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LETTER TO THE EDITOR

The future is more than a digital stethoscope

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We commend the authors for the accurate overview of cardiac auscultation techniques and differential diagnoses, as well as for offering a perspective of what the future of cardiac auscultation might hold.[1] Indeed, the evolution of the digital stethoscope has been impressive in recent years. However, we believe that in cardiology and medicine in general, the future likely has more to offer than a digital stethoscope.

First, one of the main strengths of telemedicine lies in patient empowerment, with patients using low-cost consumer devices themselves to screen for or monitor medical conditions. Readily available smartphones, smartwatches, wristbands, and other wearable devices are promptly transformed into medical devices through appropriate software. While not fully predictable, the real innovation in telemedicine will most likely be the integration and advanced analysis of all this data possibly leading to a new diagnostic paradigm, as precisely described by Krittanawong *et al.*[2] While cardiac acoustic data analysis or phonocardiography might certainly be part of this future, a dedicated digital artificial intelligence-assisted stethoscope is in our opinion less likely to be.

Second, in the field of medicine delivered by professional caregivers, a clear evolution is taking place that is turning away from the stethoscope. With the rise and increasing accuracy of point-of-care ultrasound (POCUS), and its possibility to assess multiple organ systems, many question if the stethoscope is likely to survive the coming decades.[3,4] POCUS is replacing the stethoscope in many areas: the intensive care department, the emergency department, the internal medicine ward, and even the general practitioner's (GP) office.[5,6] Beyond cardiac evaluation and volume assessment it has shown high accuracy in evaluation of other organ systems, also when performed by GPs and emergency physicians.[7,8] A recent systematic review summarizes the results.[9] For lung pathology (e.g. pulmonary oedema, pneumonia, pneumothorax, rib fractures) accuracy was high and often superior to chest X-ray in adult as well as paediatric medicine. High accuracy was also demonstrated in diagnosing abdominal pathology (e.g. biliary pathology, appendicitis, small bowel obstruction, ascites), arterial and venous disease, guidance of catheter insertions, obstetric physiology and pathology (e.g. foetal follow-up by GPs, diagnosis of ectopic pregnancy in the emergency department). It is also used for eye examination, soft tissue examination and musculoskeletal examination; areas where the stethoscope is typically of little use.

Also in rural areas, image acquisition by trained sonographers, with expert interpretation at a distance when needed, was shown feasible in the ASE-REWARD study that took place in rural India.[10] Currently POCUS is not inexpensive when compared with a stethoscope. However, many papers emphasize that, while cost is indeed a barrier, the large potential of POCUS use in low- and middle-income countries is exactly in its low cost because it can be performed by the treating physician at the point of care and, in contrast to the stethoscope, it often reduces the need for consecutive more expensive imaging modalities.[11,12] With decreasing costs of POCUS probes, increasing connectivity with smartphones and the global rollout of high-speed internet, the global usage of POCUS is thus likely to continue to grow.

Time will tell what technology the future will bring and what will be implemented. The discussion that should be held today, however, is whether to continue investing large proportions of education time in training medical students to reach an expert level in (cardiac and non-cardiac) auscultation, or to opt for integrating knowledge about digital health, telemedicine and POCUS into medical education early on. In our opinion, there are many arguments to defend the latter.

Conflict of interest: none declared.

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