

# Modern-day cardiac auscultatory teaching and its role alongside echocardiography

Maximizing physicians' cardiac auscultatory abilities alongside use of advanced diagnostic technologies results in better diagnostic accuracy and increased patient interaction.

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**ABSTRACT:** In the hands of a skilled user, the stethoscope is a quick, inexpensive, and readily available way to screen and assess patients for cardiac pathology at initial point of care. Unfortunately, reliance on sophisticated diagnostic technologies such as echocardiography and, more importantly, outdated auscultatory teaching methods has led to a decline in practitioners' ability to correctly identify heart sounds through auscultation. Current research shows cardiac auscultatory teaching should place more emphasis on auditory repetition in conjunction with visual integration, testing, and scheduled refresher learning of heart sounds. This can be done in an accessible, affordable, and self-paced manner through online or phone applications. Proficient cardiac auscultation and new diagnostic technologies have the potential to work synergistically with one another to improve patient outcomes.

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## Introduction

The stethoscope has been a part of the physician's toolkit for over 200 years since its invention in 1816 by French physician Rene Laennec.<sup>1</sup> Binaural, electronic, and more recently, iPhone stethoscopes with the ability to amplify, record, and share heart sounds are options for health care professionals to use in their daily practice.<sup>2</sup> Auscultation serves as a quick and inexpensive way for the modern-day physician to infer a variety of disease states about the cardiovascular, respiratory, and gastrointestinal system, which allows for streamlined diagnoses and management. However, with long patient lists, access to sophisticated diagnostic technology, and stagnant auscultatory teaching methods, more time is being spent combing through patient electronic medical records rather than examining and auscultating the patient. The identification of auscultated heart sounds among most medical students,<sup>3-5</sup> residents,<sup>4-6</sup> and physicians<sup>5,7-9</sup> is poor. Practitioners at all levels of training find it difficult to identify and distinguish pathological from normal heart sounds, which can lead to delayed diagnoses and treatment, as well as unnecessary, potentially harmful investigations.

## Auscultation or echocardiography?

The decline in physicians' ability to identify auscultated heart sounds could be due, in part, to the widespread introduction and reliance on advanced diagnostic technologies such as echocardiography.<sup>10</sup> The diagnostic accuracy of echocardiography is superior to auscultation when identifying many subtle cardiac pathologies, and has the capability to improve detection over cardiac auscultation alone.<sup>11-14</sup> Relatively recent advances in medical technology have led to the development of handheld ultrasound devices that can be used at the initial point of care to assess cardiac function. Cardiologists using handheld ultrasound outperformed cardiologists using physical examination with auscultation for identifying the majority of common cardiac pathologies.<sup>15</sup> Medical schools are beginning to incorporate ultrasonography early into their undergraduate curriculum as a regular part of the physical examination.<sup>16</sup> Proponents of point-of-care ultrasound acknowledge the relatively high risk of misdiagnosis among inexperienced practitioners.<sup>16</sup> Even with experienced ultrasonographers, there are circumstances where echocardiography misses car-

diac pathology that the stethoscope is able to pick up. Dr Valentine Fuster describes one of many such clinical situations, where a pericardial rub is heard through auscultation in a patient with chest pain and fever, despite echocardiography's inability to show any pericardial effusion.<sup>17</sup> The existence of better tests does not negate the stethoscope, but rather, pushes us to understand its limitations and value alongside cardiac auscultation in the physical examination.

### Modern-day cardiac auscultatory teaching

Apart from technological advances, a compelling reason for poor auscultatory heart sound identification is that teaching methods for cardiac auscultation among medical programs has not changed much over the last half century.<sup>18</sup> Current evidence-based cardiac auscultatory teaching methods involving online platforms and phone applications have the potential to revitalize cardiac auscultation in medical programs.<sup>19</sup> The technical auditory skill of recognizing abnormal from normal heart sounds, extra heart sounds, and common pathological murmurs during auscultation tends to be inadequately taught, and consequently, poorly understood by medical students. Accurate heart sound identification requires the brain to be able to recognize the volume, frequency, and timing of sounds.<sup>20</sup> This skill can only be developed by hearing many repetitions of the same, often subtle sound, in order to incorporate that new pattern of sound into long-term memory.<sup>20</sup> Multiple studies have shown that auditory training, compared to traditional teaching methods, can markedly advance a learner's ability to recognize abnormal from normal heart sounds, extra heart sounds, and common pathological murmurs.<sup>7,21-23</sup> In addition to benefiting novice and intermediate learners, cardiologists significantly improved their identification of basic



and advanced murmurs after listening to 400 repetitions of each murmur while viewing cardiac images.<sup>7</sup> Auditory training is a promising technique that should be paired with visual animations of the hemodynamics and valvular actions of the given sound,<sup>24-26</sup> in addition to skill testing and scheduled refresher learning.<sup>18,21,27</sup> Such training allows the learner to visualize the flow of blood through the heart and best understand the pathophysiology responsible for the given sound, extending retention.<sup>25</sup> Testing and periodic refresher learning ensure a high degree of competency has been reached and will be maintained over time.

### Computers, smart phones, and heart sounds

Successfully incorporating the required cardiac auditory repetition into the schedules of medical students and practising professionals poses a challenge. However, with the increasing range of Internet connectedness and use of cellphones, this challenge can be overcome. The American College of Cardiology and Teaching Heart Auscultation to Health Professionals websites offer free online auditory training programs with hundreds of repetitions of various hearts sounds, training assessments, and downloadable mp3 files for offline use on a

computer or smart phone.<sup>28,29</sup> Blaufuss Medical Multimedia Laboratories has also created a free online platform for learning four common valvular lesions using auditory repetitions of heart sounds combined with interactive computer animations and detailed text.<sup>30</sup> In addition to the online platforms, there are a variety of smart phone applications available, such as HeartMurmurs and Murmur Pro that offer auditory repetitions in combination with visual aids, descriptions, and quizzes to assess competence. The online platforms, and more specifically, the phone-based applications, offer a low-cost, flexible, and effective medium for incorporating evidence-based auscultatory teaching into the schedules of health care professionals.

### Conclusion

Cardiac auscultatory skills can work synergistically with new diagnostic technologies like point-of-care ultrasound. Cardiac auscultatory teaching methods should be modernized by incorporating auditory repetition to hone technical auscultation skills, using concurrent visualizations to improve conceptual understanding of cardiac pathology, and employing testing and periodic refresher sessions to ensure long-term knowledge re-

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tention. Online platforms and phone applications offer a portable learning medium that is affordable, readably accessible, and self-paced for mastering the technical and conceptual aspects of cardiac auscultation, in addition to the basic foundational knowledge and physical exam skills already being taught in medical schools and residency. Maximizing cardiac auscultatory ability instills confidence and encourages physical examination alongside advanced diagnostic technologies, resulting in better diagnostic accuracy, increased patient interaction, and more importantly, human connection.

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