Title

Physical Maneuvers and Recent Tools to Break the Silence of Clinically Undetectable Heart Sounds

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Authors

Maidens, John
Chorba, John S
Thomas, James D

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Full names, highest academic degrees, and affiliations of all authors (if an author's affiliation has changed since the work was done, the new affiliation also should be listed):

John Maidens, PhD

Department of Data Science

Eko Devices, Inc.

Oakland, CA

John S. Chorba, MD

Division of Cardiology

University of California San Francisco

San Francisco, CA

James D. Thomas, MD

Bluhm Cardiovascular Institute

Northwestern Medicine

Chicago, IL

Name and complete contact information for corresponding author:

John Maidens

1212 Broadway, Ste 100 Oakland, CA 94612

Email: john@johnmaidens.com

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In a recent research letter, Jariwala and colleagues[1] highlight the need to evaluate the limitations of auscultation for heart sounds. Despite the ubiquity of the stethoscope, there is still a paucity of data on the clinical interpretation of heart sounds in real-world contexts, making this work an important contribution. The results presented demonstrate the challenge of interpreting the acoustic signatures of valvular heart disease using a particular model of electronic stethoscope. But far from demonstrating that this integral part of the physical exam is ~~a thing of the past~~outdated, we believe that their work emphasizes the importance of improving the ~~set of~~ tools and digital enhancements required to maintain the value of the stethoscope in modern practice.

Electronic stethoscopes vary widely in the underlying acoustic capture technology and hence the corresponding quality of audio captured. Digital recordings acquired using one model may not accurately reflect the sound heard through others, or even through an analog stethoscope. A recent study by Koning and Lock[2] found that newer digital stethoscopes provided much better audio quality than the popular Littmann 3200 stethoscope used by Jariwala and colleagues. These improved receivers, and their future iterative enhancements such as noise cancellation, may improve the low detectability of heart sounds ~~at the auscultation positions where Jariwala and colleagues observed low detectability~~, and their commercial availability illustrates the meaningful progress made in digital stethoscope sensor technology over the past decade.

In addition, a~~Separate from technological improvements in sound acquisition, a~~utomated interpretation ~~tools~~[3] may further improve the utility of heart sounds by shifting the threshold for detection away from the limits imposed by human perception. In a multi-site study enrolling 962 subjects undergoing digital auscultation and echocardiography, we[4] demonstrated that a machine learning-based tool led to high detectability of heart sounds and accurate identification of heart murmurs. Specifically, when assessing mitral regurgitation graded moderate-to-severe or greater, we found undetectable heart sounds at

the mitral position in only 11/79 (14%) subjects in contrast to the 7/12 (58%) found by Jariwala et al. The machine learning tool could also identify mitral regurgitation murmurs with sensitivity of 66.2% and specificity of 94.6%.

While improved sensors and machine learning-based interpretation can improve the diagnostic accuracy of the stethoscope, as Jariwala and colleagues point out, auscultation of the heart benefits the patient-physician relationship in ways far beyond its diagnostic accuracy.[5] ~~As the technology used for auscultation~~As auscultation technology continues to advance, we hope that clinicians will continue to listen to their patients' hearts, strengthening trust on both sides of the relationship.

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