

Original Research

The Digital Stethoscope in Telemedicine: A Health Camp Study

Imran Pathan, MBBS, MS¹; Ravi K. Chittoria, MS, MCh, DNB, MNAMS, PhD^{1*}; Saurabh Gupta, MBBS, MS¹; Chirra L. Reddy, MBBS, DNB¹; Padmalakshmi B. Mohan, MBBS, MS¹; Shijina Koliyath, MBBS, MS¹; Nishad K, MBBS, MS¹; Mohamed Ishaq Z, MCA²

¹Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry 605006, India

²Telemedicine Infrastructure and Network Administrator, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry 605006, India

*Corresponding author

Ravi K. Chittoria, MS, MCh, DNB, MNAMS, PhD

Professor, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry 605006, India;

E-mail: drchittoria@yahoo.com

Article information

Received: January 14th, 2020; **Revised:** March 10th, 2020; **Accepted:** March 12th, 2020; **Published:** March 12th, 2020

Cite this article

Pathan I, Chittoria RK, Gupta S, et al. The digital stethoscope in telemedicine: A health camp study. *Clin Trial Pract Open J*. 2020; 3(1): 5-8.

doi: [10.17140/CTPOJ-3-111](https://doi.org/10.17140/CTPOJ-3-111)

ABSTRACT

India is a vast country with limited human resources. People living in remote areas often have limited access to healthcare facilities. To address this need and to increase healthcare awareness, health camps have been established. These camps are often supervised by junior physicians. Telemedicine, and in particular use of a digital stethoscope may provide better diagnosis and better consultation to the patient by senior physicians located remotely. This article highlights the clinical use of a digital stethoscope in such a health camp.

Keywords

Health camp; Telemedicine; Digital stethoscope.

INTRODUCTION

Institution based, services are unable to meet the present need of the Indian population because of a large patient load spread across a wide area.¹ Health camps, on the other hand, have the advantage and flexibility of delivering healthcare to the patients at their doorsteps, however, the quality of care often becomes an area of concern. This is because the health camps are primarily supervised by junior clinicians, whereas more senior doctors with greater expertise are out of reach for a large percentage of the population.

To address this need telemedicine has a definite role.^{2,4} Telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance. It has been used to overcome distance barriers and to improve access to medical services. Various modalities have been used in medical education and in recent times provide remotely located people the opportunity to interact with national and international experts in the field of medicine.^{5,6}

The digital stethoscope is a simple instrument that converts sound to a digital signal that is then transmitted and reconverted to a sound signal that can be heard by a more experienced clinician located elsewhere. In this article, we describe the use of the digital stethoscope in a health camp setting.

METHODOLOGY

This study was conducted in health camps organized by the department of plastic surgery of a tertiary care centre in 2019. Outreach Camps covered around 200 kilometers including 5 rural areas. Most of these rural regions were about 150 kilometers from the tertiary centre. A total of 26 patients were screened. Informed written and verbal consent was obtained from the patients.

A teleconsultation room consisting of a laptop with built-in speaker/smartphone and internet (Dongle data card) was set-up. Likewise, senior consultants were provided a teleconsultation room as well. Using free video calling applications, resident/junior doctors were connected to remote consultants who provided them

with guidance and consultation (Figure 1). The junior doctor used a digital stethoscope (3M Littmann Electronic Stethoscope model 3200) for auscultation of heart sounds. The 3M™ Littmann® Electronic Stethoscope model 3200 (Figures 2 and 3) picks up sounds, such as heart and lung sounds, from a patient's body. After amplification and filtering, the sounds are sent to the user through a binaural headset. The stethoscope chest piece is designed for use with adult, pediatric and infant patients.

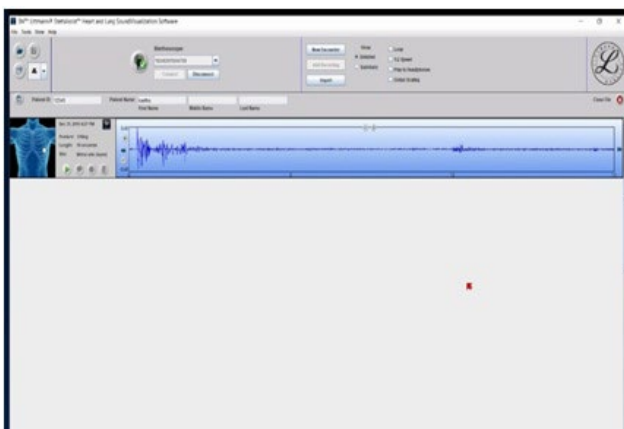
Figure 1. A Doctor at a Health Camp Using a Digital Stethoscope



Figure 2. A Digital Stethoscope with USB Memory Chip



Figure 3. An Example of the Software Required to Interface the Digital Stethoscope with the Laptop



The user interface for the stethoscope includes a 5-button keypad and an liquid crystal display (LCD) display. Sound processing is carried out with the aid of a digital signal processor. Stethoscope power is provided by a single AA battery in the chest piece. A power management system is included to prolong battery life. Using its bluetooth wireless link, the stethoscope can exchange audio data with an external device such as a personal computer (PC) having installed software provided by the company (Figure 4). Data was transmitted over a bluetooth connection to the laptop equipped with the 3M™ Littmann® TeleSteth™ System software (Figures 2 and 3). The laptop screen was shared by video conferencing with a senior physician who provided consultation based on the auscultatory finding (Figure 5).

Figure 4. A Digital Stethoscope with USB Memory Chip



Figure 5. A Senior Doctor Performing a Teleconsultation

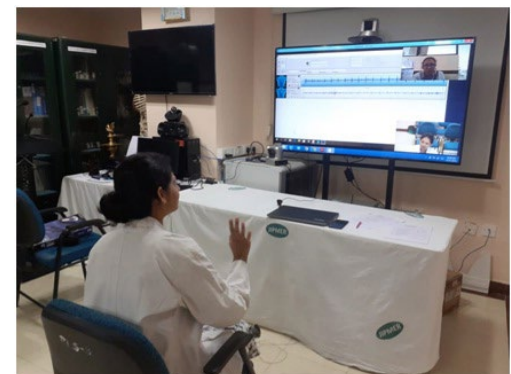


Table 1. Feedback Form

Questionnaire	Rating 1 to 5 (1 being worst, 5 being best)
How was audio quality	
How was video quality	
How was overall quality of live interaction	
How was the experience with this new device	
Would you like to recommend other for usage of this device	Yes/No
Suggestions, if any:-	

Patients and doctors were asked to rate the experience on a scale of 1 to 5 rating, the higher the score the more was the satisfaction level. Feedback statement was also taken from doctors and patients (Table 1). For patient experience was rated based on - satisfaction with their consultation, time saved and money saved. For doctors, the experience was rated based on – the experience of learning a new tool, quality of sound, ease of using the instrument.

RESULTS

Feedback was obtained from patients, and junior doctors at the health camps and from senior consulting doctors located remotely. All the patients (100%) were satisfied with their consultation and agreed that their time and money are saved by attending the telehealth camp. All the junior/resident doctors (100%) felt they had a satisfactory learning experience and all of them were satisfied in the consultations they received. Although no abnormal heart sounds were detected in any patient during these health camps, the junior doctors found the digital stethoscope to be user friendly of educational value. Likewise, the senior consultants also found it very helpful. (Tables 2 and 3).

Table 2. Patient Satisfaction Score (1 lowest, 5 highest)

Patient	Experience rating
1	5
2	4
3	5
4	3
5	3
6	5
7	4
8	4
9	4
10	5
11	3
12	4
13	5
14	3
15	3
16	4
17	5
18	4
19	5
20	5
21	3
22	4
23	5
24	4
25	4
26	4

Table 3. Patient Satisfaction Ratings (1 lowest, 5 highest)

Physician	Experience rating
Senior Consultant	5
Junior doctor-1	4
Junior doctor-2	5
Junior doctor-3	5
Junior doctor-4	5
Junior doctor-5	5
Junior doctor-6	5

DISCUSSION

Health care in India is as it stands currently, cannot provide specialist/expert care to the majority of patients in need. Health camps are conducted frequently to overcome this problem. These health camps are often conducted in remote areas with very limited connectivity to main city. Patients typically travel a long distance with limited means of public transportation. Travel costs accumulate due to travel distance and frequently being accompanied by relatives. Telehealth camps provide health care much closer to the patient resulting in a reduction in both travel time and cost. In the case of this study, a reduction in travel time of 2-3-hours, and cost saving of approximately 500-1000 Indian rupee (INR).

As these health camps are often staffed by junior doctors this may lead to under or over diagnosis of certain medical conditions. A telehealth camp, which uses telemedicine, is new idea in which telecommunication and information technology is used to provide specialty health care from a distance.⁷⁻¹⁰

The digital stethoscope is simple instrument that converts sound to digital signals. The signals are transmitted *via* the internet remotely over internet and can be interpreted by a physician elsewhere. The advantages of a digital stethoscope include ease of use, amplification of sound, and noise reduction filters. The primary limitation of such a device is the cost (>50,000 INR).

Although this study detected no cardiac auscultatory abnormalities, it did demonstrate the feasibility of such telehealth camps, and greater patient and clinician satisfaction.

CONCLUSION

The digital stethoscope enhances the telehealth camp experience, both for patients and clinicians alike. It saves both time and money for the patient, while providing them with specialty consultations. Larger trials are required to confirm these findings.

DECLARATIONS

Authors' Contributions

All authors made contributions to the article.

Availability of Data and Materials

Not applicable.

Financial Support and Sponsorship

None.

Consent for Publication

Not applicable.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Mohan V, Pradeepa R. Telemedicine in diabetes care: In rural India, a new prevention project seeks to fill in the screening gap. *IEEE Pulse*. 2014; 5(3): 22-25. doi: [10.1109/MPUL.2014.2309575](https://doi.org/10.1109/MPUL.2014.2309575)
2. Bashshur RL. On the definition and evaluation of telemedicine. *Telemed J*. 1995; 1(1): 19-30. doi: [10.1089/tmj.1.1995.1.19](https://doi.org/10.1089/tmj.1.1995.1.19)
3. Lustig TA. *The Role of Telehealth in an Evolving Health Care Environment*. Washington (DC), USA: National Academies Press; 2012.
4. Chittoria R K. Telemedicine for wound management. *Indian J Plast Surg*. 2012; 45(2): 412-417. doi: [10.4103/0970-0358.101330](https://doi.org/10.4103/0970-0358.101330)
5. Bashshur RL, Shannon G, Krupinski EA, Grigsby J. Sustaining and realizing the promise of telemedicine. *Telemed J E Health*. 2013; 19(5): 339-345. doi: [10.1089/tmj.2012.0282](https://doi.org/10.1089/tmj.2012.0282)
6. Ganapathy K, Ravindra A. Telemedicine in India: The apollo story. *Telemed J E Health*. 2009; 15(6): 576-585. doi: [10.1089/tmj.2009.0066](https://doi.org/10.1089/tmj.2009.0066)
7. Mishra SK, Kapoor L, Indra PS. Telemedicine in India: Current scenario and the future. *Telemed J E Health*. 2009; 15(6): 568-575. doi: [10.1089/tmj.2009.0059](https://doi.org/10.1089/tmj.2009.0059)
8. Shaw DK. Overview of telehealth and its application to cardiopulmonary physical therapy. *Cardiopulm Phys Ther J*. 2009; 20(2): 13-18.
9. Zundel KM. Telemedicine: History, applications, and impact on librarianship. *Bull Med Libr Assoc*. 1996; 84(1): 71-79.
10. Vockley M. The rise of telehealth: Triple aim, innovative technology, and popular demand are spearheading new models of health and wellness care. *Biomed Instrum Technol*. 2015; 49(5): 306-320. doi: [10.2345/0899-8205-49.5.306](https://doi.org/10.2345/0899-8205-49.5.306)