Stethoscopes: Friend or fomite?

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Hospital-acquired infections (HAIs) continue to remain at the forefront of the challenges facing healthcare today. According to the CDC, on an average day in U.S. hospitals, 1 in every 25 patients has at least one HAI.[1] These infections affect approximately 2 million patients annually, resulting in 99,000 estimated deaths and attributable costs of $6.7 billion.[1-4] Although estimates suggest that between 10% and 70% of HAIs are preventable with simple improvements in hygiene, predominantly hand washing, current research leads us to believe that poor hand hygiene isn't the sole means by which infection spreads.[4,5] There's compelling evidence from recent studies that many stethoscopes when tested were found to harbor disease-causing bacteria, such as *Staphylococcus aureus,* including methicillin-resistant strains (MRSA).

Moreover, evidence is accruing that many clinicians fail to properly clean their stethoscopes, often citing both a basic lack of understanding of stethoscope hygiene principles and a general misconception regarding the potential implications for patient safety when proper stethoscope hygiene practices aren't followed. These studies are small and many have been conducted outside of the U.S. healthcare system. A gap persists in our understanding of knowledge, attitudes, and practices of U.S. nursing staff, particularly among ICU nursing staff where stethoscopes are used more frequently than on other units.

Source of infection

Meticulous hand hygiene is now widely regarded as the best defense against the transmission of bacteria. Hospital administrators have invested substantial time, money, and energy on reinforcing the importance of proper hand hygiene. However, despite these efforts, HAIs continue to be unacceptably high. Since its invention in 1816, the stethoscope has become not only an iconic symbol associated with patient care, but is also widely considered one of the most essential pieces of equipment used regularly by bedside clinicians. Although there's little dispute about the positive role that the stethoscope plays in assisting clinicians to identify and diagnose a multitude of ailments, there have been several recent studies that indicate unclean stethoscopes also have the potential to serve as fomites of infection.[6,7] In the past, stethoscopes weren't often studied regarding their potential for contamination; however, there's new evidence suggesting that stethoscopes pose high levels of contamination.[7]

A seminal study in 1970 found that stethoscopes were contaminated in 13 out of 50 cases (26%), including penicillin-resistant *S. aureus*.[8] More recently, "stethoscope ear pieces were found to have been indirectly related to infections in a neonatal ICU where a healthcare worker with chronic otitis externa and MRSA likely infected two neonates by the possibility that the ear pieces were placed in the hands after auscultation."[9] Another study on an ICU identified that 3 out of 22 personal stethoscopes were colonized with pathogens.[10] One innovative study of ungloved physicians who auscultated MRSA-colonized patients with presterilized stethoscopes showed that the fingertips of the examiners or the diaphragms of their stethoscopes became contaminated with MRSA in 76% of the exams.[6]

A recent systematic review of 31 studies found that 87% of diaphragms and bells were contaminated with microorganisms, and 1 in 7 were

contaminated with MRSA, concluding that stethoscopes do harbor microorganisms and are a potential vector for the spread of pathogenic organisms.[7] In a 2013 study at a tertiary care hospital in Ujjain using a semistructured questionnaire distributed to 80 participants and swabbing diaphragms of their stethoscopes for bacterial contamination, 86% were found to be contaminated with at least one type of microorganism; *Pseudomonas aeruginosa* was the most predominate microorganism found on 58 stethoscopes, followed by *Bacillus subtilis* and *Staphylococcus* species, including MRSA.[11] The potential role of stethoscopes to transmit *Clostridium difficile* was demonstrated in a study that found 3 of 61 (4.9%) hospital physician stethoscopes sampled had *C. difficile* colony-forming units.[12] Another study also found high rates of contamination in 141 personal stethoscopes on an ICU; notably, standard methods of disinfection were found to be effective.[13]

Methods of decontamination

Contemporary evidence confirms high rates of bacterial contamination and that regular cleaning with appropriate isopropyl alcohol or ethanol-based products diminishes the possibility of cross-infection between patients.[14] Evidence suggests that stethoscope diaphragms, tubing, and ear pieces should be decontaminated between patients.[15] Ethanol-based products and alcohol have been shown to reduce bacterial growth by 94% for both techniques.[16] Healthcare professionals using ethanol-based products during hand cleaning have been observed to clean their stethoscope in one action, which appears to fit within the workflow better than locating an alcohol pad, using it, and then finding a place to dispose of the pad and wrapping. However, studies have demonstrated that disinfecting with hand rub is less effective than using alcohol because the mechanical friction generated when using an alcohol pad was found to be more effective.[17]

Clearly there's variability in practice, in part because no consensus on a stethoscope cleaning method and its frequency exists. The Healthcare Infection Control Practices Advisory Committee and the CDC provide recommendations, but these lend to wide interpretation to clean when "visibly soiled" and on a "regular basis."[18,19] This is evident in a survey of 150 emergency care providers about their stethoscope cleaning: Overall, only 48% of healthcare providers cleaned their stethoscopes daily or weekly, 37% monthly, 7% yearly, and 7% never cleaned their stethoscopes.[20]

Attitudes toward disinfection

"In a survey of 1,400 pediatric physicians and nurses on the barriers related to stethoscope hygiene, 76% acknowledged that stethoscopes were a potential vector for infection, but only 24% used disinfectant after each use. Those who were aware of the infection risks were more likely to clean their stethoscopes."[20] Barriers reported included time restraints, absence of disinfecting material, and insufficient visual reminders.[20] A quasi-experimental study conducted in a tertiary private hospital in Pasig City sought to determine the effects of an educational intervention on the contamination rates of stethoscopes and the knowledge, attitudes, and practices regarding stethoscope use of healthcare providers.[21] Ninety stethoscopes of 172 healthcare providers were cultured; contamination rates decreased from a baseline of 68.9% to 27.6% after an educational intervention, which consisted of a lecture-demo, performance feedback, handouts, and flyers.

A more recent study using observational data found that despite an intensive educational campaign, including visual reminders, provision of cleaning supplies, and ongoing feedback, stethoscope hygiene practices remained at zero.[22] In a study that found only 1 out of 50 physician stethoscopes was free from bacteria, only 3 out of 50 clinicians (6%) were unaware of the need to regularly clean their stethoscopes.[23] Of the 47 clinicians who were aware, 9 (19%) stated that they didn't clean their stethoscope regularly. When asked to quantify regularity of stethoscope cleaning, responses varied from "after every patient contact" to "I don't clean my stethoscope regularly." The median answer was "weekly."[23]

In a study to identify current stethoscope hygiene habits and attitudes in a U.K. medical school setting, 22.4% of those surveyed reported never cleaning their stethoscopes and only 3.9% cleaned their stethoscopes after every patient. In this same study, only 2.9% had received teaching on stethoscope cleaning and 86.4% felt that this topic needed more attention in their medical curriculum. Four main themes were identified: limited teaching, poor availability of cleaning material, poor role modeling, and a need to raise awareness.[24] These findings are similar to other studies in other countries and settings, thus underscoring the belief that this may be a widespread issue. In contrast, few studies, if any, have been done specifically targeting the nursing population in an ICU setting. Because nurses represent the largest number of health-

care workers, it would be remiss not to include this specific population in a study regarding stethoscope hygiene.

Significance for nursing

Nurses use stethoscopes repeatedly over the course of a day, come directly in contact with patients' skin, and may become contaminated with several thousand bacteria during physical exams. The possibility of stethoscopes as a potentially significant vector of transmission is evident as we found in our literature review. "Failing to disinfect stethoscopes may constitute a serious patient safety issue akin to omitting hand hygiene."[25] The stethoscope should be regarded as an extension of the clinician's hands.[25] Although current recommendations for stethoscope hygiene exist, healthcare professionals often fail to adhere to these guidelines due to lack of time, lack of availability of disinfecting materials, and insufficient visual reminders.

Identifying nurses' attitudes toward stethoscope hygiene and factors that contribute to poor stethoscope hygiene practices while unveiling misconceptions may provide a knowledge base that can be used locally to target educational endeavors and pave the way for future research on a larger scale. In addition, hospitals can be proactive in reducing the potential spread of infection by ensuring that current infection control policies and procedures include best-practice stethoscope hygiene recommendations and having systems in place to support these practices. NM

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