

**Comparison of Two Digital Stethoscopes with the Traditional Stethoscope Used on International Space Station**

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Introduction: A traditional stethoscope is currently flown on the International Space Station (ISS). The background noise on the ISS is much higher than a normal exam room, and the literature shows that traditional stethoscopes are unable to function effectively in high noise environments. Digital stethoscopes provide amplification which improves the audibility in a quiet environment. This study is designed to determine if digital stethoscopes offer any advantage over traditional stethoscopes in being able to identify normal and abnormal sounds in the ISS noise environment. Methods: An ISS noise simulation facility was created to reproduce ISS noise profiles by modifying pink noise with a software-based graphic equalizer. The files were played in a continuous loop on a computer, amplified through a high-end stereo system and adjusted using a sound level meter. Nine caregiver analogues were given the same auscultation lesson received by astronauts. They began testing by becoming familiar with normal and abnormal sounds on a Student Auscultation Manikin. They then used two digital stethoscopes and a traditional stethoscope identical to the one flown on the ISS to auscultate the manikin sounds in the noise facility. They identified the sounds on a questionnaire and picked which of the three stethoscopes they preferred. Results: Evaluators displayed equivalent accuracy in sound identification when using either the 3M model 4000 digital stethoscope or traditional stethoscope. However, the 3M was preferred 2 to 1 by the evaluators, primarily because of additional amplification of the sounds. Discussion: Although our results show that the current ISS stethoscope and the "best-of-breed" digital stethoscope provide essentially the same auscultation utility, the latter has the advantage of recording and transmitting sounds to a remote physician. Since the astronaut caregivers are non-physicians, this capability may be worth the additional expense and effort needed to certify the digital stethoscope for flight.