



Evidence-based Practice Center Technical Brief Protocol

Project Title: *Emergency Medical Service/911 Workforce Infection Control and Prevention Issues*

I. Background and Objectives for the Technical Brief

Standard infection prevention and control (IPC) measures for emergency medical service (EMS) workers include hand hygiene, glove-wearing, and disinfection of equipment. Compliance with these measures has been less than optimal. In Nevada, EMS workers wore gloves during 56% of activations, washed hands in 27% of activations, and disinfected equipment 31% of the time.¹ In Maine, one study suggested that half of ambulances tested positive for methicillin resistant *S. aureus*.² A second study showed that 57% of reusable ambulance equipment tested positive for blood.³ Another study reported that current decontamination practices may not reduce viral load on ambulance surfaces.⁴ Furthermore, adherence to IPC standards involve structural determinants, such as budget shortages, and individual determinants, such as knowledge, attitudes, and skills. The COVID-19 pandemic has highlighted the importance of IPC practices. The resulting decisional dilemmas relate to addressing reasons for decreased adherence to IPC standards by EMS workers (including 911 telecommunicators) and implementing effective IPC at the individual and system level. The Office of Emergency Medical Services at the U.S. Department of Transportation requested this technical brief for the purpose of summarizing the evidence on: exposures to and incidence/prevalence/severity of infectious diseases in the EMS/911 workforce; and interventions for preventing, recognizing, and controlling occupationally-acquired infectious diseases in the EMS/911 workforce. This brief should be useful to policy makers, researchers, and managers in the EMS field in making decisions about how to minimize the risk of infectious diseases in the EMS/911 workforce. Although the nature of the evidence may not be amenable to a full systematic review, the technical brief should help to identify future research needs by identifying research questions that have not been addressed in the literature.

II. Guiding Questions

1. What are the **characteristics, incidence, prevalence, and severity of occupationally-acquired exposures** to infectious diseases for the EMS/911 workforce?
 - a. How do the incidence, prevalence, and severity of exposures vary by *demographic characteristics* (e.g., age, sex, race, ethnicity) of the workforce?
 - b. How do the incidence, prevalence, and severity of exposures vary by *workforce characteristics* (e.g., training, experience, level of practice, geographic region)?

2. What are the characteristics and reported effectiveness (i.e., benefits and harms) in studies of EMS/911 workforce practices to **prevent** infectious diseases?
 - a. How do workforce practices to prevent infectious diseases vary by *demographic characteristics* (e.g., age, sex, race, ethnicity)?
 - b. How do workforce practices to prevent infectious diseases vary by *workforce characteristics* (e.g., training, experience, geographic region etc.)?
 - c. How do workforce practices to prevent infectious diseases *vary by practice characteristics* (e.g., training, personal protective equipment (PPE), personnel, and budget requirements)?
 - d. What is the *reported effectiveness* (i.e. benefits and harms) in studies of EMS/911 workforce practices to prevent infectious diseases? (Outcomes of interest include but are not limited to, incidence, prevalence, duration, severity, missed work, healthcare utilization, separation from the workforce, disability, and death from infections.)
3. What are the characteristics and reported effectiveness (i.e., benefits and harms) in studies of EMS/911 workforce practices to **recognize and control** (e.g., chemoprophylaxis, but excluding treatment) infectious diseases?
 - a. How do workforce practices to recognize and control infectious diseases vary by *demographic characteristics* (e.g., age, sex, race, ethnicity) of the EMS/911 workforce?
 - b. How do workforce practices to recognize and control infectious diseases vary by *workforce characteristics* (e.g., training, experience, level of practice, geographic region)?
 - c. How do workforce practices to recognize and control infectious diseases vary by *infection recognition and control practice characteristics* (e.g., training, PPE, personnel, and budget requirements)?
 - d. What is the *reported effectiveness* (i.e., benefits and harms) in studies of EMS/911 workforce practices to recognize and control infectious disease? (Outcomes of interest include but are not limited to, incidence, prevalence, duration, severity, missed work, healthcare utilization, separation from the workforce, disability, and death from infections.)
4. What are the context and implementation factors of studies with effective EMS/911 workforce practices to prevent, recognize and treat occupationally-acquired infectious diseases? This description might include distinguishing factors such as workforce training, surveillance, protective equipment, pre- and post-exposure prophylaxis, occupational health services, preparedness for emerging infectious diseases, and program funding.
5. What future research is needed to close existing evidence gaps regarding preventing, recognizing, and treating occupationally-acquired infectious diseases in the EMS/911 workforce?

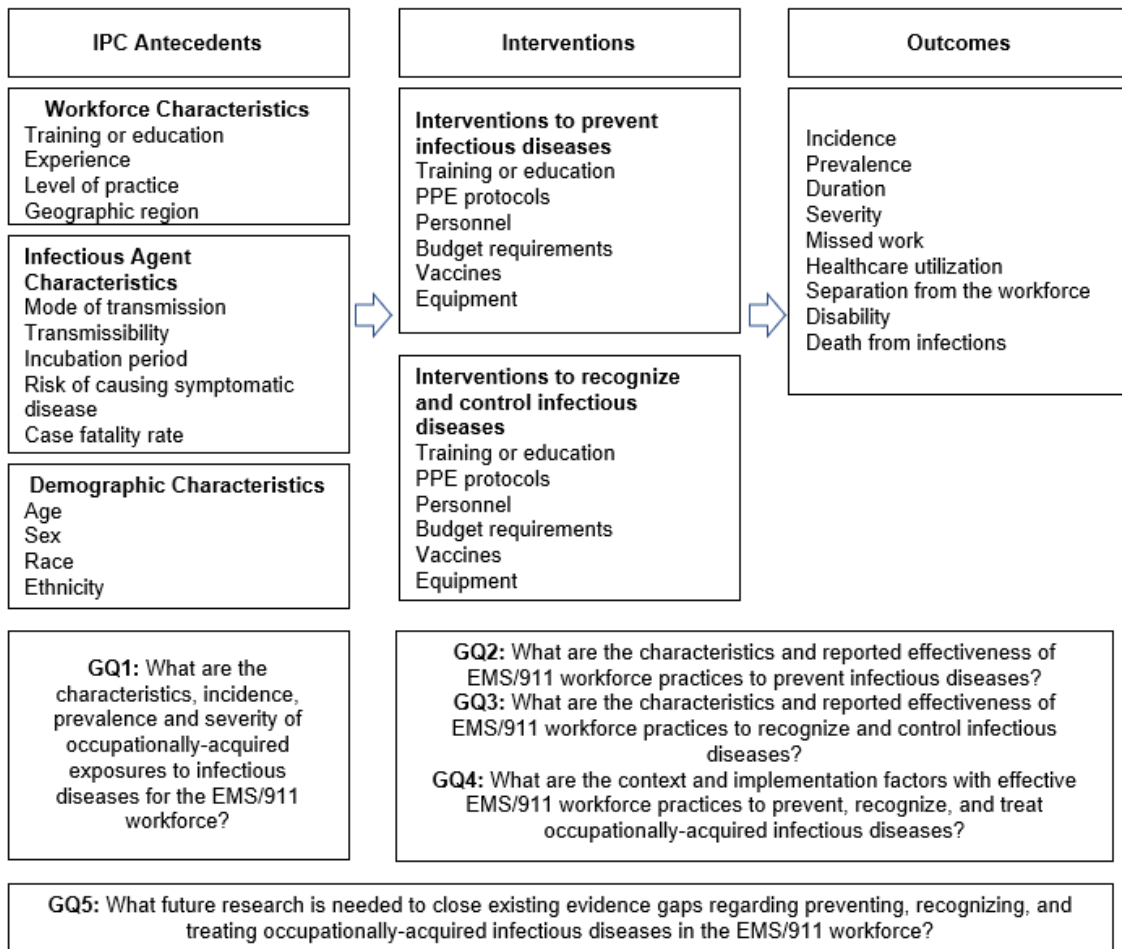
For Guiding Question 1, we will define occupationally-acquired exposures to infectious diseases as contact exposure (intact skin), respiratory exposure (inhaled and aerosolized), and blood-borne exposure (needlesticks, blood to non-intact skin, etc.). Organisms of interest included but are not limited to severe acute respiratory syndrome coronavirus 2

(SARS-COV2), influenza, tuberculosis, human immunodeficiency virus (HIV), and Hepatitis B and C.

We will consider the 911 workforce to be the 911 telecommunicators who are fielding the calls. The EMS workforce will include the responding health care personnel in field settings.

We developed a conceptual framework to guide work on the technical brief (Figure 1).

Figure 1. Conceptual framework for infection prevention and control in EMS/911 workforce



(IPC = infection prevention and control; KQ = key question; PPE = personal protective equipment)

III. Methods

1. Data Collection:

A. Discussions with Key Informants

We will recruit a panel of external experts on emergency medical technicians, state-level EMS leadership, and programs relevant to EMS personnel. We will

also consider representatives of professional societies in infectious diseases and emergency medicine. The external experts will provide advice on how we answer each of our Guiding Questions. Sample questions for the Key Informants include: 1) do they suggest any revision in our analytic framework? 2) do they suggest any revision in how we define the relevant scope of occupationally-acquired exposures to infection? 3) do they suggest any change in the criteria we use to determine whether an intervention is effective? 4) do they suggest any change in how we define or describe relevant contextual factors? and 5) what do they think is most important to know about the quality of the studies we identify?

B. Gray Literature search.

We will search the gray literature (e.g., LexisNexis, websites) for reports from selected state and federal government agencies or nongovernmental organizations that have an interest in this topic (e.g., Centers for Disease Control and Prevention, the National Institutes of Health, Infectious Diseases Society of America, the Assistant Secretary for Preparedness and Response, Society for Healthcare Epidemiology of America, and Association for Professionals in Infection Control and Epidemiology). We will search for ongoing research by using the clinicaltrials.gov database and by querying our advisors. We will review any material that is submitted through the Supplemental Evidence and Data for Systematic Reviews (SEADS) portal.

C. Published Literature search.

We will conduct a systematic search for published evidence using PubMed, Embase, CINAHL, ERIC, SCOPUS, PsycINFO, and the Cochrane Central Register of Controlled trials. We will limit the search to the last 15 years because older studies have little relevance to modern IPC practices. A 15-year cut-off corresponds to passage of the landmark Pandemic and All-Hazards Preparedness Act (PAHPA) in 2006,⁵ which focused on improving the nation’s public health and medical preparedness and response capabilities for emergencies.

Two members from the team will independently assess each citation to determine whether it meets inclusion criteria (Table 1). Studies will be included if they provide original data on the guiding questions.

Table 1. Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Population	<ul style="list-style-type: none"> • Emergency medical service workforce including 911 dispatchers exposed to or at risk of exposure to an occupationally-acquired infectious disease as contact exposure, respiratory exposure, or blood-borne exposure* 	<ul style="list-style-type: none"> • Fire fighters and police personnel not involved in medical care
Intervention	<ul style="list-style-type: none"> • One or more of the following types of interventions: <ul style="list-style-type: none"> ○ Training or education ○ PPE protocols ○ Personnel policies ○ Budget allocations 	<ul style="list-style-type: none"> • NA

	<ul style="list-style-type: none"> ○ Vaccines ○ Equipment 	
Comparison	<ul style="list-style-type: none"> • Any comparison group (for studies that evaluate the effectiveness of an EMS/911 workforce practice) 	<ul style="list-style-type: none"> • Studies without a comparison group (for studies that evaluate the effectiveness of an EMS/911 workforce practice)
Outcomes	<ul style="list-style-type: none"> • Incidence • Prevalence • Duration • Severity • Missed work • Healthcare utilization • Separation from the workforce • Disability • Death from infections 	<ul style="list-style-type: none"> • NA
Timing	<ul style="list-style-type: none"> • Published after 2006 and includes data after 2006 	
Setting	<ul style="list-style-type: none"> • Conducted in the United States 	<ul style="list-style-type: none"> • Military exercises and drills • Live evacuations from another country
Study design	<ul style="list-style-type: none"> • Experimental and non-experimental studies with comparison groups, including pre-post studies • Relevant systematic reviews 	<ul style="list-style-type: none"> • No original data (Narrative reviews, commentaries, simulation studies)

* Organisms of interest included but are not limited to SARS-COV2, influenza, tuberculosis, HIV, and Hepatitis B and C.

2. Data Organization and Presentation:

A. Information Management

For each eligible study, a team member will use DistillerSR to extract information about the epidemiologic characteristics of the infectious disease exposures (Guiding Question 1), as well as characteristics, effectiveness, and context of interventions (Guiding Questions 2-4), following the framework in Figure 1. To assess effectiveness, we will abstract data on the main outcomes of each study, whether or not there was a statistically significant effect, and the direction and magnitude of the effect when there is a significant difference. We also will capture the sample size of studies, recognizing that some studies may fail to find a significant difference because of a small sample size. A second team member will review extracted information for accuracy.

Paired reviewers will independently assess the quality of each study by focusing primarily on classifying the study design according to the accepted hierarchy of study designs. For this technical brief, we do not plan to perform a detailed assessment of study quality, although we will discuss with the Key Informants whether to focus on a few specific aspects of study quality that would be most important for the targeted audience to know. Using the Effective Public Health Practice Project tool⁶ as a reference, we will consider focusing on a few aspects of study quality, such as on selection bias and confounders.

B. Data Presentation

We will use tables and accompanying text to summarize information from the studies on each of the Guiding Questions. We will consider creating an evidence

map with associated data visualization techniques to help describe the extent of the literature on each of the questions. We will also sort studies into intervention and outcome categories to determine whether any meta-analysis would be feasible.

The Technical Brief will include a summary of selected national, state, and local IPC protocols pertinent to the EMS/911 workforce that meet our inclusion/exclusion criteria. We will help to identify and prioritize future research needs in light of revealed gaps. We will use the population, intervention, comparison, outcome (PICO) framework to identify and organize the research gaps.

IV. References

1. Bledsoe BE, Sweeney RJ, Berkeley RP, et al. EMS provider compliance with infection control recommendations is suboptimal. *Prehospital Emergency Care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2014 Apr-Jun;18(2):290-4. doi: 10.3109/10903127.2013.851311. PMID: 24401023.
2. Brown R, Minnon J, Schneider S, et al. Prevalence of methicillin-resistant *Staphylococcus aureus* in ambulances in southern Maine. *Prehospital Emergency Care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2010 Apr-Jun;14(2):176-81. doi: 10.3109/10903120903564480. PMID: 20199231.
3. Lee JB, Levy M, Walker A. Use of a forensic technique to identify blood contamination of emergency department and ambulance trauma equipment. *Emergency Medicine Journal : EMJ*. 2006 Jan;23(1):73-5. doi: 10.1136/emj.2005.025346. PMID: 16373813.
4. Valdez MK, Sexton JD, Lutz EA, et al. Spread of infectious microbes during emergency medical response. *American Journal of Infection Control*. 2015 Jun;43(6):606-11. doi: 10.1016/j.ajic.2015.02.025. PMID: 26042849.
5. Pandemic and All Hazards Preparedness Act. Public Law 109-417. 120 Stat. 2831. 2006.
6. Thomas BH, Ciliska D, Dobbins M, et al. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews on Evidence-based Nursing*. 2004;1(3):176-84. doi: 10.1111/j.1524-475X.2004.04006.x. PMID: 17163895.

V. Definition of Terms

EMS = emergency medical service

HIV = human immunodeficiency virus

IPC = infection prevention and control

PAHPA = Pandemic and All-Hazards Preparedness Act

PICO = Population, Intervention, Comparison, Outcomes

PPE = personal protective equipment

SARS-COV2 = severe acute respiratory syndrome coronavirus 2

SEADS = Supplemental Evidence and Data for Systematic Reviews

VI. Summary of Protocol Amendments

In the event of protocol amendments, the date of each amendment will be accompanied by a description of the change and the rationale.

VII. Key Informants

Within the Technical Brief process, Key Informants serve as a resource to offer insight into the clinical context of the technology/intervention, how it works, how it is currently used or might be used, and which features may be important from a patient or policy standpoint. They may include clinical experts, patients, manufacturers, researchers, payers, or other perspectives, depending on the technology/intervention in question. Differing viewpoints are expected, and all statements are crosschecked against available literature and statements from other Key Informants. Information gained from Key Informant interviews is identified as such in the report. Key Informants do not do analysis of any kind nor contribute to the writing of the report and will not review the report, except as given the opportunity to do so through the public review mechanism.

Key Informants must disclose any financial conflicts of interest greater than \$5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals are invited to serve as Key Informants and those who present with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential conflicts of interest identified.

VIII. Peer Reviewers

Peer reviewers are invited to provide written comments on the draft report based on their clinical, content, or methodologic expertise. Peer review comments on the draft report are considered by the EPC in preparation of the final report. Peer reviewers do not participate in writing or editing of the final report or other products. The synthesis of the scientific literature presented in the final report does not necessarily represent the views of individual reviewers. The dispositions of the peer review comments are documented and may be published three months after the publication of the Evidence report.

Potential Reviewers must disclose any financial conflicts of interest greater than \$5,000 and any other relevant business or professional conflicts of interest. Invited Peer Reviewers may not have any financial conflict of interest greater than \$5,000. Peer reviewers who disclose potential business or professional conflicts of interest may submit comments on draft reports through the public comment mechanism.

IX. EPC Team Disclosures

EPC core team members must disclose any financial conflicts of interest greater than \$1,000 and any other relevant business or professional conflicts of interest. Related financial conflicts of interest that cumulatively total greater than \$1,000 will usually disqualify EPC core team investigators.

X. Role of the Funder

This project was funded under Contract No. xxx-xxx from the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services. The AHRQ Task Order Officer reviewed contract deliverables for adherence to contract requirements and quality. The authors of this report are responsible for its content. Statements in the report should not be construed as endorsement by the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services.