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Major Article

Observation of stethoscope sanitation practices in an emergency department setting

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Background: Stethoscopes harbor pathogens that can be transferred to patients when proper sanitary measures are not taken. Our aim was to assess medical provider stethoscope cleaning and hand hygiene in an emergency department setting.

Methods: The frequency and methods of stethoscope cleaning during and after provider-patient encounters were observed anonymously in an emergency department of the VA San Diego Healthcare System.

Results: Among the total of 426 encounters, 115 (26.9%) involved the use of a personal stethoscope. In 15 of these 115 encounters (13.0%), the provider placed a glove over the stethoscope before patient contact. In 13 of these 115 encounters (11.3%), the provider cleaned the stethoscope with an alcohol swab after patient interaction. Stethoscope hygiene with water and a hand towel before patient interaction was observed in 5 of these 115 encounters (4.3%). Hand sanitizer use or handwashing was observed in 213 of the 426 encounters (50.0%) before patient interaction. Gloves were used before patient interaction in 206 of these 426 encounters (48.4%). Hand sanitizer or handwashing was used in 332 of the 426 encounters (77.9%) after patient interaction.

Conclusions: Rates of stethoscope and hand hygiene performance were lower than expected. Further investigation of stethoscope contamination and the associated risk of nosocomial infection are needed. Perhaps clearer guidelines on proper stethoscope cleaning would reduce this risk.

Hospital-acquired infections (HAIs), or infections acquired while receiving care within a medical facility, pose a significant risk to patients. A Centers for Disease Control and Prevention (CDC) report estimated that 721,000 HAIs occurred in acute care hospital settings in 2011, and approximately 75,000 patients died during their hospitalization that year.[1] A 2009 report estimated that HAIs had an attributed direct medical cost between $28 and $45 billion annually.[2] Hand hygiene practices have been extensively investigated and targeted to reduce the incidence of nosocomial infections,[3-6] but stethoscope hygiene has yet to be thoroughly investigated and targeted as a risk factor.

Hands and stethoscopes are both involved in direct patient contact and can harbor similar levels and types of microorganism contamination.[7,8] Bacteria found on stethoscopes include methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci, *Clostridium difficile*, *Pseudomonas aeruginosa*, and *Klebsiella* species.[8-13] Hospitalized patients are more susceptible to infection owing to their compromised immunity and prolonged exposure to hospital-related pathogens,[14] so it is important to investigate the current state of stethoscope hygiene practices and seek potential improvements. Although survey-based studies of stethoscope hygiene have been published,[15-20] very few studies have assessed stethoscope hygiene through observation. We sought to hospital-acquired infection perform a descriptive study through direct observation to more accurately assess the state of stethoscope hygiene compliance. The purpose of this study was to observe the frequency and methods of stethoscope hygiene among medical providers in an emergency department (ED). Hand hygiene was also examined, owing to its correlation with stethoscope hygiene.

METHODS

We performed a descriptive study through direct observation in which provider-patient interactions were observed for their hand

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and stethoscope hygiene practices in an ED of the Veterans Affairs San Diego Healthcare System. The study was conducted using a single-blinded method, with the provider unaware of the observation. The observations were done by a graduate student research associate and an undergraduate assistant (2 observers), both of whom were trained in the pertinent clinical research methods and data collection. Observations were made between 12 PM and 4 PM over separate days of observation between October 16, 2017, and November 22, 2017. Both observers used the same parameters for observation, were instructed by the principal investigator, and communicated closely with each other.

Observers were situated behind the ward station in the ED hallway, where they were able to observe providers in the patient rooms while maintaining anonymity. When solicited by ED staff members, the goals of the study were not disclosed. Given the vantage point of the observers outside the patient rooms, sometimes providers and their actions were not completely visible. Handwashing stations, sanitizer dispensers, and cleaning wipes were present both in the ward hallway and within the patient room. The occurrence of hygiene practices was manually recorded by the observers from this position via checklist. Observation of the provider began before interaction with patients (outside the room) and ended once some form of postencounter hygiene was concluded or it was determined by the researcher that the provider was not going to engage in any form of postencounter hygienic practice. Data were organized by pre-encounter, during encounter, and postencounter stages.

Pre-encounter hand hygiene was assessed by the incidence of alcohol-based hand sanitizer use, washing with antiseptic soap and water, or wearing gloves. The presence of contact precautions and gown usage was also noted. During interaction, use of either a personal or a disposable stethoscope was noted, as was whether the provider covered the stethoscope with a clean glove. Postencounter hand hygiene was observed for hand sanitizer use or handwashing, and stethoscope hygiene was observed for at least 15 seconds of cleaning with either an alcohol swab or with faucet water and a paper hand towel. CDC guidelines recommend 60 seconds of cleaning for general noncritical surfaces but make no specific recommendation for stethoscope cleaning.[21] The minimum recommended duration of hand disinfection is 15 seconds,[22] so for our purposes, this value was chosen as the adequate duration of stethoscope cleaning. Cleanings observed to be < 15 seconds were not recorded.

Medical providers were involved in each patient interaction. Whether the encounter was performed by a physician or a nurse was reported. Because observations were done in only 1 ED, each provider was observed for multiple interactions.

Waiver of consent for this study was granted by the institutional review board (Protocol H160183). Patient and provider identifying information was deidentified to protect both parties.

RESULTS

A total of 426 provider-patient encounters were observed for hand and stethoscope cleaning practices, of which 141 were by physicians and 285 were by nurses. All encounters occurred within the same ED across 14 separate days of observation.

Stethoscope disinfection frequency

The frequency and methodology of the observed stethoscope hygiene practices are depicted in Table 1. A provider was seen using a personal stethoscope in 27.0% of the total patient encounters. The use of a disposable stethoscope was not observed in any encounter. During the patient encounter, the stethoscope was covered with a glove in 13.0% of the encounters in which a stethoscope was used. Following the encounter, the stethoscope was cleaned with an alcohol swab in 11.3% of the encounters and with faucet water and a hand towel in 4.3% of the encounters.

Table 1
Stethoscope hygiene frequency and methods

Stage	Method	No. of encounters (N = 115)	%
During encounter	Glove over stethoscope	15	13.0
After encounter	Alcohol swab	13	11.3
	Water/hand towel	5	4.3

Hand hygiene

The frequency and methodology of observed hand hygiene practices are summarized in Table 2. Use of alcohol-based hand sanitizer or handwashing with antimicrobial soap and water before the patient interaction was seen in 50.0% of the total observed patient encounters. Gloves were worn in 48.4% of the encounters. In 24.6% of encounters, no form of hand sanitation was performed and gloves were not worn before patient contact. Either the use of hand sanitizer or handwashing was observed following patient contact in 77.9% of encounters. In 4.0% of patient encounters, gloves, hand sanitizer, and handwashing were not observed either before or after the encounter. In 1 of the 4 cases in which there was patient contact precautions, neither a gown nor gloves were worn.

Stethoscope hygiene practices by provider type

The frequency and methodology of stethoscope hygiene practices by provider type are presented in Table 3. Among the 115 encounters in which a personal stethoscope was used, 63 were performed by a physician and 52 were performed by a nurse. A physician was observed placing a glove over the stethoscope in 19.0% of encounters, and a nurse was observed placing a glove over the stethoscope in 5.8% of encounters. Following patient interaction, physicians cleaned the stethoscope with an alcohol swab in 7.9% of encounters and with a hand towel and water in 4.8% of encounters, and nurses cleaned the stethoscopes with an alcohol swab in 15.4% of encounters and with a hand towel and water in 3.8% of encounters.

DISCUSSION

In the majority of provider-patient encounters, stethoscope hygiene was not performed. Instances in which the stethoscope was cleaned with water and a hand towel do not reflect proper cleaning methodology for noncritical surfaces. CDC guidelines recommend that objects involved in noncritical patient interactions (ie, with intact skin, no bodily fluids) should be cleaned for at least 1 minute anywhere from after each patient interaction to once weekly using an alcohol- or bleach-based disinfectant.[21] However, the ambiguity of these guidelines might not properly address the risk associated with

Table 2
Hand hygiene frequency and methods

Stage	Method	No. of encounters (N = 426)	%
Before encounter	Hand sanitizer	209	49.1
	Soap and water	4	0.9
	Gloves	206	48.4
	Contact precautions	4	0.9
	Gown	3	0.7
After encounter	Hand sanitizer	304	71.4
	Soap and water	28	6.57

Table 3
Stethoscope hygiene by provider

Stage	Method	Physician encounters (n = 63)	%	Nurse encounters (n = 52)	%
During encounter	Glove over stethoscope	12	19.0	3	5.8
After encounter	Alcohol swab	5	7.9	3	4.8
	Water/hand towel	8	15.4	2	3.8

stethoscope contamination specifically. One study found that bacterial contamination of the stethoscope can still occur after a thorough cleaning with isopropyl alcohol, and that the bacteria can be transferred from the stethoscope to the patient after just 3 seconds of stethoscope contact to the skin.[23] Therefore, a stethoscope could possibly become contaminated from contact with a patient despite a thorough daily cleaning performed beforehand, and pathogens could transfer to other patients on subsequent contact.

Stethoscopes are then often placed in the pockets of lab coats, where contaminants from the stethoscope can be harbored, thus facilitating their spread. One study examined the contamination of various fabrics found in hospital environments, as well as the duration of bacterial survival on the fabrics. All bacteria survived for at least 1 day, with some surviving for up to 90 days on certain fabrics.[24] In particular, methicillin-resistant *S aureus* was found to survive for up to 3 days on 60% cotton/40% polyester blend fabric, which is commonly used for lab coats and scrubs.[24] Given the potential for the stethoscope to act as a vector for infectious disease, the same emphasis given to hand hygiene should be applied to stethoscopes. More studies are needed to establish guidelines to address this potential risk and effectively prevent the transfer of infectious disease-causing pathogens from stethoscopes to patients.

Despite the emphasis placed on hand hygiene, with CDC guidelines recommending hand disinfection before each patient encounter,[25] our findings show that proper hand disinfection was performed in only 50% of encounters before patient contact. The risk associated with hand contamination is well established. We note that hand contamination might be exacerbated by the possible correlation between provider hand and stethoscope contamination. Longtin et al[7] found significant correlations between contamination of several parts of the hand and the stethoscope diaphragm, with greater contamination on the stethoscope diaphragm than on the thenar eminence of the hand. Stethoscopes frequently come in contact with providers' hands and thus can become easily contaminated and facilitate the spread of pathogens.

Bacterial stethoscope contamination has been described and investigated since the late 20th century, with several studies advocating regular disinfection.[10,14,16,20] However, compliance with proper stethoscope hygiene remains low; therefore, studies have sought to elucidate the factors contributing to low stethoscope hygiene compliance. One study surveyed providers in the ED to determine potential barriers contributing to poor stethoscope hygiene practices, identifying lack of time, being too busy or forgetful, and lack of access to cleaning materials as the most common responses.[19] Especially considering the fast-paced nature of the ED, the inconvenience of stethoscope hygiene is likely reducing compliance. Obtaining a disinfected and clean stethoscope after every patient contact takes time that might be interpreted as disruptive, especially if a provider has limited time between patients. Hand hygiene using hand sanitizer is a short, convenient process, and dispensers are ubiquitous in modern medical facilities, but there is no equivalent method of disinfecting stethoscopes.

Many studies on stethoscope hygiene practices have relied on survey-based data to assess rates of compliance. Reported stethoscope hygiene rates range widely, from 10% to 80%.[15-20,26] However, recall and social desirability bias might be contributing to higher reported compliance rates than are actually the case.[27,28] Observation-based studies eliminate these biases and can accurately assess hygiene practices, but providers are likely to change their behavior if they are aware of being observed.[28] These observer effects can be avoided if proper measures are taken to prevent the providers from knowing that they are being observed. Two of the few currently available observational studies on stethoscope hygiene assessed hygiene rates before and after an intervention to improve stethoscope hygiene compliance.[29,30] One of these studies found an increase in the rate of stethoscope disinfection from 34% to 59% with an intervention that involved stethoscope hygiene reminders and accessible baskets of alcohol swabs placed in the wards[29]; however, the other study, which implemented a similar intervention, found no compliance (0%) either before or after the intervention.[30] Ambiguity surrounding the effectiveness of such interventions might warrant investigation for an alternative method of improving stethoscope hygiene compliance.

LIMITATIONS

Although our study is one of the largest direct observational evaluations performed to date, it has some limitations. First, this study was performed within a single ED at a VA hospital, so generalization of this study to other departments and hospital settings is limited. Second, because the study was performed in a single department, the same providers might have accounted for multiple encounters, and the hygiene practices of any one individual provider might have affected the overall hygiene practice rates. Third, in some cases, the researcher was unable to continuously observe providers within the ED, so it is possible that stethoscope hygiene could have occurred unobserved. Furthermore, stethoscope hygiene was not reported if it occurred for <15 seconds, so the actual incidence of attempted stethoscope cleaning may have been higher than reported. Although both observers were instructed to use the same parameters for observation, interpretation of whether hygiene practices occurred can be subjective, potentially diminishing the interrater reliability. Finally, observation was intended to be performed without the providers' awareness, but it is possible that some providers were aware they were being observed and altered their behavior.

CONCLUSIONS

Our findings show that stethoscope cleaning practices are deficient, and the frequency of hand hygiene is low. Although wearing gloves may mitigate the risk associated with a lack of hand cleaning during patient-provider interactions, no such option currently exists for the stethoscope. A convenient and effective method of providing stethoscope hygiene that would not interrupt the work flow likely would be beneficial. Ultimately, the potential risk for nosocomial infection from stethoscopes is probably significant. Future observational studies of stethoscope hygiene practices are needed to further quantify this risk and potentially establish specific guidelines for stethoscope hygiene.

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