

The Ebola outbreak heightened our awareness of infection control and the gravity of even small lapses in our extensive protocols. Nurses caring for an Ebola patient in late 2014 in Texas were nearly covered from head to toe, however just a small breach was enough to transmit Ebola to two health care providers.

Stepping into the physician's office, there are surfaces carrying pathogens that patients are far more likely to contract – *C. difficile*, MRSA, Influenza, Rotavirus, Norovirus and Enterovirus. Health care-associated infections (HAIs) affect 1 in 20 patients, resulting in significant morbidity, mortality and billions of dollars in medical costs. What deficiencies in our exhaustive procedures allow HAIs to be the fifth leading cause of death in acute care hospitals?

In my experience, standard infection control procedures always included hand hygiene, changing paper on the exam table, disinfecting entire hospital rooms, perhaps wearing gowns, shoe covers, hair nets, etc., but one item touches patients frequently without being cleaned – the stethoscope! I have seen stethoscopes travel from patient to patient, often without any type of sanitation.

The first time I noticed this disconnect, the provider used a stethoscope on a patient with MRSA and then placed it on the chest of a cancer patient with a central line - without cleaning it! Before entering the exam room of the patient who had a MRSA infection, we donned gloves and an isolation gown. The attending performed the usual physical exam including listening to the patient's heart and lungs with a stethoscope. As we left, we removed our gloves and gowns and washed our hands. Next, we greeted an elderly woman who was undergoing chemotherapy treatment for breast cancer. During the physical exam, the same stethoscope that was used on the patient with MRSA was placed inches from the patient's central line without any form of sanitation. I cringed at this site knowing I lost my own grandmother to a lethal surgical wound infection. I initially presumed such a small weakness was insignificant – we take so many steps to prevent HAIs – surely we could not be overlooking the piece of equipment most eponymous with medicine? That night I poured through research articles searching for an answer.

Dozens of studies have documented the ability of stethoscopes to spread dangerous germs, yet 70-90% of health care providers do not systemically clean their stethoscopes. As recently as February 2014, a study in the Mayo Clinic Proceedings grabbed national headlines when it demonstrated that during patient examinations, stethoscopes acquire MRSA bacteria at levels comparable to parts of physicians' hands. However, this does not appear to have changed standard procedures.

With Ebola, we quickly noted that lack of explicit guidelines is not justification for inaction and quickly rectified protocols.

In the case of stethoscopes, the procedure modifications are not entirely clear. What prevents providers from sanitizing stethoscopes? A study of pediatric health care providers published in The American Journal of Infection Control found reasons for not sanitizing the stethoscope include concern about stethoscope wear and tear, lack of access to disinfection materials, lack of visual reminders, and lack of time. Alcohol damages stethoscopes and does not kill pathogens such as spores and non-enveloped viruses (e.g., adenovirus). Furthermore, providers must spend approximately 15 seconds rubbing an alcohol wipe on each stethoscope surface to provide the

mechanical removal, rather than just inactivation necessary for alcohol to be effective against many pathogens.

The effectiveness of “contact precautions” designed to prevent infections in the hospital setting is dependent on health care provider adherence to protocols. It is common knowledge that health care providers often opt to utilize their personal high-quality stethoscope instead of the low-quality dedicated disposable stethoscope, thereby breaching standard infection control practices. I was once told, “You will hear better with a Styrofoam cup to the chest than with the disposable stethoscope!” Indeed, a recent study demonstrated that using disposable stethoscopes to care for patients on contact precaution could compromise identification of important auscultation findings, especially crackles and stridor. Furthermore, I often heard providers say that they did not want to share ear tips with every other provider who used the disposable stethoscope in the patient’s room.

My response to the problem of contaminated provider stethoscopes and inadequate disposable stethoscopes was to craft a solution that addresses the systemic barriers to stethoscope hygiene through social entrepreneurship: I developed small and full-length disposable stethoscope covers that do not damage the stethoscope, are easy to change between each patient contact, cost less than alcohol wipes, and provide a visual reminder of stethoscope hygiene – its bright blue so providers will notice if their stethoscope is missing one. Furthermore, disposable covers improve quality of care while reducing supply costs by replacing low-quality disposable stethoscopes with providers’ high-quality stethoscopes outfitted with a disposable cover.

I have developed my invention, performed laboratory testing, interviewed several health care providers, and started producing the covers – which many providers have already begun incorporating into their practices. I am now organizing an academic study to quantify the benefits of the disposable covers to demonstrate their utility in advancing patient care while reducing supply costs.

The Ebola cases contracted within the United States incited fear and scrutiny leading us to question whether the guidelines in place are adequately preventing infection transmission. I believe we should take this critical mindset and apply it to infection control in health care settings, without the panic. Modern medicine has created immense hope for a multitude of diseases and conditions. Yet, HAIs prevent medical interventions from reaching their full potential. This experience has taught me to always think critically about identifying gaps in health care quality, communicate my concerns with colleagues, and to not be afraid to pursue the development of a potential solution. As a physician-in-training, I now recognize that my responsibility to the patient is not confined to a given organ system or disease condition. I hold myself responsible for catering to the patient’s overall well-being and recognize that dangers to patient safety are not always glaringly obvious – they can also present in mundane form.