementation:

After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the team can implement the change on a broader scale — for example, try to determine the best location for alcohol-based hand hygiene

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products and gloves at the point of care in just one or two rooms in the ICU; try including checks on the availability of alcohol-based hand hygiene products and compliance with hand hygiene and glove policies in multidisciplinary rounds.

Spread:

After successful implementation of a change or package of changes for a pilot population or an entire unit, the team can spread the changes to other parts of the organization or to other organizations.

You can learn more about the Model for Improvement and how to spread improvements on IHI's website [<http://www.IHI.org/IHI/Topics/Improvement>].

Getting Started

Do not expect that the hand hygiene and glove intervention package can be implemented successfully overnight. A successful program involves careful planning, testing to determine if the processes are working, making modifications as needed, re-testing, and carefully implementing best practices.

- Select the team and the ward(s) for initial testing of change ideas.
- Assess current practice and compliance. Even if there is a hand hygiene and glove program currently in place, work with staff to begin preparing for changes to achieve raise-the-bar performance targets. Perform a survey to determine baseline hand hygiene and glove compliance rates. Determine how these compliance rates compare to those published in the literature.
- Organize an educational program. Teach the core principles of hand hygiene and glove practices to clinical staff throughout the hospital. Providing feedback to staff using baseline compliance data will open people's minds to opportunities for improvement.
- Assess satisfaction with current hand hygiene products. If an alcohol-based hand hygiene product is already available in the institution, interview caregivers about

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their satisfaction with the product in terms of degree of skin irritation, consistency (“stickiness”), drying time, scent, and ease of use and reliability of dispensers.

- If an alcohol-based hand hygiene product is not currently available in the institution, have nurses and some physicians trial two or three products to determine which one(s) are most acceptable to clinical staff before selecting the product to be used. It is also important to evaluate the design and function of dispensers before selecting a product for use since poorly functioning dispensers may adversely affect hand hygiene compliance rates.
- Solicit input from clinical staff (including nurses, physicians, respiratory therapists, and others on the care team) about the best locations for installing alcohol-based hand hygiene product dispensers.
- Introduce the hand hygiene intervention package to all staff.

First Test of Change

Once a team has prepared the way for change by studying the current process and educating health care providers, the next step is to begin testing the hand hygiene intervention package.

- Select a few nursing units on which to begin using the intervention package.
- Make sure that alcohol-based hand hygiene product dispensers have been installed at the point of care and are functioning properly.
- Ensure that there is an adequate supply of clean gloves of various sizes available at the point of care.
- Conduct educational sessions on individual nursing units, or sessions that can be attended by personnel from multiple nursing units. Include patient care managers in early educational sessions.
- Give demonstrations on the appropriate techniques for using an alcohol-based hand rub and handwashing with soap and water.
- Have a member of the team (e.g., an infection control professional) visit the nursing unit(s) to answer any questions about using an alcohol-based hand hygiene product routinely for cleansing hands and appropriate use of gloves.

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- Place hand hygiene promotion posters in highly visible locations throughout the hospital and begin a multi-modal campaign to improve performance.
- Engage patients and families by providing a patient safety “tip sheet,” including information about hand hygiene best practices. Encourage patients and families to remind clinical staff to comply with hand hygiene and glove policies.

Measurement

Measurement tools have been included as appendices in this guide:

- Appendix 1. Hand Hygiene Knowledge Assessment Questionnaire
- Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves
- Appendix 3. Hand Hygiene and Glove Use Monitoring Form

For Appendices 2 and 3, please refer to the forms for specific information regarding the recommended process and outcome measures for improving hand hygiene.

Compliance with all aspects of each of the four interventions in the hand hygiene package should be measured as “all-or-none.” In other words, if staff demonstrate correct knowledge of some, but not all, of the aspects of hand hygiene and glove use, they are not in compliance with the intervention package. If staff demonstrate only partial competency, they are not yet competent. If alcohol is present at the point of care but the dispenser is empty or gloves are not available, this is not compliant with the package. Similarly, all aspects of hand hygiene and glove use must be performed correctly during a patient encounter. This measurement strategy recognizes that raise-the-bar performance requires highly reliable care processes, and that from the patient’s point of view, partial compliance is unacceptable.

Measurement is the only way to know whether a change represents an improvement. There are a number of measures that can be used to determine if hand hygiene and glove use are improving.

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1. The percentage of caregivers who answer *all five questions* correctly on a standardized hand hygiene knowledge assessment survey

This measure assesses the proportion of clinical staff who demonstrate adequate knowledge of the key elements of hand hygiene and glove use. A simple, rapid, and low technology strategy is to assess the knowledge of caregivers in real time on the ward. Consider selecting a random sample of 10 clinical providers from diverse disciplines each month (or at other intervals specified by the hospital) to answer a five-question survey (see Appendix 1) in tandem with a competency check (see measure 2 below). Specific questions can be designated by the hospital and/or selected from examples in the survey in Appendix 1.

An alternative strategy is to assess knowledge using an Intranet-based learning or knowledge management system. Such electronic systems are being adopted rapidly by health care institutions in the United States. The clear advantage of this approach is that the entire clinical staff can be tested annually, or a sample may be tested at more frequent intervals. Completion of the assessment can be documented electronically and used for recertification purposes. Some systems can document which questions are being answered incorrectly, allowing direct measurement of the percent of caregivers who answer all of the questions correctly and facilitating design of targeted educational programs. However, some systems do not capture incorrect answers, and others allow personnel to retake the test as often as necessary to achieve a perfect score, making it impossible to calculate the required measure.

2. The percentage of caregivers who perform *all three key hand hygiene procedures* correctly

This is a simple, rapid, low technology strategy that can be used in tandem with the method described in measure 1. Randomly select a sample of 10 clinical providers from diverse disciplines each month (or at other intervals specified by the hospital) and

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observe them to determine if they perform the three key hand hygiene procedures correctly: handwashing, alcohol-based hand rub, and gloves. This method has the strength of direct evaluation and feedback, but is time consuming. It also provides an opportunity to ensure that providers are not wearing artificial nails or nail extenders and have their nails trimmed to less than ¼ inch.

- Boyce JM, Pittet D. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morbidity and Mortality Weekly Report*. 2002;51:1-45.

Alternatively, competence can be assessed by monitoring hand hygiene practices during actual work (see measure 4 below). This has the advantage of being unobtrusive and integrated with other monitoring activities, but precludes direct feedback and adds complexity to the monitoring process.

- Handwashing: Wash hands with soap and water, including contact with soap for at least 15 seconds, covering all surfaces (palm, back of hand, fingers, fingertips, and fingernails); rub with friction
 - Turn off water without recontaminating hands: If the faucet is hand-operated, use paper towel to turn off the faucet; if the faucet is automatic, credit for compliance is given for correct performance
 - Dry hands with fresh paper towel
- Alcohol-based hand hygiene product (rub, gel, or foam): Use enough to cover all surfaces (palm, back of hand, fingers, fingertips, and fingernails); rub until dry (at least 15 seconds), which ensures sufficient volume has been applied
- Remove gloves using correct technique (so as not to contaminate the hands with a contaminated glove surface)

3. The percentage of bed spaces at which there are clean gloves in appropriate sizes *and* dispensers (wall-mounted or free-standing bottles) for alcohol-based hand rub/gel/foam that contain product, are functional, and dispense an appropriate volume of product

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Make direct observations monthly (or at other intervals specified by the hospital) using a standardized procedure and form (see Appendix 2) on the same nursing units where measures 1 and 2 are monitored. Alternatively, availability can be assessed periodically as part of routine multidisciplinary rounds.

- Dispenser of alcohol-based product must be present, readily accessible at the point of care, not empty, functional, and capable of delivering the appropriate volume of product. If hand/pocket bottles are used, an adequate supply must be readily available and accessible on the ward.
- At least two sizes of gloves should be available and readily accessible at the point of care.

4. The percentage of patient encounters in which there is compliance by health care workers with all components of appropriate hand hygiene and glove practices

Compliance is monitored with direct observation by a trained observer using a standardized procedure and form (see Appendix 3). Independent observers are strongly recommended, preferably individuals who routinely are on the ward for other purposes and are not part of the care team. (This independent monitoring can be reinforced with monitoring by the care team during routine multidisciplinary rounds, which permits immediate assessment and feedback.) Observation periods should be 20-30 minutes (repeated if necessary) so that approximately 25-30 patient encounters are observed. The emphasis should be on observing complete encounters so that the proper measure of *complete* compliance with all components of the hand hygiene and glove intervention package can be calculated. Divide the number of encounters in which all components were performed correctly by the number of encounters observed and multiply by 100 to calculate the percentage compliance rate.

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“Complete compliance” is defined by the adherence with the hand hygiene techniques and use of gloves as outlined in the table below. Gloves should be worn for all types of contact if the patient is on isolation precautions that require the use of gloves for contact with the patient and the environment, or if there is a unit-based procedure for universal gloving (wearing gloves for contact with all patients and their immediate environment).

Type of contact	Hand hygiene before	Hand hygiene after	Use of gloves
Patient contact that involves an invasive procedure (i.e., insertion of an intravascular catheter, urinary catheter, or other invasive device)	Yes	Yes	Yes
Patient contact that involves direct contact or potential contact with blood, body fluids, secretions (except sweat), excretions, mucous membranes, and nonintact skin (i.e., wounds, ulcers)	Yes	Yes	Yes
Patient contact not involving those noted above (i.e., taking vital signs, examination, repositioning, etc.)	Yes	Yes	*
Contact with the patient environment	--	Yes	*

** Gloves should be worn for all types of contact if the patient is on isolation precautions that require the use of gloves for contact with the patient and the environment, or if there is a unit-based procedure for universal gloving (wearing gloves for contact with all patients and their immediate environment).*

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The following additional measure can also be used, but it does not replace direct observation of health care worker compliance during patient encounters:

- Volume of alcohol-based hand hygiene product consumed per week (or per month) divided by the number of patient days in the corresponding time period

Self-reporting by personnel or patients is not a reliable measure of compliance.

Barriers That May Be Encountered

- **Reluctance to change, tolerance of the status quo:** All change is difficult. The antidote is knowledge about the deficiencies of the present process and optimism about the potential benefits of a new process. The rate of compliance in most institutions is woeful, and dramatic improvement is possible.
- **Lack of leadership commitment and follow-through:** Hard work and good intentions cannot produce dramatic, long-term change without leadership buy-in and support.
- **Failure to educate and communicate:** Staff must understand the rationale for hand hygiene and glove practices, the danger of non-compliance to themselves and their patients, and the effectiveness and tolerability of hand hygiene products.
- **Failure to tailor product selection to staff preferences:** Staff should test products before they are introduced.
- **Lack of staff self-efficacy and empowerment:** Staff must believe that they have the ability and power to make major improvements.
- **Failure to make compliance a social norm and establish a culture of safety:** Staff must be empowered to remind other caregivers, regardless of rank or position, to practice hand hygiene. This should be reinforced by patients.
- **Failure to provide real time feedback of performance data:** Performance data should be communicated regularly and properly. Post trended data prominently.
- **Lack of a cohesive approach to behavior change:** A multi-factorial, creative approach to behavior change is essential.
- **Lack of physician buy-in:** Opinion leaders, role models, and physician champions, armed with educational materials and evidence, are essential.

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Appendix 1. Hand Hygiene Knowledge Assessment Questionnaire

Use this questionnaire to periodically survey clinical staff about their knowledge of key elements of hand hygiene. Select 5 questions from this survey, or use other questions derived from your hospital's existing educational program. **[NOTE: The correct answer for each question has been indicated below.]**

1. In which of the following situations should hand hygiene be performed? **[Correct answer: #4]**

- A. Before having direct contact with a patient
- B. Before inserting an invasive device (e.g., intravascular catheter, foley catheter)
- C. When moving from a contaminated body site to a clean body site during an episode of patient care
- D. After having direct contact with a patient or with items in the immediate vicinity of the patient
- E. After removing gloves

Circle the number for the best answer:

- 1. B and E
- 2. A, B and D
- 3. B, D and E
- 4. All of the above

2. If hands are not visibly soiled or visibly contaminated with blood or other proteinaceous material, which of the following regimens is the most effective for reducing the number of pathogenic bacteria on the hands of personnel? **[Correct answer: C]**

Circle the letter corresponding to the single best answer:

- A. Washing hands with plain soap and water
- B. Washing hands with an antimicrobial soap and water
- C. Applying 1.5 ml to 3 ml of alcohol-based hand rub to the hands and rubbing hands together until they feel dry

3. How are antibiotic-resistant pathogens most frequently spread from one patient to another in health care settings? **[Correct answer: C]**

Circle the letter corresponding to the single best answer:

- A. Airborne spread resulting from patients coughing or sneezing
- B. Patients coming in contact with contaminated equipment
- C. From one patient to another via the contaminated hands of clinical staff
- D. Poor environmental maintenance

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4. Which of the following infections can be potentially transmitted from patients to clinical staff if appropriate glove use and hand hygiene are not performed? **[Correct answer: E]**

Circle the letter corresponding to the single best answer:

- A. Herpes simplex virus infection
- B. Colonization or infection with methicillin-resistant *Staphylococcus aureus*
- C. Respiratory syncytial virus infection
- D. Hepatitis B virus infection
- E. All of the above

5. *Clostridium difficile* (the cause of antibiotic-associated diarrhea) is readily killed by alcohol-based hand hygiene products **[Correct answer: False]**

- True
- False

6. Which of the following pathogens readily survive in the environment of the patient for days to weeks? **[Correct answer: #3]**

- A. *E. coli*
- B. *Klebsiella spp.*
- C. *Clostridium difficile* (the cause of antibiotic-associated diarrhea)
- D. Methicillin-resistant *Staphylococcus aureus* (MRSA)
- E. Vancomycin-resistant enterococcus (VRE)

Circle the number for the best answer:

- 1. A and D
- 2. A and B
- 3. C, D, E
- 4. All of the above

7. Which of the following statements about alcohol-based hand hygiene products is accurate? **[Correct answer: C]**

Circle the letter corresponding to the single best answer:

- A. They dry the skin more than repeated handwashing with soap and water
- B. They cause more allergy and skin intolerance than chlorhexidine gluconate products
- C. They cause stinging of the hands in some providers due to pre-existing skin irritation
- D. They are effective even when the hands are visibly soiled
- E. They kill bacteria less rapidly than chlorhexidine gluconate and other antiseptic containing soaps

Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves

Unit/Dept.: _____ Day of Week: _____ Date: _____ / _____ / _____ Time: _____ : _____ AM/PM to _____ : _____ AM/PM Initials _____

Room #	Bedspace #	Hand rub bottle or dispenser			Disperses correct volume	Clean gloves near patient	Adherence to all elements	Comments	
		Near patient	Not empty	Functional					
1		Y N	Y N	Y N	Y N	Y N	Y N		
2		Y N	Y N	Y N	Y N	Y N	Y N		
3		Y N	Y N	Y N	Y N	Y N	Y N		
4		Y N	Y N	Y N	Y N	Y N	Y N		
5		Y N	Y N	Y N	Y N	Y N	Y N		
6		Y N	Y N	Y N	Y N	Y N	Y N		
7		Y N	Y N	Y N	Y N	Y N	Y N		
8		Y N	Y N	Y N	Y N	Y N	Y N		
9		Y N	Y N	Y N	Y N	Y N	Y N		
10		Y N	Y N	Y N	Y N	Y N	Y N		
11		Y N	Y N	Y N	Y N	Y N	Y N		
12		Y N	Y N	Y N	Y N	Y N	Y N		
13		Y N	Y N	Y N	Y N	Y N	Y N		
14		Y N	Y N	Y N	Y N	Y N	Y N		
15		Y N	Y N	Y N	Y N	Y N	Y N		
16		Y N	Y N	Y N	Y N	Y N	Y N		
17		Y N	Y N	Y N	Y N	Y N	Y N		
18		Y N	Y N	Y N	Y N	Y N	Y N		
19		Y N	Y N	Y N	Y N	Y N	Y N		
20		Y N	Y N	Y N	Y N	Y N	Y N		
21		Y N	Y N	Y N	Y N	Y N	Y N		
22		Y N	Y N	Y N	Y N	Y N	Y N		
23		Y N	Y N	Y N	Y N	Y N	Y N		
24		Y N	Y N	Y N	Y N	Y N	Y N		
25		Y N	Y N	Y N	Y N	Y N	Y N		
26		Y N	Y N	Y N	Y N	Y N	Y N		
27		Y N	Y N	Y N	Y N	Y N	Y N		
28		Y N	Y N	Y N	Y N	Y N	Y N		
29		Y N	Y N	Y N	Y N	Y N	Y N		
30		Y N	Y N	Y N	Y N	Y N	Y N		
Total # Y									
% Present									

Appendix 2. Checklist for the Availability of Alcohol-Based Hand Rub and Clean Gloves (continued)

Instructions:

1. Each row should be used to record data regarding the availability of an alcohol-based hand rub (liquid, gel, or foam) and clean gloves at the point of care for an individual patient. A point of care is a bedside, exam room, or treatment/procedure area. If multiple hand rub bottles or dispensers are available at a specific point of care, only one need be assessed. If pocket/belt bottles or dispensers are the primary way hand rub is dispensed in the unit or department, each row should be used to assess the bottle or dispenser for an individual health care worker providing care to patients in this unit or department during the assessment period.
2. The room number and bedside fields are used to facilitate a complete assessment of all points of care in a unit or department and for reference if problems are noted with the availability of hand-rub bottles or dispensers or clean gloves, or if additional comments are recorded.
3. To qualify as being near the patient, a hand-rub bottle or dispenser and clean gloves should be accessible to a health care worker who is standing or sitting at the point of care (i.e., close to the patient's bed or attached to the frame of the bed) or to a health care worker who approaches the point of care (i.e., inside the patient's room just inside the door or in the corridor adjacent to door).
4. For the purposes of this measurement exercise, each bottle or dispenser should be assessed with regard to its capacity to dispense the correct volume into the hand of the user when activated once (i.e., that the bottle is not empty, is functional and does not spray aberrantly, and dispenses correct volume of product). Additional comments regarding bottles that are poorly placed, nearly empty, or functioning incorrectly can be noted in the comments section of the form to facilitate remedial action.
5. Codes are: Y = Yes, N = No.
6. In the Adherence field, use the following rule: Y = if **all** elements are Y (that is, Near patient, Not empty, Functional, Dispenses correct volume, and Clean gloves near patient are **all** Y); N = if not.
7. Count the total number of Y for each column and record the total in box at the bottom of each column.
8. Calculate the percent adherence using the formula below and record the percent in the box at the bottom of each column.
Total # of Y ÷ Total # of Points of Care (number of rows with data recorded) x 100

Appendix 3. Hand Hygiene and Glove Use Monitoring Form (continued)

Instructions:

- Each row should be used to record an encounter between one healthcare worker (HCW) and one patient that involves touching by the HCW of the patient or the patient's immediate environment. In situations involving and extended or complicated encounter, it is appropriate to use more than one row (see #4 below). Encounters that do not involve touching (i.e., only verbal communication between the HCW and the patient) should not be recorded.
- An encounter may involve patient contact, environmental contact or both.
- Patient contact involves touching the patient's body, gown, or clothes. Environmental contact involves touching the patient's bed or bed linen, bedside equipment, or other equipment, supplies, articles, or surfaces in the patient's bedside or room.
- For the purposes of this measurement exercise, an encounter begins when a healthcare worker enters the patient's room or approaches the patient's bedside (for multibed rooms) and ends when the healthcare worker leaves the room or bedside. In a situation where a patient requires extended or complicated care (such as in an ICU), an encounter may involve multiple contacts and it may be appropriate to record these individually if they are distinct activities. For example, a nurse may perform multiple patient care tasks at the bedside, complete this care, and then begin a series of contacts with the patient's environment. Or a nurse may complete a task that involves contact with mucous membranes and secretions, such as suctioning a patient, and then take on a separate task at a separate body site, such as changing a dressing. To the extent that these contacts can be observed and distinguished clearly, they may be recorded separately on separate rows.
- The observer must be aware of whether a patient is on any type of isolation precautions that require the use of gloves. This information is necessary to determine whether gloves are required (see below).
- For patient contact, the observer should be aware of the nature of the contact. This information is necessary to determine whether gloves are required (see below). It is important to distinguish three general subtypes of patient contact:
 - contact that involves performing an invasive procedure (i.e., inserting an intravascular catheter or indwelling urinary catheter);
 - contact that involves actual or potential contact with blood, body fluids, secretions (except sweat), excretions, mucous membranes or non-intact skin (i.e., suctioning an intubated patient, emptying a urinal or bedpan, changing an dressing on an open wound);
 - other patient contact that does not qualify for a or b (i.e., measuring vital signs, examining a patient, repositioning a patient, etc.).
- Use the following codes to record data (Note: Y = Yes, N = No, unless otherwise noted):

Type of Healthcare Worker: D = attending physician, fellow, resident, physician's assistant, medical student; N = nurse, aide, TH = therapist (respiratory therapist, physical therapist, occupational therapist); PH = phlebotomy/IV team; XR = radiology technician; ES = environmental services; TR = transporter; OT = other;

Hand hygiene before/after: Alc = alcohol-based hand rub (liquid, gel, or foam); HW = handwashing with soap and water; N = none;

Gloves Required: Y if the patient is on any type of isolation precautions requiring gloves or the Type of Contact involved an invasive procedure or actual/potential contact with blood, body fluids, secretions/excretions, mucous membranes, or non-intact skin; N if not.
- In the Adherence section, use the following rules to record Y or N for Hand Hygiene, Glove Use, and Overall Adherence:

Hand hygiene: Y if the Type of Contact was patient contact and Hand hygiene before and after are both Y or if the Type of Contact was Environmental Contact only and Hand hygiene after is Y; N = if not;

Glove use: Y if Gloves Required and Used are both Y; N if Gloves Required is Y and Used is N; NA if Gloves Required is N;

Overall: Y if Hand hygiene is Y and Glove Use is Y or NA; N if not.
- In the Adherence section, count the number of Y for Hand hygiene, Glove use, and Overall and record the total in box at the bottom of each column.
- In the Adherence section, calculate the percent adherence using the formulas below and record the percent in the box at the bottom of each column
Hand hygiene: $\text{Total \# of Y} \div \text{Total \# of Encounters (number of rows with data recorded)} \times 100$
Glove use: $\text{Total \# of Y} \div [\text{Total \# of Encounters (number of rows with data recorded)} - \text{Total \# of NA}] \times 100$
Overall: $\text{Total \# of Y} \div \text{Total \# of Encounters (number of rows with data recorded)} \times 100$