

Towards Decreasing the Effect of Stethoscopes as Fomites in Healthcare Acquired Infections: Can Practitioners Tell Difference Between Disposable and Standard Stethoscopes and Gloved versus Ungloved Stethoscopes?

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ABSTRACT

Purpose of the study: The purpose of this study was to determine if participant emergency residents were to correctly identify a disposable stethoscope versus a standard stethoscope and also whether participants were able to identify a gloved standard stethoscope versus an ungloved standard stethoscope. **Materials and Methods:** The setting was the three emergency departments of a community-based, university-affiliated hospital system. The study was approved by the Institutional Review Board. The participants were residents in emergency medicine. They were asked to perform a first-pass assessment to determine if they could correctly detect whether they were listening to volunteer resident lung sounds through a standard or a disposable stethoscope. Participants consented to the study. The subject will not be requested to identify the nature of the sounds. They were also asked to determine if they could detect whether a nitrile glove was, or was not, placed on a stethoscope. Thus, the practitioner's ears, blinded visually to the presence or absence of the glove, would provide the first-pass assessment of the effect of nitrile gloves on acoustic performance on volunteer normal participants. All participants consented to the study. **Results:** 12 participants were able to correctly identify the disposable stethoscope (57%). Nine (9) participants could not (43%) The difference between the correct and incorrect identification was not statistically significant ($p=0.37$). Only 14% of participants were able to identify the gloved stethoscope. 86% of participants thought that the gloved stethoscope was a superior sound and that it was ungloved. Further research could confirm these findings.

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The inability to identify the correct (gloved) stethoscope was highly statistically significant ($p < 0.001$). **Conclusions:** Participants were not able to distinguish between the disposable and the standard stethoscope. 86% of participants felt that the ungloved stethoscope gave a superior sound and was the ungloved stethoscope. This pilot data recommends a larger study included assessment of disposable and gloved stethoscopes in identifying abnormal sounds.

Keywords: Stethoscope acoustics, disposable stethoscopes, nosocomial infections, gloved stethoscope

BACKGROUND

In 1546, the Italian physician Girolamo Frascato proposed that epidemic diseases were caused by direct or indirect contact with extremely small particles of some sort of contaminating (“contagious”) matter. It is doubtful that even Frascato’s great genius and far-reaching prescient intuition could have foreseen the sheer magnitude of what has become known as “nosocomial infections”, implying hospital-acquired infections, let alone the more commonly-used and more broad problem of “Healthcare acquired infections”, (HAI) implying infections related to exposure in the wide panoply of modern inpatient and out-patient healthcare facilities.

In the context of preventability, Frascato’s fomites emerge as being particularly associated with HAI infections. Modern references refer to fomites in terms that would have made complete sense to Frascato. For example, one very commonly used lay reference discusses fomites as “possible routes to pass pathogens between patients. Stethoscopes and neckties are two such fomites associated with healthcare providers. Basic hospital equipment...can be carriers.” [<http://en.wikipedia.org/wiki/Fomite>]

In reference to stethoscopes as fomites, there is evidence in the literature of a rather remarkable level of stethoscope contamination in the healthcare environment.

Based on a review of the literature, it appears that:

- Stethoscopes are proven fomites.
- Stethoscopes tend not to be cleaned regularly, and when they are, they quickly become recontaminated.
- Complete stethoscope cleansing would appear to require the removal and cleansing of the diaphragm retaining ring, making cleansing with each use less practical
- Diaphragm covers may actually increase surface colonization

Anecdotally, several of our team members have observed that the use of nitrile gloves as covers of the lower stethoscope unit. It is unclear how prevalent this practice might be at various centers. It would appear likely that the use of gloves in such a way would create a barrier to the fomite nature of the lower stethoscope unit. This could, of course, be formally tested as a proposition. However, as a precursor to such a study, a relevant question would be whether the use of a nitrile glove degrades the acoustic properties of a stethoscope. A review of the literature (PubMed) by the authors of this proposal did not identify a specific study that looked that effect of nitrile gloves on acoustic performance of stethoscopes.

The purpose of this study was:

1. to perform a first-pass assessment to determine if practitioners can correctly identify a disposable stethoscope. The question framed was which stethoscope is disposable and which is standard.
2. to perform a first-pass assessment of the effect of nitrile gloves on stethoscope performance. The question framed was which stethoscope do you believe to be the gloved stethoscope.

MATERIALS AND METHODS

The setting was the three emergency departments of a community-based, university-affiliated hospital system. The study was approved by the Institutional Review Board. The participants were residents in emergency medicine. They were asked to perform a first-pass assessment to determine if they could correctly detect whether they were listening to volunteer resident lung sounds through a standard or a disposable stethoscope. The participants were not able to see or touch the stethoscope itself. The stethoscope was put in place by a study member. Participants consented to the study. The subject was not requested to identify the nature of the sounds. They were also asked to determine if they could detect whether a nitrile glove was, or was not, placed on a stethoscope. Thus, the practitioner’s ears, blinded visually to the presence or absence of the glove, would provide the first-pass assessment of the effect of nitrile gloves on acoustic performance on volunteer normal participants. All participants consented to the study.

RESULTS

There were 21 participants.

Objective 1) to determine if practitioners can correctly identify a disposable stethoscope.

12 participants were able to correctly identify the disposable stethoscope (57%). Nine (9) participants could not (43%) The difference between the correct and incorrect identification was not statistically significant ($p=0.37$).

Objective 2) to determine if practitioners can correctly identify gloved stethoscopes

Three (3) participants were able to correctly identify the gloved stethoscope (14%). 18 participants could not (86%) The inability to identify the correct (gloved) stethoscope was highly statistically significant ($p<0.001$).

DISCUSSION

12 participants were able to correctly identify the disposable stethoscope (57%). Nine (9) participants could not (43%) The difference between the correct and incorrect identification was not statistically significant ($p=0.37$). This is an interesting finding and suggests that the difference in ability to identify was no different than by chance. Participants were unable to correctly identify the gloved stethoscope. There appears to be rather limited literature concerning stethoscope acoustics, in general.

As two examples of the work that has been done, Callahan et al., developed an objective methodology to test the audio quality of stethoscopes that was independent of the manufacturer's published test results. The study proposed that stethoscopes can be divided into basic categories, such as basic assessment, cardiology, disposable and high-end cardiology stethoscopes (Callahan et al., 2007). Mehmood compared high-end stethoscopes to disposable stethoscopes through the use of a simulation center model in which the accuracy of identification of five basic auscultatory sounds was studied. The lower end stethoscopes appeared to be less reliable than the higher end stethoscopes, especially in reference to stridor and crackles (Mehmood et al., 2014).

CONCLUSION

Participants were not able to distinguish between the disposable and the standard stethoscope. 86% of participants felt that the ungloved stethoscope gave a superior sound and was the ungloved stethoscope. This pilot data recommends a larger study included assessment of disposable and gloved stethoscopes in identifying abnormal sounds.

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