

SPARSH electronic sub-health centers (e-SHCs) – A model of nurse-run SHCs supported by general practitioners through telemedicine

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ABSTRACT

Background: The primary health care services in India suffer from inconsistent availability of providers, lack of quality, poor availability of medicines and diagnostics, and a poorly functioning referral linkage. A multi-pronged approach is required to address these issues. **Methods:** We describe here a model of electronic sub-health centers (e-SHCs) managed by trained nurses supported by a general practitioner over telemedicine. The e-SHCs are expected to meet two objectives – 1) to create a point of comprehensive primary health care delivery at an affordable cost and 2) to create a referral support system backed by information technology and physical movement. **Results:** The model is described in nine sections – service delivery framework, human resources, diagnostics, infrastructure, quality improvement, health management information system, materials management, financing, and branding. It is a video-based real-time (synchronous) health worker to the registered medical practitioner telemedicine facility. The model has been compared with five other telemedicine and five other tele-rehabilitation models. **Conclusion:** Although there are inherent challenges to operationalize this model, it also presents a unique opportunity of testing an innovative approach of providing quality primary health care at an affordable cost. The process will generate learnings for addressing the primary care health care delivery gaps in the country.

Keywords: Nurse-run clinics, rural health, sub-health center, telemedicine

Introduction

India experiences a health burden of 486 million DALYs (disability-adjusted life years) every year (2017),^[1] accounting for an annual economic loss of 848.205 billion USD. 26% of the DALYs are lost because of conventional health problems such as communicable diseases, reproductive and child health-related problems, and nutritional problems, whereas 62% are because of non-communicable diseases.^[2-3] This dual burden creates a challenge for the health system as the diverse disease groups need different

types of approaches. With an investment of 2.5% of gross domestic product (GDP) on health care (one of the lowest in the world), India is not doing enough to address this burden. It results in a 62.40% out-of-pocket expenditure on health care, resulting in impoverishment of 63 million households annually. The doctor-patient ratio of India (0.69:1000) is abysmally low as compared to countries such as USA (2.6), China (1.8), Sweden (4.8), and Sri Lanka (1.0).^[4] An estimated 75% of dispensaries, 60% of hospitals, and 80% of doctors are clustered in urban areas serving only 35% of the population. Thus, 65% of the population is devoid of the majority of the health care services.^[5]

The primary health care services wherever available suffer from inconsistent availability of providers, lack of quality, poor availability of medicines and diagnostics, and a poorly

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Received: 22-12-2020

Revised: 01-07-2021

Accepted: 07-06-2022

Published: 14-10-2022

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_2517_20

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How to cite this article: Roy K, Dutt B, Patel JM, Raithatha SJ. SPARSH electronic sub-health centers (e-SHCs) – A model of nurse-run SHCs supported by general practitioners through telemedicine. *J Family Med Prim Care* 2022;11:5556-62.

functioning referral linkage. This results in two scenarios – first, a large portion of patients with common illnesses seeks care at secondary and tertiary level facilities, which could have been managed at well-functioning primary care facilities. This leads to over-crowding and inefficient use of the resources. Second, to avoid the hassle of traveling long distances, wasting long waiting hours, and not getting satisfactory responses from the already over-burdened health system, patients end up consulting non-qualified providers or private practitioners in their close vicinity. This leads to greater out-of-pocket expenditures and unsatisfactory treatment outcomes.^[6]

To address this health care crisis, a multi-pronged approach is required focusing on task sharing, strengthening rural primary health care systems, and optimum use of technology. Many countries have adopted a nurse practitioner model for managing health care tasks which can be delivered by nurses when doctors are not accessible. The tasks range from simple history taking to giving anesthesia to a patient.^[7] Although there is not enough administrative and legal recognition for nurse practitioners in India, the cadre of Community Health Officers (CHOs) being created in the primary health care system is expected to do a similar role. They shall be posted at the 1.5 lakh Health and Wellness Centers (HWCs) expected to be operationalized by 2022.^[8] There is a major challenge of providing clinical and referral support to these HWCs. Without the continuous clinical and referral support by a primary care practitioner (PCP), such a model is not expected to succeed. In the Indian primary health care system, the PCP (Medical Officer – MO) at the PHC is required to support 5–6 CHOs at the SHCs. Considering the multiple responsibilities on the PCP, it may not be possible to visit the SHCs regularly for the necessary support. In such a situation, telemedicine can provide an effective solution to connect the SHCs with the PHC.

Telemedicine services in India have evolved a lot since Indian Space Research Organization's (ISRO) pilot project in 2001, linking an urban tertiary care facility with a rural hospital in Southern India.^[9] In wake of the coronavirus disease (COVID) pandemic, the Government of India has issued Telemedicine Practice Guidelines, enabling registered medical practitioners to provide health care using telemedicine. This provides the necessary policy support to reap the benefits of telemedicine to the maximum.^[10] The COVID 19 pandemic has resulted in an increase in adoption of telemedicine to provide health care services.^[11] However, telemedicine has not been utilized to its fullest possible potential, and a lot more can be achieved.^[12]

In an attempt to find a solution to the health care crisis and address the challenges mentioned above, we have designed a model of electronic sub-health centers (e-SHCs), which has components of task sharing through a nurse-practitioner approach, a strengthened health system with continuous clinical support through telemedicine, strong referral support by a tertiary care teaching hospital, and appropriate use of technology in synchronization with the health system and community health needs.

Methods

Shree Krishna Hospital (SKH) is a rural tertiary care teaching hospital based in central Gujarat, a state located in western India. It runs a community health program named SPARSH (Shree Krishna Hospital Program for Advancement of Rural and Social Health) in 150 villages across three districts. The program focuses on prevention, treatment, and care of non-communicable diseases (NCDs). While implementing this program, a need for creating a facility with a continuous presence of a health provider for all the health issues beyond NCDs was perceived. Based on the field experiences and learnings from SPARSH implementation and a close observation of the Government of India's Comprehensive Primary Health Care initiative through the HWCs, this model was designed. It is expected to meet the following objectives:

1. To create a point of comprehensive primary health care delivery at an affordable cost.
2. To create a referral support system backed by information technology (IT) and physical movement.

Institutional permission to publish this model is available. Because the paper does not reveal any patient information, ethical approval was not applied for.

Results

Model description

Here, we describe this model in nine sections – service delivery framework, human resources, diagnostics, infrastructure, quality improvement, health management information system (HMIS), materials management, financing, and branding. As per the Medical Council of India's recent telemedicine guidelines, this facility can be classified as a video-based real-time (synchronous) health worker to the RMP (registered medical practitioner) telemedicine facility.^[10]

1. Service delivery framework: Each e-SHC shall be equipped to provide services as listed in Table 1. The process flow for patient consultation shall be as depicted in Figure 1. Each patient coming to the center will be registered by a village health worker (VHW). Thereafter, a trained nurse shall elicit a medical history and undertake a basic clinical examination. The patient will then undergo a telemedicine consultation with an MO (Indian Medical Graduate – MBBS) based at the hub. As per the MO advice, the patient shall undergo investigations. The medicines shall be prescribed by the MO in the EMR (Electronic Medical Records) and printed at the center. The medicines shall be dispensed from the medicine vending machine (MVM) by scanning the prescription. The machine will be able to store up to 88 different types of medicines. At present, as per the Drugs and Cosmetics act, there is no provision for allowing storage and dispensing medicines through such a machine without the presence of a pharmacist.^[13] An application shall be made to obtain a special approval for pilot testing for this initiative. Until the time the permission is obtained, a pharmacist shall be appointed to

Table 1: Services provided at SPOKE

Services available at Spoke
Physical consultation by the nurse and telemedicine consultation by an MO
Physiotherapy
Various diagnostic services – Point of care and sample collection facility
Dispensing medicines
Referral services
Palliative care
Health education for various conditions through different audio-visual media
Enrolment facility in various health care schemes of SKH
Sale of health products such as sanitary napkins, neem soap, etc.

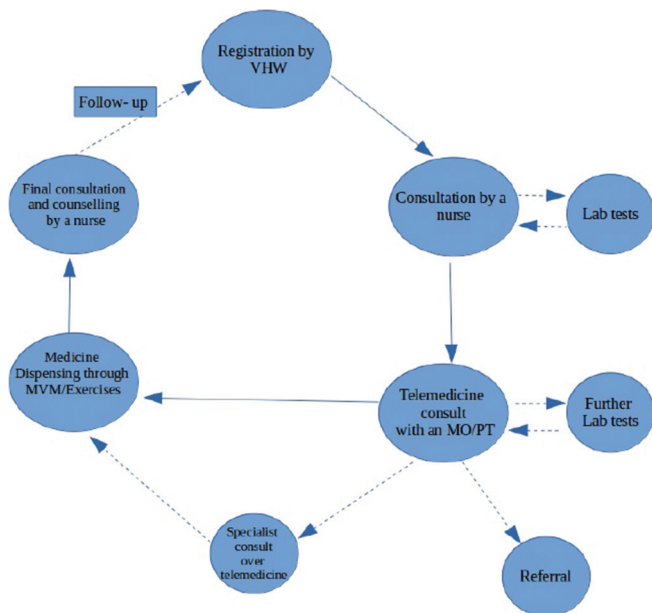


Figure 1: Process flow for consultation at an e-SHC. Notes – The dotted line indicates a need-based pathway which may not occur for each patient consultation

dispense the medicines as per the current legal framework. Based on the MO’s clinical assessment, the patient may be referred to a specialist from SKH if required. The specialist consultation shall occur over telemedicine preferably, and the patient shall be required to physically visit a specialist only if required. In the case of patients presenting with acute emergencies at the facility, the nurse will manage the patient as per the BLS (Basic Life Support) protocol and call for additional help without waiting for a doctor’s consultation. Physiotherapy consultation: Each e-SHC shall be equipped with a minimal setup of physiotherapy equipment such as ultrasound therapy (US), transcutaneous electrical nerve stimulation (TENS), moist heat therapy, infrared therapy (IR), walker, gait, gripping exerciser, and shoulder mobility equipment. A brief assessment customized for each condition shall be performed by the nurse, followed by a physiotherapist (PT) consultation over telemedicine. The nurse will demonstrate the specific exercises prescribed by the physiotherapist. A printed handout containing the home

exercise program in the local language shall also be provided. The patient shall be reviewed daily during treatment by the physiotherapist through telemedicine. The physiotherapist shall visit each center weekly.

The nurse will conduct home visits for palliative and provide services such as wound dressing, tube care (catheter/Ryle’s tube/tracheostomy tube), bed sore prevention, vitals monitoring, clinical assessment, counselling, and so on. The care shall be provided in consultation with the MO. For patients needing more support, a palliative care team from SKH shall conduct a home visit. Palliative patients needing physiotherapy shall be consulted by the PT during her weekly visit.

2. Human Resources: Three personnel shall be stationed at the e-SHC, that is, VHW, a trained nurse (general or auxiliary nurse midwife, GNM/ANM), and a pharmacist (B. Pharm). The VHW shall be a lady from the same village and associated with SPARSH for providing various services. She should have at least 10 years of schooling and the ability to use an android phone.

The nurse will be a female with an experience of at least 2 years. She shall undergo a 2 months induction training through a mix of classroom sessions, OSCE (objectively structured clinical examination), case discussions, clinical postings, and so on. The training contents shall comprise a basic clinical understanding of common health problems, history taking, approach to common complaints, a set of 40 core skills, and basic exercises. A pharmacist will be stationed at e-SHC for dispensing medicines after the online consultation is completed. At the hub, there shall be an MO (medical graduate) and a PT (physiotherapy graduate). Their work will be supervised by a clinical team lead (post-graduate in community medicine).

3. Diagnostics and biomedical devices: At the e-SHC, point-of-care diagnostic services such as hemoglobin estimation, HbA1C, blood sugar, urine routine examination, urine pregnancy test (UPT), rapid malaria test, and so on will be available. For other investigations, samples shall be collected and transported to the hub. Biomedical equipment such as a dermascope, fundus camera, vibrotherm, and digital stethoscope shall be connected to the EMR.
4. Infrastructure: Of the four e-SHCs, two shall be in rented pre-existing facilities. The indoor space in the existing facilities will be 37 × 15 and 16 × 20 square feet, respectively. The other two shall be set up in pre-designed porta cabins (24 × 12 sq. ft) placed in open spaces. Porta cabins have the advantages of being more customizable, being more mobile, less space requirements, and better visual appeal. Amenities such as drinking water, toilets, benches for waiting areas, televisions for health awareness promotion, storage space, registration desks, consultation desks, physiotherapy setups, and so on shall be available at each facility. The porta cabin layout is depicted in Figure 2. The layout for the rented facilities shall be similar.
5. Quality improvement (QI): The QI initiatives shall comprise the following: a) Clinical audits – 10% of the consultations performed by the nurse; MO and PT shall be clinically

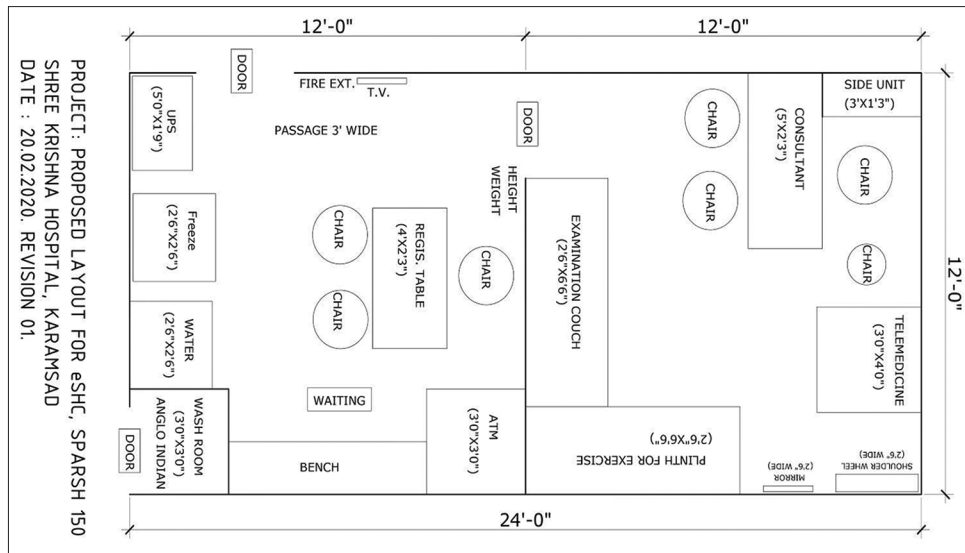


Figure 2: Layout of a porta cabin for the e-SHC

audited daily using a checklist. Refresher trainings and constructive feedback shall be provided weekly. b) Supportive supervision – a monthly supportive supervision visit shall be undertaken using a checklist for assessment of compliance to SOPs. Patient satisfaction interviews shall also be conducted during the visit. c) Calibration and quality control of instruments (biomedical and lab) shall be undertaken on a regular basis. d) A rigorous management audit will be conducted annually. e) Expert visits – consultants from other departments (clinical and management levels) of the institute and from outside shall be organized on a quarterly basis.

6. HMIS and EMRs: The HMIS will be linked with the SPARSH app and SKH HMIS for integration of patient records and inventory management. During consultation, the patient EMR shall also be accessible to the doctor at the hub for recording clinical findings and prescription. While referring a patient to a specialist, a link will be generated and shared with the specialist over e-mail and SMS. By simply clicking the link, patient consultation can be undertaken.
7. Materials management: All materials shall be issued from the SKH central store through monthly on-line indents raised by the GNM after appropriate approval. Each e-SHC shall function as a sub-store in SKH HMIS. A pharmacist shall deliver materials at each e-SHC where stock shall be verified before receiving. The inventory shall be shared between the e-SHCs so that slow moving items of an e-SHC can be utilized at the center having a high demand for the same.
8. Financing: The capital costs and operational cost for an initial period of 1–2 years shall be supported through a grant from Sir Dorabji Tata Trust. Services shall be offered at concessional user fees. For diagnostics, service charges shall be fixed considering the break even and overhead costs. Medicines shall be charged at selling prices. An additional system of offering need-based concessions shall be created for supporting those not able to pay.

9. Branding: The e-SHC’s branding shall be performed taking into consideration principles such as maintaining connect with the identity of SKH and making it relevant to the local culture to be easily identifiable and acceptable as a health facility for the rural poor and to have a soothing effect for a patient in distress.

The e-SHCs shall be locally known as SPARSH clinics. The branding strategy shall comprise wall paintings, poster displays, and distribution of pamphlets in the same and nearby villages.

Discussion

In this paper, we describe in detail a model of nurse-run e-SHCs supported by general practitioners over telemedicine. It is an attempt to address primary health care delivery gaps in rural India through a comprehensive approach supported by a teaching hospital. In the past 2 decades, with the increase in internet penetration in rural areas, there has been an increased focus on telemedicine for bridging the health care delivery gaps. We carried out a rapid literature search for articles published on telemedicine-assisted primary health care delivery in India between 2000 and 2021 using the PUBMED database. We consulted experts and performed a manual search of the reference lists of review articles. Through this process, we could identify eight models. Among these, we compared different aspects of five which were the most similar to our model [Table 2]. The models compared had a mix of private, non-governmental organization (NGO), and public–private partnership approaches. In terms of geographical spread, Apollo’s Common Service Center (CSC) model has the most widespread presence in 11 states, whereas most others are restricted to one or a few states. All the models have assigned a nurse or a local village person as a contact person at the spokes to gain the community’s trust and to work as an interface between the telemedicine setup and the patient. Most models have basic facilities such as height, weight,

Table 2: Comparison of our e-SHC with various telemedicine models across India

Parameter	Apollo model CSC (Common Service Centers) ^[14]	Care Rural Health Mission ^[15]	World Health Partners ^[15]	Glocal Digital Dispensary ^[15]	e-Health point ^[14]	e-SHC
Staff members at Spoke	VLE (Village level entrepreneur)	VHC (Village Health champion)	Local woman entrepreneur	Nurse (ANM/ GNM)	Village health worker, ANM, Water point operator, Pharmacist, Clinical assistant, Diagnostic technician	Village health worker, GNM, Pharmacist
Person of contact at the hub	Medical Officer, Ayurvedic, Homoeopathic and Veterinary physicians	M.B.B.S Doctor	M.B.B.S Doctor	M.B.B.S Doctor	M.B.B.S Doctor	M.B.B.S Doctor
Medicines dispensed at spoke	Yes	Yes	Yes	Yes	Yes	Yes
Specialist consultation	Specialist from Apollo hospital	Empanelled private tertiary care hospital	Empanelled private tertiary care hospital	Empanelled private tertiary care hospital	Empanelled private tertiary care hospital	Not for profit teaching tertiary care hospital
User Fees Pricing model	Rs. 50 per consultation	At the community health center, consultation is free.	Rs. 50 per consultation	Rs. 250 per consultation	Rs. 20 per consultation	Rs. 10 per consultation
MODEL: Government/ Private/PPP/ NGO	PPP	PPP	NGO	Private	PPP	NGO
Location	11 states of India	Andhra Pradesh, Maharashtra, Odisha.	Bihar, U.P, West Bengal, Rajasthan, Jharkhand	West Bengal, Rajasthan, Odisha	Punjab	Anand, Gujarat
Physiotherapy services at SPOKE	Not available	Not available	Not available	Not available	Not available	Available
Biomedical equipment at spoke						
B. P	Available	Available	Available	Available	Available	Available
SpO2	Available	Available	Available	Not available	Not available	Available
ECG	Available	Available	Available	Not available	Not available	Available
Pulse rate	Available	Available	Available	Available	Available	Available
Temperature	Available	Available	Available	Available	Not available	Available
Digital stethoscope	Not available	Not available	Available	Not available	Available	Available
Diagnostic services at spoke						
Hb	Available	Available	Sample collection	Available	Available	Available
Malaria kit	Available	Available	Sample collection	Available	Not available	Available
Pregnancy Test	Available	Not available	Sample collection	Available	Not available	Available
RBS	Available	Available	Sample collection	Available	Available	Available
Dengue test	Available	Not available	Sample collection	Available	Not available	Not Available
HIV test	Available	Not available	Sample collection	Not available	Not available	Not available
Typhoid test	Not available	Not available	Sample collection	Available	Not available	Available
Urine routine	Available	Not available	Sample collection	Available	Not available	Available
Extra services other than consultation and dispensing	1. Patanjali Products* 2. ESSILOR: Spectacles and Sunglasses 3. Customized Health packages	1. Sanitary napkins 2. Nutritional supplements 3. Insurance plan packages	1. Non-clinical contraceptives	–	Water point (Naandi)	Palliative care, Products available such as sanitary napkins, neem soap,

Note - *Patanjali Ayurveda limited is an Indian consumer goods company, who manufactures mineral and herbal products

blood pressure, random blood sugar, pulse rate, and temperature measurements. Only one (e-health point) had a pharmacist

available at the spoke. At e-SHC, medicines are planned to be dispensed through an automated medicine dispensing machine

which was found in the Glocal digital dispensary as well. Service components of the e-SHC such as physiotherapy services at the spoke, the medicine vending machine, linkage with a community outreach program, a tertiary care hospital, and so on make it a unique model as compared to other ones.

We compared our model with three other tele-rehabilitation models in India and two outside India [Table 3]. Although tele-rehabilitation is well established in countries such as Australia and Canada, it is in a nascent stage in India. However, at almost all places, it is performed through a stand-alone facility. We have tried to integrate it with primary health care for multiple reasons. It will make the entire process more cost-effective as the same infrastructure and resources will be used for providing medical care as well as physiotherapy. Second, it will also help in providing a whole person care as the patient will not have to go to a different place to avail physiotherapy services. 15–20% of consultations with a general practitioner are because of musculoskeletal problems, all of which shall need some form of physiotherapy.^[16] In addition, several other conditions such as stroke, chronic obstructive pulmonary disease (COPD), obesity,

and so on can have better clinical outcomes if physiotherapy is integrated as a part of the care. Considering these facts, a sizeable portion of the patients coming for a general practice consultation can benefit from physiotherapy.

In the process of operationalizing this model, we are facing challenges related to availability of high-speed internet in the interior rural areas, availability of trained nurses, making the model financially viable, and getting clearance for managing the medicine vending machine without a registered pharmacist and several others. At the same time, it also presents a unique opportunity of demonstrating an ideal nurse-run SHC supported by a general practitioner through telemedicine in a cost-effective way. The model described here has many innovative components such as integration of physiotherapy and medical care, a tertiary care medical institution supporting a network of nurse-run SHCs, use of technology for medicine dispensing, use of telemedicine for providing comprehensive primary health care, a robust HMIS, and intense quality control measures. The entire exercise of operationalizing these sub-centers will make quality primary health care accessible to the community served.

Table 3: Comparison of our e-SHC with various tele-rehabilitation models in and outside India

Features	Lead Tele-Physiotherapy ^[17]	Reliva Online Physiotherapy ^[18]	ISIC Indian Spinal Injuries Center ^[19]	Tele-rehabilitation Clinic (TRC), University of Queensland, Australia ^[20]	Tele-Rehab 2.0, University of Alberta, Canada ^[21]	e-SHC
Staff member at the hub	Physiotherapist	Team of Physiotherapists from different specialities	Team of Physiotherapists from different specialities	Physiotherapy students who are in later part of degree program supervised under a qualified physiotherapist	Team of Physiotherapists from different specialities	A General Physiotherapist with referral support from specialists
Technologies/ Equipment Present at the hub	Video conferencing	Video conferencing	EMR with video conferencing	EMR, Video conferencing, Marker less Motion Capturing software	EMR, Video conferencing, Marker less Motion Capturing software	EMR with video conferencing
Location of Spoke	Any person with internet connection	Any person with internet connection	Any person with internet connection	Any person with internet connection	Spoke: Remote and rural physiotherapy clinics* Tele-consultation: Any person with internet connection	4 rural spokes
Infrastructure and Equipment at Spoke	No equipment	No equipment	No equipment	No equipment	Spoke: Basic physiotherapy equipment, Clinician EMG. Tele-consultation: No equipment	Basic equipment for pain relief, muscle strengthening, and assistive aids
Staff member/s at Spoke	Patient or caregiver	Patient or caregiver	Patient or caregiver	Patient or caregiver	Spoke: Physiotherapist or physiotherapy support Tele-consultation: Patient or caregiver	GNM Nurse and Health worker
Physiotherapy Services available for	Orthopedic and neurological conditions – back Sports Injury	Common physiotherapy conditions – back pain, knee pain, frozen shoulder, osteoarthritis	Stroke Spinal Cord Injury, Traumatic Brain Injury	Audiology, Occupational Therapy, Physiotherapy, and Speech Therapy	Shoulder pain, hip and knee replacements, vertigo and balance and wheelchair special seating assessment	Common physiotherapy conditions manageable at the primary care level such as stroke, COPD, frozen shoulder, osteoarthritis of the knee, etc.

Note – *A significant number of the spokes of this model are located in the remote and rural physiotherapy clinics of northwest territories of the Alberta state of Canada. The clinics are manned by a physiotherapist to provide routine physiotherapy care, and for specialist consultation, they utilize this telemedicine facility

It will also generate a lot of learnings for the government and non-governmental agencies interested in making primary health care accessible to the large rural masses of our country at a cost which the society can manage to afford.

Acknowledgements

The authors wish to thank Dr. Neha Bhatnagar for her contribution in reviewing intricate details of a few telemedicine Models in India. We acknowledge the financial support extended to us by Sir Dorabji Tata Trust to run the programme – SPARSH (Shree Krishna Hospital Program for Advancement of Rural and Social Health) and for operationalising the eSHCs.

Financial support and sponsorship

This work was supported by Sir Dorabji Tata Trust [Grant ID: SDDT/MUM/HEA/CAM/2017-2018/0054].

Conflicts of interest

There are no conflicts of interest.

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