A low-cost solution for converting existing stethoscope into tele-stethoscope in resource-constrained setting for COVID-19 pandemic

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ABSTRACT

In the present scenario of COVID-19, there has been a sudden surge in demand for tele-consultancy. Such measures require resources to support the system. Replacement of conventional equipment used in a clinic with digital equipment is not feasible due to their cost and scalability issues. The authors developed a simple low-cost (almost zero cost) method to convert a conventional stethoscope into a tele-stethoscope. Such a simple modification can be useful in periphery wherein doctors are still not available and the growing number of patients would require a diagnosis of the chest conditions.

Keywords: COVID-19, stethoscope, teleconsultation

Commentary

A stethoscope is a vital tool in a doctor’s life. It is used for auscultating heart, lungs, and even hearing gastrointestinal sounds. It consists of a diaphragm with air-filled tubes to transmit the sounds from the chest to the ear. Since the invention of the stethoscope by Laennec, the stethoscope has undergone a lot of changes to reach its current form.¹ The stethoscope has also evolved with the advancement of technology. Electronic and digital stethoscopes are expensive and not at all viable solutions to measure vital body parameters remotely due to nonscalability in a large country like India. Some authors have modified the stethoscope for teaching purposes in medical institutions but such modifications have largely been confined to undergraduate labs only.²,³

In clinical examination, the usage of stethoscope at primary level screening is multifold. In the resource-constrained environment such as rural areas where availability of healthcare professionals is very rare, a patient has to travel miles before reaching a clinician for consultancy. This scenario is even more important in today’s times when the number of COVID-19 cases are rising in India.

In this article, the authors describe a low-cost solution for enabling remote usage of a conventional stethoscope by experts to facilitate tele-consultancy.

The tele-stethoscope was constructed using a conventional stethoscope, two pairs of earphones with mic and two mobile handsets with SIM cards.

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The steps involved in the construction of the tele-stethoscope were as follows:

The earpiece of a stethoscope was attached to an earphone's mic [Figure 1]. The earphone jack was plugged in the healthcare worker's or patient's mobile handset. A pair of good quality headphones were plugged into the doctor's mobile phone.

To use a stethoscope for tele-auscultation by the doctor, the healthcare worker at the periphery needed to set up a normal mobile call with the doctor and place the diaphragm of the stethoscope on the patient's chest as guided by the doctor.

In case of the call being done by the patient, he/she could use one or both earplugs to listen to the doctor, thereby allowing the doctor to guide the patients over the phone call to move the stethoscope appropriately as required. This allowed the doctor to hear the chest sounds and suggest the possible measures to the healthcare worker or necessary steps to be taken by the patient. This is a simple technical solution using existing resources without any intervention and tested under experimental conditions. The future clinical validation would encompass appropriate ethical clearances. This tool highlights that simple innovation can be done to help healthcare setups.

The authors used a simple combination of easily available components to convert a conventional stethoscope into a tele-stethoscope at a very low cost or almost zero cost. The proposed approach did not require any engineering marvels and can be performed without much expertise by even layman. Also, the stethoscope was not cut so as to allow its use as a normal stethoscope also. The system could also be used with low-budget phones and help to provide expert access at the periphery. A normal earphone costing around INR 100/- was good enough to provide a reasonable performance and high-end headphones can also be used improving the performance depending upon affordability.

In the present scenario, this kind of setup allows an expert to monitor patients safely and reliably. Such kind of simple and cost-effective solutions can be useful to all clinicians and particularly the primary care physicians in rural setup and can be scaled up immediately without any capital investment. This is an initiative for efficient use of existing resources in resource-poor settings especially relevant in these times of COVID-19 pandemic where access to healthcare has been compromised even in urban settings. The primary care is worst affected by this pandemic and this may provide much-needed cost-effective tool for use by primary care physicians.

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Conflicts of interest
There are no conflicts of interest.

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