

Infection Prevention in the Emergency Department

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Infection prevention remains a major challenge in emergency care. Acutely ill and injured patients seeking evaluation and treatment in the emergency department (ED) not only have the potential to spread communicable infectious diseases to health care personnel and other patients, but are vulnerable to acquiring new infections associated with the care they receive. This article will evaluate these risks and review the existing literature for infection prevention practices in the ED, ranging from hand hygiene, standard and transmission-based precautions, health care personnel vaccination, and environmental controls to strategies for preventing health care-associated infections. We will conclude by examining what can be done to optimize infection prevention in the ED and identify gaps in knowledge where further research is needed. Successful implementation of evidence-based practices coupled with innovation of novel approaches and technologies tailored specifically to the complex and dynamic environment of the ED are the keys to raising the standard for infection prevention and patient safety in emergency care. [Ann Emerg Med. 2014;64:299-313.]

Please see page 300 for the Editor's Capsule Summary of this article.

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INTRODUCTION

Infection prevention is a major challenge in the rapid-paced, high-volume setting of emergency care. The emergency department (ED) is a complex and dynamic health care environment. Patients present with undifferentiated illnesses and variable acuity, ranging from the otherwise healthy to the critically ill. Risk recognition and medical decisionmaking are often based on limited and evolving data, under significant time and resource constraints. Patients await diagnosis, intervention, and disposition in close proximity of one another. With more than 129.8 million patient visits made to US EDs in 2010 alone, the ED is a busy place subject to rapid patient turnover and even crowding.¹ The ED is a major gateway to inpatient medical care, contributing nearly half of all hospital admissions.² It also constitutes our health care system's front line in the response to public health emergencies and disasters. Amid these diverse roles and competing demands, infection prevention can easily be overlooked or superseded by other immediate and life-threatening issues. Yet significant infectious disease risks exist in emergency care that can carry substantial clinical consequences for both patients and health care personnel.

This article will address infection prevention in the ED through 2 central themes: preventing the transmission of infectious diseases from ill patients to health care personnel and to other patients, and reducing the risk of infection associated with receiving emergency care. We will review the existing literature behind ED hand hygiene, standard and transmission-based isolation precautions, health care personnel vaccination, and environmental controls. Next, we will examine the threat of

health care-associated infections related to central venous catheters, urinary catheters, mechanical ventilation, and other medical devices commonly used in the ED. We will conclude by identifying areas in which we can improve infection prevention in the ED today, as well as highlight gaps in knowledge that would benefit from further investigation.

PREVENTING TRANSMISSION OF INFECTIOUS ORGANISMS IN EMERGENCY SETTINGS

Hand Hygiene

Ignaz Semmelweis first recognized the fundamental role of hand hygiene in curbing the spread of contagion more than a century and a half ago while working in the obstetrics wards of Vienna General Hospital. At a time when puerperal fever was common and often fatal, Semmelweis demonstrated that physician hand disinfection with a chlorinated lime solution could lead to a significant decline in the incidence and mortality of this disease. To this day, hand hygiene remains the cornerstone of modern infection prevention and is the single most important strategy for curbing transmission of infectious microorganisms between patients, health care personnel, and the health care environment.³

Although normal human skin is routinely colonized with resident bacterial flora (eg, coagulase-negative *Staphylococcus*), transient flora can contaminate the skin of health care personnel through direct patient contact or contact with the patient's immediate environment.^{3,4} Transient flora can include *Staphylococcus aureus*, *Enterococcus*, Gram-negative bacilli, and *Clostridium difficile*, all of which have been associated with health

Editor's Capsule Summary*What is already known on this topic*

Significant infectious disease risks exist in the emergency department (ED) for both patients and health care personnel.

What question this study addressed

This literature review examined the efficacy and effectiveness of various infection control strategies applicable to ED care.

What this study adds to our knowledge

By examining studies from ED and non-ED settings, the latter of which compose the majority of published experience, the authors identified several strategies shown to reduce infection risk in the ED and others that require further investigation.

How this is relevant to clinical practice

The strategies identified in this article can make care safer for patients and providers.

foam products are superior to regular and antimicrobial soap in reducing bacterial counts and are therefore recommended for most routine hand hygiene. They also incur less of a time burden than soap and water, which may improve adherence to their use.^{5,6} Hospital-wide hand hygiene programs using alcohol-based hand rubs have been credited with significant reductions in health care-associated infections.^{7,8} However, scrubbing and rinsing with soap and water is recommended when caring for patients with *C difficile* infection because alcohol-based products are not effective against its spores, and is preferred when there is visible soiling of the hands. Hand hygiene should be performed anytime health care personnel enter the 3-foot space around a patient because the immediate environment and equipment surrounding the patient can be readily contaminated. The Centers for Disease Control and Prevention (CDC) and the World Health Organization provide valuable guidance on effective hand hygiene practices.^{3,9}

Hand hygiene adherence has been shown to be lower in settings with high patient activity, such as the ICU, and among physicians.¹⁰ Early studies of ED hand hygiene echo these trends.¹¹⁻¹⁴ More recently, ED hand hygiene adherence rates have ranged from 10% to 90%.¹⁵⁻¹⁹ Variable adherence to hand hygiene in the ED has been attributed to lack of time, urgent clinical situations, and high patient workload. Lower hand hygiene adherence has also been associated with caring for patients in ED hallways, a marker for high ED visit volume and a surrogate for crowding.¹⁸

Much of the existing literature on hand hygiene implementation is composed of quasi-experimental studies. Interventions addressing ED hand hygiene practices have been

care-associated infections, as well as a host of respiratory and gastrointestinal viruses. When performed regularly and correctly, hand hygiene eliminates transient flora, thereby disrupting transmission of these microorganisms.³ Alcohol-based gel and

Table 1. Interventions to improve adherence to hand hygiene in emergency care.

Author, Year	Country	N	Method of Observation	Intervention	Pre- → Postintervention Adherence, %
Dorsey et al, 1996 ¹⁴	USA	252 HCP encounters	Direct	High-visibility signs Educational literature	Emergency physicians: 38 → 41 (<1 mo) ($P=.83$) Registered nurses: 50 → 63 (<1 mo) ($P=.23$) Nurse practitioners: 65 → 72 (<1 mo) ($P=.42$) Unspecified baseline → 35 (2 mo)
Larson et al, 2005 ²⁰	USA	Unspecified	Direct and electronic counters	Touch-free hand sanitizer dispenser	
Haas and Larson, 2008 ²¹	USA	757 HCP encounters	Direct	Personal hand sanitizer dispenser	43 → 51 (3 mo) ($P=NS$)
Saint et al, 2009 ²³ ; di Martino et al, 2011 ²⁴	Italy	883 HCP encounters (6 mo) ²³ 456 HCP encounters (1 y) ²⁴	Direct	Educational program Clinician champions Personal hand sanitizer dispenser	14.3 → 44.9 (6 mo) → 45.2 (1 y) ($P<.001$)
Schuur et al, 2011 ²⁵	USA	Unspecified	Direct	Educational program Clinician champions Increased access to hand sanitizer dispensers Regular HH performance reporting Multidisciplinary HH team	36 → 91 (10 mo) → >80 (3 y) ($P=NR$)
Scheithauer et al, 2013 ²²	Germany	5,674 HCP encounters	Direct	Educational program Workflow optimization and standardization	21 → 45 (6 mo) ($P<.001$)

USA, United States; HCP, health care personnel; NS, nonsignificant; HH, hand hygiene; NR, not reported.

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