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## Implementation of the CDC Core Practices for Infection Prevention and Control in Prehospital Emergency Medical Services Settings: Strategies for Sustainable Success

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### About the Author

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He has completed the Johns Hopkins Fellows Program in Hospital Epidemiology and Infection Control. He is a Senior Fellow and Ambassador of the Management and Strategy Institute. In 2019, he was inducted as a Distinguished Fellow and Practitioner in the National Academies of Practices. Dr. Garrett was recently selected in 2020 as 1 of 20 healthcare leaders globally to participate in the 2021 13-month Global Patient Safety Fellowship with the Institute for Healthcare Improvement and is a graduate of the IHI Patient Safety Executive Development Program. In August of 2021, Dr. Garrett was awarded the prestigious Fellowship Designation by the Society for Healthcare Epidemiology of America in recognition of his work in infectious diseases and infection prevention and control. He holds graduate certificates in healthcare leadership from both Cornell and the University of Notre Dame. He is a Certified Emergency Medical, Fire, and Police Dispatcher. He is a Certified Tactical Medic, Designated Infection Control Officer, and a Nationally Certified EMS Educator.



**T**he last two and a half years have been tumultuous for prehospital medical professionals due to the raging COVID-19 pandemic. Emergency Medical Services (EMS) has been uniquely impacted by the pandemic as they served as the initial conduit for most seriously ill COVID-19 patients to begin medical evaluation and access advanced medical treatment. The pandemic has been a stark reminder of the importance of the core elements of infection prevention and control, not only to protect the patient being treated but equally important to the EMS crew's safety.

In 2017, the Centers for Disease Control and Prevention (CDC) Healthcare Infection Control Practices Advisory Committee, HICPAC, developed evidence-based recommendations to direct healthcare professionals on how to most effectively address the primary reasons for the transmission of infection in all healthcare settings. These recommendations became formally adopted and disseminated as the Core Infection Prevention and Control Practices for Safe Healthcare Delivery in All Settings-Recommendations of the Healthcare Infection Control Practices Advisory Committee. These recommendations were selected by the CDC committee as they are not expected to change and have the potential to substantially reduce the transmission of infection to both patients as well as EMS professionals.

The Core Practices are categorized into eight different categories which include:

1. **Leadership Support**
2. **Education and Training of Healthcare Personnel on Infection Prevention**
3. **Patient, Family, and Caregiver Education**
4. **Performance Monitoring and Feedback**
5. **Standard Precautions**
  - a. **Hand Hygiene**
  - b. **Environmental Cleaning and Disinfection**
  - c. **Injection and Medication Safety**
  - d. **Risk Assessment with Appropriate Use of Personal Protective Equipment**
  - e. **Minimizing Potential Exposures**
  - f. **Reprocessing of Reusable Medical Equipment**
6. **Transmission-Based Precautions**
7. **Temporary Invasive Medical Devices for Clinical Management**
8. **Occupational Health**





Whether the EMS agency is a public or private service, the senior leadership team must support policies and procedures to reduce infections.

### Leadership Support

As with most successful programs in health-care, executive leadership must completely buy into the EMS agency's infection prevention and control program. This top-down leadership approach is necessary to both model the desired infection prevention behaviors, but also to communicate to frontline EMS providers that agency leadership is a collaborative partner in the entire infection control process. Whether the EMS agency is a public or private service, the senior leadership team must first support the policies and procedures to reduce infections and then provide the Designated Infection Control Officer (DICO) with the necessary resources to fulfill their obligations in protecting both EMS providers and the community. Human resources is an integral player in this process since they are logistically responsible for managing the day to day personnel-related issues along with frontline supervisors. Part of the executive leader's fundamental responsibility in the infection control program is to designate a qualified individual to lead the infection control program for the agency. This individual is also the legally defined departmental representative to interact with healthcare facilities regarding infection control-related mat-

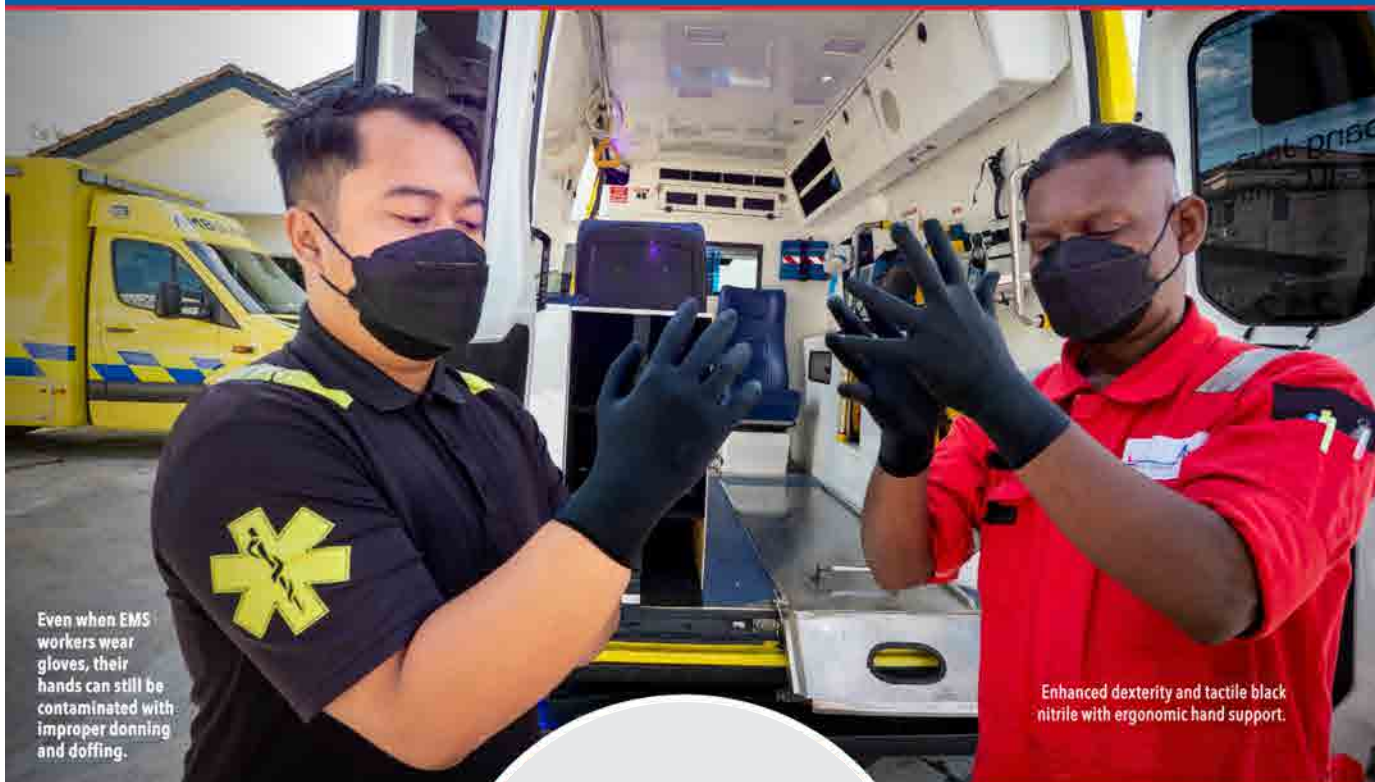


ters for EMS crews and patient encounters. The Designated Infection Control Officer (DICO) must be empowered with the authority to immediately intervene and act to mitigate critical risks to patient and EMS provider safety. This is the ultimate exercise of leadership support in situations of this nature and demonstrates a culture of leadership engagement and safety.

### Education and Training of Healthcare Personnel on Infection Prevention

EMS professionals are very different from traditional hospital-based healthcare providers and have quite limited resources in terms of patient care and infection control. The benefit of following the CDC core measures for infection prevention is that they can tremendously protect EMS providers in the prehospital setting from preventable occu-





Even when EMS workers wear gloves, their hands can still be contaminated with improper donning and doffing.

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pational exposure when properly adhered to. When EMS providers are hired, they must be provided role-specific training on all agency processes, equipment, and procedures at the time of hire. This training should be repeated at least once annually as part of an established annual competency assessment, and any-time something changes regarding a product or process. Training should also be assessed using a wide variety of modalities such as in-person assessment teach-backs and digital tools that allow for ongoing self-assessment like recent technology released by the American Heart Association to evaluate quarterly competency for EMS professionals on core lifesaving skills such as Basic Life Support, Advanced Cardiac Life Support, and Pediatric Advanced Life Support.

### Patient, Family, and Caregiver Education

EMS providers in traditional 911 response agencies and private transport services are not typically responsible for patient, family, and caregiver education in most EMS models; however, that is rapidly changing with the expansion of the community paramedicine model. As EMS providers expand their scope of practice and role in the community, there is an additional opportunity for targeted patient

counseling regarding infection reduction strategies. Many of these high-risk patients are repeat readmissions and require frequent transports to the emergency department for preventable causes, substantially draining an already taxed EMS delivery system. By educating patients and families about basic infection prevention strategies in the community before they become infected with serious pathogens,

EMS providers can more directly and positively

impact patient outcomes. Private EMS services that primarily perform interfacility transfers and patient discharges also can play a pivotal role in patient education about basic infection prevention measures such as hand hygiene, immunization, and more. During the COVID-19 pandemic, EMS providers were on the frontline of administering community COVID-19 vaccines which was a prime opportunity for patient education. EMS providers and leaders must continue to innovate in this arena to solidify the expertise of EMS professionals as community care providers.

### Performance Monitoring and Feedback

Continuous Quality Improvement is one of the primary methods by which EMS practitioners can improve their skills and act on agency-specific performance data such as infection



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transmission rates or compliance with evidence-based standards such as the appropriate use of Personal Protective Equipment. Many electronic patient care record systems are now including built-in quality metrics that have prebuilt reporting capabilities to help drive quality improvement and process standardization. This was most recently evident when evaluating the appropriate use of Personal Protective Equipment when caring for high-risk COVID-19 patients. By actively monitoring performance data pulled from the patient care reporting system daily, EMS leaders and DICOs could immediately act on unsafe EMS provider behaviors and mitigate these risks as part of a closed feedback loop process. For feedback to truly be meaningful, it must be specific, provide a tangible example, and be delivered promptly to the frontline EMS practitioners.

### Standard Precautions

Standard Precautions, by CDC definition, are basic practices that apply to all patient care, regardless of the patient's suspected or confirmed infectious state, and apply to all settings where care is delivered. These practices are designed to protect healthcare personnel and prevent healthcare personnel or the clinical care environment from transmitting infections to other patients. Standard precautions include specific infection control interventions such as hand hygiene, environmental cleaning and disinfection, injection and medication safety, risk assessment with the use of appropriate personal protective equipment (e.g., gloves, gowns, masks, eye protection) based on activities being performed, minimizing potential exposures (e.g., respiratory hygiene or cough etiquette), and reprocessing of reusable medical equipment





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between each patient and when soiled.

Hand Hygiene continues to be recognized by infection control experts worldwide as the most important and basic infection control intervention. This simple act can substantially reduce the transmission of pathogenic microorgan-

isms from patients to EMS providers and vice versa. Hand hygiene should be performed with either soap and water or an alcohol-based hand sanitizer. Given the resource limitations that exist in the prehospital medical setting, the availability of sinks is limited, except in extremely specialized transport units. As such, EMS providers are dependent upon the use of alcohol-based hand sanitizers. The commercial availability of these hand sanitizers is widespread, and most products have good overall efficacy against a wide variety of pathogens.

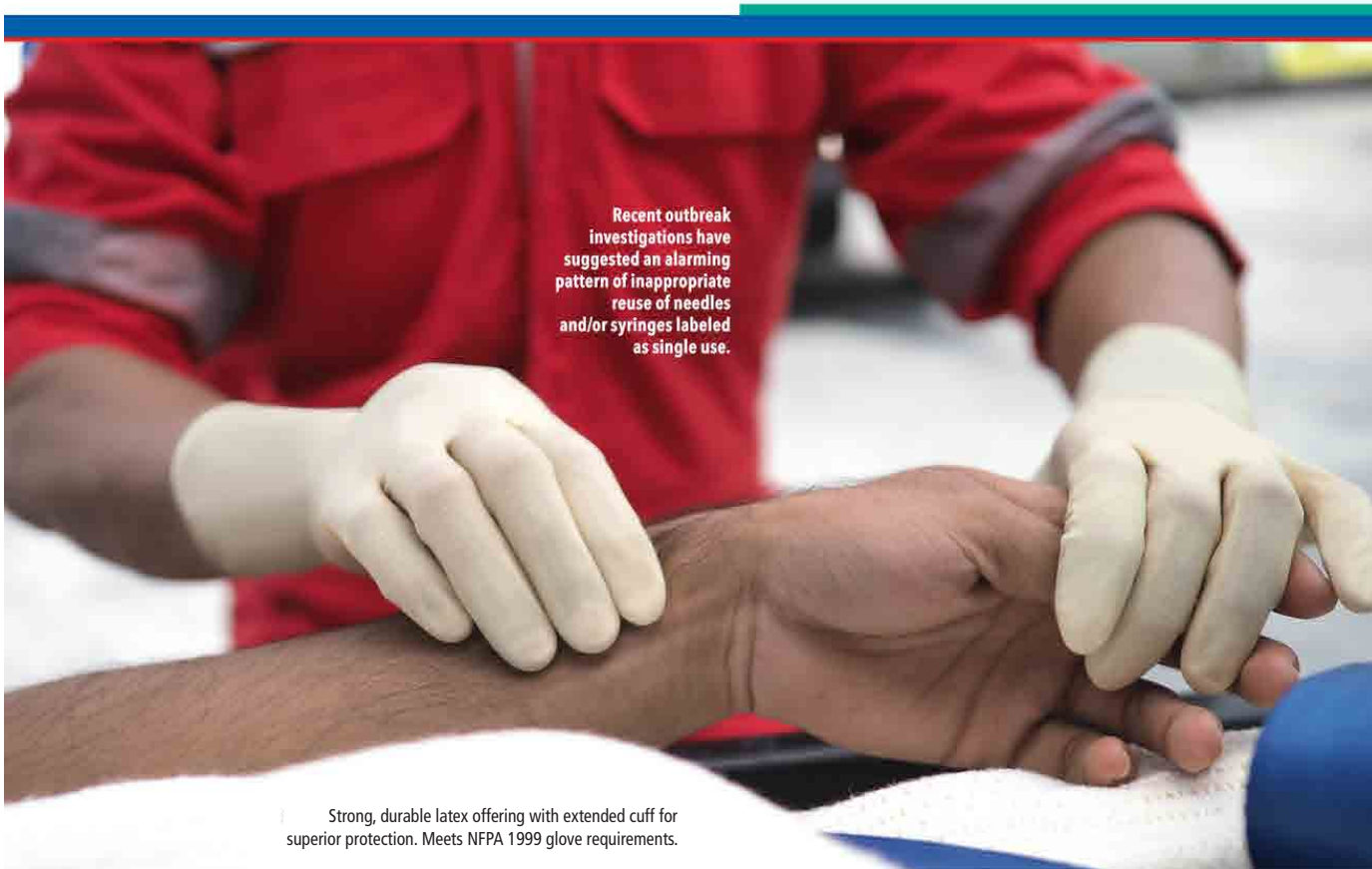
The CDC recommends that alcohol-based hand sanitizers used in healthcare contain an alcohol concentration between 60-90%, and more solutions have recently moved towards the 70% formulation due to manufacturer standardization. The challenge with hand sanitizers is that they should not be used on visibly soiled hands, which is, unfortunately, a common occurrence within prehospital medical settings. Even when EMS practitioners wear gloves, their hands can still become visibly contaminated with improper donning and doffing techniques. If an EMS provider's hands are visibly soiled, the provider should try and mechanically rinse with saline or water the gross contaminant off the hands and then utilize the alcohol-based hand sanitizer. This will maximize the effectiveness of the hand sanitizer on the practitioner's hands. Hand hygiene should be performed:

- Immediately before touching a patient
- Before performing an aseptic task (e.g., placing an indwelling catheter) or handling invasive medical devices
- Before moving from work on a soiled body site to a clean body site on the same patient
- After touching a patient or the patient's immediate environment
- After contact with blood, body fluids, or contaminated surfaces
- Immediately after glove removal



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Training should be repeated at least once annually as part of an established annual competency assessment, and any time something changes regarding a product or process.



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Hand hygiene remains our most important tool in the infection prevention armamentarium to reduce transmission and contamination of the clinical environment. While hand hygiene is one important tool in our arsenal, using Personal Protective Equipment (PPE) is a critical component of an EMS infection prevention program. Current Occupational Safety and Health Administration (OSHA) regulations also require healthcare employers to assess each job classification and provide both training on and physical PPE equipment that is appropriate for the anticipated clinical tasks. For example, paramedics have a reasonable expectation during their shift that they might have to perform endotracheal intubation. As such, the availability

of eye protection is required to comply with OSHA standards and protect the paramedic's eyes from potential body fluid exposure. Most pathogens encountered in EMS-delivered care can be effectively managed using gloves and hand hygiene. Still, certain pathogens such as spore-forming bacteria may require additional precautions such as using an isolation gown. PPE is rated by standards bodies, and the DICO should select appropriate PPE for the anticipated tasks. Gowns, for example, in EMS ideally be fluid resistant given the common nature of fluid exposure in the confined spaces of ambulances. Gloves, the most utilized form of PPE, should be carefully sourced from reputable manufacturers and vendors to ensure that they are high-quality and not subject to regular supply chain disruptions which proved to be problematic during the most recent pandemic.

The next component of Standard Precautions is Environmental Cleaning and Disinfection. In the US, all disinfectants must be registered and approved by the Environmental Protection Agency (EPA). If a surface has visible contamination, it should ideally first be cleaned, and then after it is visibly clean, the disinfection process can take place. Because of the varied nature of pathogen exposure that occurs in EMS settings, DICOs must select broad-spectrum disinfectant agents that will be effective against a wide variety of pathogens including:

- Gram+ Bacteria
- Gram - Bacteria



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- Enveloped Viruses
- Nonenveloped Viruses
- Pathogenic Fungi
- Blood borne Pathogens (HIV, Hepatitis B Virus, Hepatitis C Virus)
- Some Bacterial Spores such as *Clostridioides difficile*

In addition to broad-spectrum efficacy claims, disinfectants used in EMS must have fast overall contact times which inactivate the targeted microorganisms in a reasonable time frame to allow for quick turnover of ambulances. DICOs should ideally select disinfectants with total overall contact times of 3-5 minutes, with less than three minutes being advantageous. Finally, an additional consideration for EMS agencies in terms of disinfectant use is equipment compatibility. EMS units are filled with valuable and highly utilized pieces of patient care equipment that can be damaged by overly aggressive disinfectant agents if they are incompatible with the disinfectant chemistry. Before purchasing and implementing disinfectants, the DICO should ensure that there is established compatibility between the disinfectant product and the EMS agencies most used medical devices such as cardiac monitors, tablet computers, and glucometers. This proactive approach will mitigate preventable damage to these expensive medical devices and prevent the voiding of any existing device manufacturer warranties.

Finally, when possible, the use of disposable patient care equipment is preferred, especially when the equipment will meet patient mucosal tissue or sterile body cavities. A specific example in EMS settings that have historically been reusable was laryngoscope blades and handles. For many years, EMS agencies performed low or sometimes high-level disinfection of these reusable devices and reprocessed them. These practices were highly variable and inconsistent in outcomes related to microorganism inactivation. EMS agencies should avoid any medical equipment which requires reprocessing above that of low or intermediate-level disinfection. The use



of high-level disinfectants in EMS setting is not a safe practice and should be prohibited.

The next element in the Standard Precautions arena is Injection and Medication Safety. Injection safety practices must be strictly adhered to prevent misuse of disposable items such as single-use needles and syringes. The risk for occupational exposure to bloodborne pathogens such as Hepatitis B Virus and HIV has dramatically decreased since the release of the Bloodborne Pathogens Standard from the Occupational Safety and Health Administration (OSHA). Still, recent outbreak investigations have suggested an alarming pattern of inappropriate reuse of needles and/or syringes labeled and indicated for single patient use. These recent investigations by CDC have revealed a pattern of poor injection safety practices including 1) the use of a syringe needle, with or without the syringe, to administer medication to multiple patients, 2) reinsertion of a used syringe, with or without the same needle, into a medication vial or solution container to obtain additional medication for a single patient and then using that vial or solution container for subsequent patients, and 3) preparation of medications near contaminated supplies or equipment. These same principles apply to the aseptic handling of sterile intravenous catheters as well.

When selecting medication sizes, the DICO should preferably source single-patient vials of medication which will prevent cross contamination of the vial and result in potential harm to subsequent patients.

### Transmission-Based Precautions

The CDC defines Transmission-Based Precautions as a “second tier of basic infection control measures that are used in addition to standard precautions for patients who may be infected or colonized with certain infectious agents for which additional precautions are needed to prevent infection transmission.” There are three defined levels of Transmission-Based Precautions:

- **Contact:** In this scenario, these pathogens will likely be effectively stopped with basic PPE such as gloves and a standard isolation gown. A common example of a microorganism that would dictate contact precautions is *Clostridioides difficile* infection. Preferably, disposable patient care equipment should be used such as blood pressure cuffs when available. If reusable medical equipment is used, a broad-spectrum, EPA-registered disinfectant should be utilized according to the manufacturer’s instructions.
- **Droplet:** This level of isolation precaution is utilized when caring for patients with known or suspected pathogens that are transmitted via respiratory droplets through coughing, sneezing, or talking. These respiratory particles are large and typically do not remain suspended in the air for long periods. The best example of this

category of isolation precautions is the Influenza virus. To protect EMS providers from these infectious respiratory droplets, the use of surgical masks is advised, preferably those that are fluid resistant given the nature of EMS patient care.

- **Airborne:** This is the highest level of isolation precautions and should be utilized for patients with known or suspected pathogens transmitted via the airborne route. Common pathogens in this category include Tuberculosis, Measles, and Chickenpox. In this isolation category, a surgical mask should be placed on the patient, and a fit-tested, N-95 or higher respirator should be worn by the EMS provider in contact with the patient. Pathogens in this category are smaller in particle size and can be suspended in the air for long periods, especially in areas with poor ventilation such as ambulances.

### Temporary Invasive Medical Devices for Clinical Management


Most patients cared for by EMS providers receive some type of treatment, and many will receive intravenous therapy even just for direct vascular access purposes. When any type of artificial medical device is introduced into the human body, the body’s immune system immediately recognizes this invader. It attempts to mount a robust and specific immune response in patients with fully functional immune systems. Many patients that EMS providers care for are immunocompromised and already may have invasive catheters such as



The general rule of thumb regarding patient safety is to promptly remove all invasive medical devices as soon as they are no longer medically necessary.

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Having a Designated Infection Control Officer (DICO) is a federal requirement to help proactively mitigate risk to EMS providers and the community.

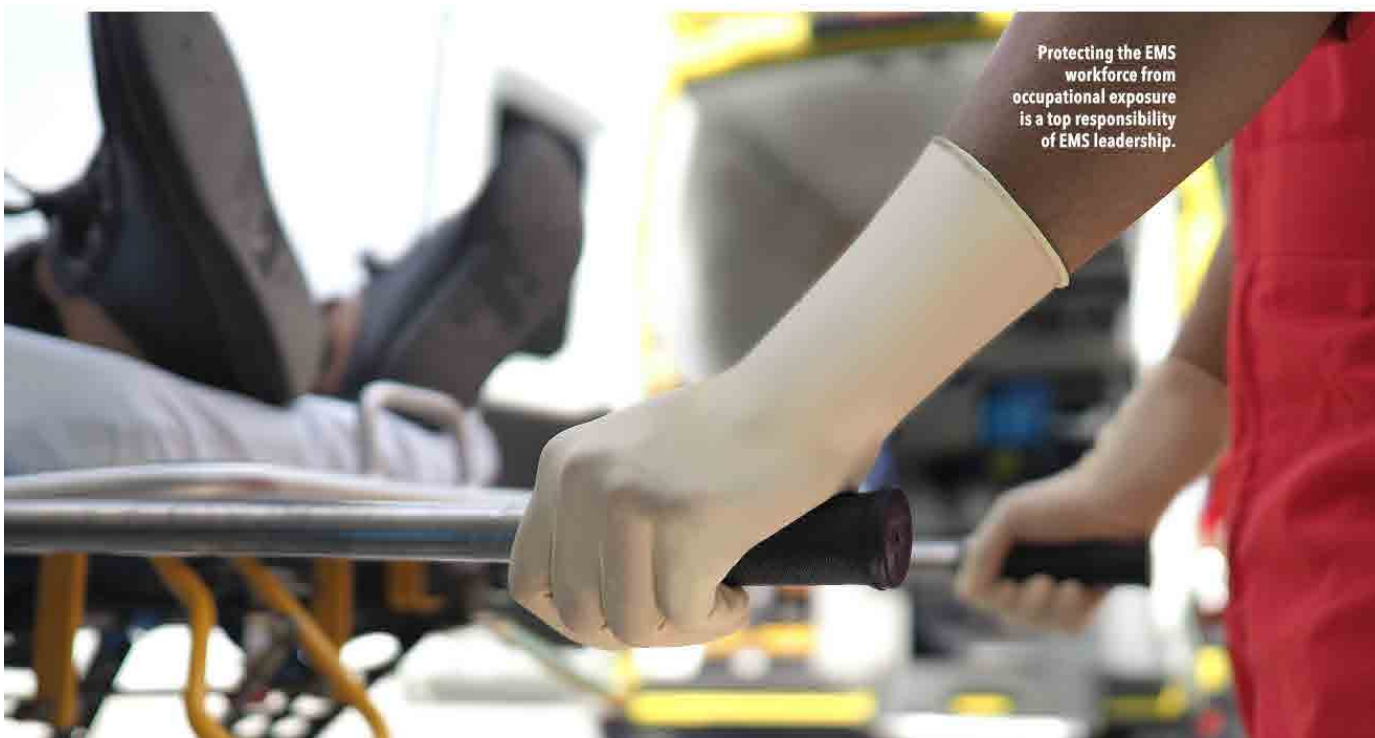
Nitrile glove offers extra durability and superior strength. Industry best AQL (0.65), tested for chemotherapy/cytotoxic drugs, and fentanyl exposures (>240 minutes).

foley catheters for long-term care residents. These invasive devices can serve as direct conduits for endogenous and exogenous flora to contaminate the device and lead to life-threatening infections such as sepsis. The general rule of thumb regarding patient safety is to promptly remove all invasive medical devices as soon as they are no longer medically necessary. The patient's intact skin is their most natural barrier against infection transmission, but many patients encountered in EMS, particularly those in traumatic situations, will not have intact skin. Patients can also translocate microorganisms from different places on their bodies resulting in self-inoculation.

### Occupational Health

Now more than ever with the ongoing EMS staffing crisis across the US, EMS leaders and agencies must take all necessary steps to protect their workforce from preventable occupational exposures to infectious pathogens. The most important element of reducing workplace exposures is the maintenance of a rigorous Occupational Health management program that leverages the baseline physical health assessment of employees at time of hire and then evolves to respond to any suspected or confirmed occupational

exposure that might occur while executing clinical duties in the prehospital setting. Many EMS agencies do not have a dedicated Designated Infection Control Officer or DICO. However, there is a requirement to have a trained person perform this function per federal law and regulations. Having a specially trained EMS provider or leader that oversees the agencies infection control program can prove extremely helpful in proactively mitigating occupational exposures before they become an actual exposure or worse yet a confirmed transmission of infection to an EMS provider. Occupational Health is not only a responsive process, but it must start with a thoughtful approach to human resources and addressing the unique personnel situations that arise with EMS providers that might also work multiple jobs with different agencies, resulting in additional occupational exposure possibilities outside of their primary employer. As such, sick and leave processes must address these circumstances and EMS leadership must incentivize ill employees to stay home and not report to work. While this creates an acute staffing shortage for EMS leaders, the risk of infecting the EMS workforce is simply too high and cannot be toyed with. EMS professionals that have active vomiting, diarrhea, fever, or draining skin lesions should be excluded from work to prevent



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transmission to patients and other EMS personnel. This requires a very proactive and thoughtful approach to personnel management that protects the continuity of EMS operations but also ensures that the organization is protected from abuse and fraud in the system as well.

Occupational Health also requires that EMS agencies approach employee prophylactic and postexposure prophylaxis vaccines systematically. Specific vaccines such as the annual Influenza vaccine and Hepatitis B Virus (HBV) vaccine series should be offered to all employees at the time of hire (when seasonally indicated), annually, and as work duties and potential exposure change. Vaccines such as the HBV series must be offered to all EMS providers as regulated by the Occupational Safety and Health Administration Bloodborne Pathogens Act. EMS agencies and Designated Infection Control Officers should base their employee vaccination policies on the current CDC Advisory Committee on Immunization Practices recommendations for healthcare worker vaccination.

Protecting the EMS workforce from occupational exposures is a top responsibility of EMS leadership. Still, it also is an important element in maintaining EMS continuity of operations in communities across the country. EMS leaders should consult with hospital-based and outpatient occupational health professionals and medical staff for consultation regarding post-exposure event management and then

create comprehensive programs to ensure that impacted EMS providers have immediate access to well-qualified medical evaluation and treatment if needed.

### Summary

As the infectious disease threats in the prehospital care environment continue to become more common each year, EMS agencies must take the necessary steps to build comprehensive infection prevention and control programs that are proactive in nature and agency-specific based on the population served. The role of the DICO will continue to evolve over time and likely will become a more full-time role within public safety and private EMS agencies due to the increasing workload and responsibility associated with the position. Infectious pathogens are always evolving daily and as such our programmatic approach to prehospital infection prevention and control must as well. Mitigation of transmission is always the preferred goal of our efforts, but a robust response and outbreak investigation capability is equally necessary to protect patients, communities, and EMS providers. As evidence-based guidelines and recommendations change over time, EMS-based infection prevention programs must continuously be agile and evolve with the most current science. This will protect patients and EMS practitioners from preventable harm, reduce costs, and improve clinical outcomes.



## Additional Tools and Resources

- [ASPR Tracie EMS Infectious Disease Playbook](#)
- [CDC Core Infection Prevention and Control Practices Toolkit](#)
- [CDC Healthcare Infection Control Practices Advisory Committee Guidelines Repository](#)
- [Occupational Safety and Health Administration Blood-borne Pathogens Act](#)
- [Ansell Hand Wash Poster](#)
- [Ansell Hand Rub Poster](#)
- [PPE Donning and Doffing Guide for EMS Providers](#)
- [Safe PPE Use for EMS Providers Poster](#)
- [Video: Single Use Glove Doffing](#)
- [Webinar: Infection Prevention Strategies for Emergency Medical Services.](#)
- [Webinar: Protecting First Responders: Choosing the Right Glove.](#)
- [Webinar: First Responders: Answering the Call During the COVID-19 Pandemic with Peter Graves.](#)
- [AnsellCARES](#)

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