

# Telemedicine as a Cost-effective Tool for Cardiovascular Diseases in Rural India: A Pilot Study in Delhi-NCR

Nisha<sup>1</sup>, Shridhar Dwivedi<sup>2</sup>, Suresh K Gupta<sup>3</sup>

## ABSTRACT

**Objective:** Telemedicine is an economical tool for providing healthcare to remote areas. So far, not much is known about such endeavors targeting rural parts of India. The National Heart Institute, New Delhi joined hands with an NGO at Jewar, Greater Noida (predominantly a rural area) to provide teleconsultation to patients attending the Community Health Center. The present study aims to evaluate the direct and indirect cost of treating cardiovascular diseases using teleservices at Jewar.

**Materials and methods:** It is a prospective, observational, and questionnaire-based study regarding the rural India. The demographic and complete clinical profile is noted in the telemedicine e-sanjeevani portal by a patient coordinator. A plausible clinical diagnosis is made at the NHI end after interacting with a patient on television and reviewing relevant investigations followed by instructions about drug treatment. At the end of the tele-session, the direct cost (including medication, lab-investigation, consultation, transportation, any adverse drug reaction, internet, and setup cost) is calculated. The indirect medical cost was worked out using the human capital approaches such as the productivity loss of both the patient and attendants.

**Results:** A total of 100 consecutive cardiovascular patients (including diabetes cases attending telemedicine sessions at NHI) were studied. There were 53 males and 47 females. The mean age of patients was found to be  $55.29 \pm 11.6$  years (mean  $\pm$  SD). The common cardiovascular diseases noted were found to be diabetes alone (48%), hypertension and diabetes (24%), diabetes and other comorbid conditions (9%), hypertension alone (9%), diabetes with two cardiovascular conditions (4%), diabetes, hypothyroidism and cardiovascular diseases (3%), hypertension associated with coronary artery disease (2%), and coronary artery disease alone (1%) in that order. The average treatment cost per patient (direct as well as indirect) for 10-month duration for diabetes alone was INR 6,302.22 (630.22/month), diabetes and hypertension together cost INR 10,546.71 (1,054.67/month), diabetes with other comorbid condition cost INR 12,086.62 (1,208.66/month), hypertension cost INR 15,505.63 (1,550.57/month), diabetes and other two cardiovascular diseases cost INR 8,376.91 (837.69/month), diabetes and hypothyroidism and cardiovascular diseases cost INR 13,899.80 (1,389.98/month), hypertension and coronary artery disease cost INR 8,844.33 (884.43/month), and coronary artery disease cost INR 2,125.34 (212.53/month). The overall total cost direct as well as indirect for this telemedicine project was around INR 9,09,095.63, including direct, indirect, set-up and internet charges for 10-months tenure.

**Conclusion:** Telemedicine for rural people is a feasible proposition. Diabetes was found to be the most prevalent disease, thus possesses the maximum overall economic burden. The treatment for diabetes alone costs less than for diabetes associated with other comorbidities. Government telemedicine initiatives in India will further reduce the direct medical cost burden on rural patients substantially. Women empowerment is another important aspect of telemedicine. Adoption of this telemedicine model by health policymakers in India will lead to the better and affordable treatment to rural patients suffering from cardiovascular diseases.

**Keywords:** Cardiovascular diseases, Cost-of-illness, Diabetes, Rural health care, Telemedicine.

*MGM Journal of Medical Sciences* (2019): 10.5005/jp-journals-10036-1232

## INTRODUCTION

Telemedicine, as per World Health Organization (WHO), is the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment, and prevention of disease and injuries, research and evaluation and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities.<sup>1</sup> It was first started in the 1960s when two healthcare projects incorporated the principles of telemedicine in healthcare delivery in the United States.<sup>2-4</sup> The interest in telemedicine has increased over the past four or five years, with application of newer telecommunication technologies.<sup>5</sup> The first telemedicine project was started in India by Indian Space Research Organization (ISRO), Bengaluru, India in collaboration with Apollo Hospitals Group in 2001. 2016 has been a great year of telemedicine expansion as a memorandum of understanding (MoU) is established with ISRO to expand its telemedicine network to remote places.<sup>6</sup> Other centers in India that effectively run telemedicine centers are located in All India Institute of Medical Sciences (AIIMS), New Delhi, India; Sanjay

<sup>1,3</sup>Department of Clinical Research, Delhi Pharmaceutical Sciences and Research University, New Delhi, India

<sup>2</sup>Department of Cardiology, National Heart Institute, New Delhi, India

**Corresponding Author:** Shridhar Dwivedi, Department of Cardiology, National Heart Institute, New Delhi, India, Phone: +91 9818929659, e-mail: shridhar.dwivedi@gmail.com

**How to cite this article:** Nisha, Dwivedi S, *et al.* Telemedicine as a Cost-effective Tool for Cardiovascular Diseases in Rural India: A Pilot Study in Delhi-NCR. *MGM J Med Sci* 2019;6(2):58-64.

**Source of support:** Nil

**Conflict of interest:** None

Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, India; Postgraduate Institute of Medical Education and Research, Chandigarh India; A Coronary Care Unit in Siliguri; and Bankura Sammilani Hospital. The latest to start such a venture was Medanta Medi City Hospital.<sup>7</sup> However, not much is known about the cost-effectiveness of telemedicine as a therapeutic

and preventive tool for cardiovascular diseases (CVDs). Our study addresses the cost-effectiveness and utility of telemedicine in CVDs for the rural population with limited financial constraints.

Two types of telemedicine technology are being used. The first one is “store and forward,” which is used to transfer digital images taken and stored from a camera and then sent to another location. Teleradiology, telepathology, and teledermatology are some examples.<sup>8</sup> The second is “Real-time consultation,” which involves the use of a video-conferencing equipment at both locations. Departments such as psychiatry, internal medicine, rehabilitation, cardiology, pediatrics, obstetrics and gynecology, and neurology are based on real-time streaming.<sup>9</sup> India is a developing country with a population size of 1,339,180.127 billions,<sup>10</sup> of which 68% of the population still lives in rural areas.<sup>11</sup> India’s total annual budget is around Rs. 24.42 lakh crore. The budgetary expenditure collectively on health, education, and social protection for 2018–19 is Rs.1.38 lakh crore.<sup>12</sup> Astonishingly, public health expenditure is only 1% of the total GDP in India. Healthcare is a serious issue in our country; yet the government is unable to spend more on it because of financial constraints. Telemedicine appears to provide a new healthcare opportunity to treat cardiovascular patients effectively within limited resources.

The purpose of the present study was to know the cost of therapy for cardiovascular diseases using telemedicine as a tool in a rural setting. The cost of illness studies are descriptive: to itemize, value, and sum the costs of a particular problem with the aim of giving an idea of its economic burden.<sup>13</sup> The cost of illness aims to calculate the direct, indirect, and intangible dimensions in monetary units.<sup>14</sup> The prevalence-based method is commonest to estimate the total cost of a disease incurred in a year.<sup>15</sup> This study is being done from the societal perspective by a joint venture of a private corporate hospital and an NGO collaboration with the hospital.

## MATERIALS AND METHODS

It is a prospective, cross-sectional, observational, and questionnaire-based study used in the overall cost estimate for cardiovascular patients at the rural-end located at Noida, Jewar. Study centers include an urban center—National Heart Institute (NHI), community center, East of Kailash, New Delhi-110065, where teleconsultation is delivered to all patients through telemedicine portal (e-sanjeevani)—and a rural center—Community Health Center, Kanigarhi road, Jewar, Noida, where patients were called, enrolled, investigated, and given treatment advice by a senior cardiologist from the NHI side. Patients visit the telemedicine center twice a week for the treatment of various cardiovascular ailments. This is a pilot study spanning for 10 months. A total of 120 patients were chosen for this study, of which only 100 patients who had cardiovascular problems/diabetes have been included. A study performa was prepared to pass through a rigorous and strict content-validation process.

### Inclusion Criteria

- Patients belonging to the age group of 20–85 years have been included in the study
- Patients who were diagnosed or known to have any cardiovascular disease visiting the telemedicine center are included in the study
- Participants ready to participate and sign the informed consent were included in the study

### Exclusion Criteria

- All terminally ill patients were excluded
- Patients not willing to participate were also excluded

### Process of Patient Enrollment

Patient coordinator at the rural end arranged the prospective cases at the Jewar Health Centre. List of all telemedicine patients was made available to an NHI consultant before the start of the television. The demographic details like height, weight, blood pressure, and blood sugar levels fasting as well as postprandial were noted before the start of session and the information was conveyed to the NHI center at the time of tele-session (Flowchart 1). Once the tentative diagnosis was made on the basis of history and clinical details, the patient was advised for essential investigations, prescribed medicines and lifestyle measures—particularly tobacco cessation and appropriate diet, etc. The patient was then asked to come for a review with reports after 2 weeks. This is the time when cost calculations (direct as well as indirect) were made for each patient. The patients were followed up as per necessity on the telemedicine portal for assessing medication, investigation, consultation, and adverse drug reactions (if any).

### Telemedicine Components (Flowchart 1)

#### *NHI-end-components*

A telemedicine portal (e-sanjeevani), a consultant, an IT professional, Pharmacy Postgraduate works in Unit, Internet access, a computer with an inbuilt camera, and headphones.

#### *Jewar-end-components*

A telemedicine portal (e-sanjeevani), a Chief Medical Officer, Patients, a patient coordinator, and an NGO coordinator, Internet access, a computer with an inbuilt camera, and attachable headphones.

## COST PARAMETERS IN STUDY

### Direct Medical Cost

It includes the cost of medication, lab-investigations, consultation, adverse drug reaction (if any) and surgery. However, under the telemedicine project, all kinds of medications, lab investigations, and consultation fee were free.

### Direct Non-medical Cost

It includes a computer setup, software and transportation cost.

### Indirect Medical Cost

Patient and caregiver productivity losses.

### Assumption

Medication charges are kept on a 40% discount from MRP to know the cost borne by the government/NGO to treat patients (medicine tender rate is confidential); all lab-investigation charges were calculated as per CGHS rates. Consultation and staff cost are based on the salary slabs as per the existing salary at both ends (Table 1).

## RESULTS

### Demographic Profile

A total of 120 cases attended these tele-sessions, of which a total of only 100 patients (53% males and 47% females) had some kind of cardiovascular problems (Table 2). The mean age of all patients

Flowchart 1: Pictorial view of telemedicine session

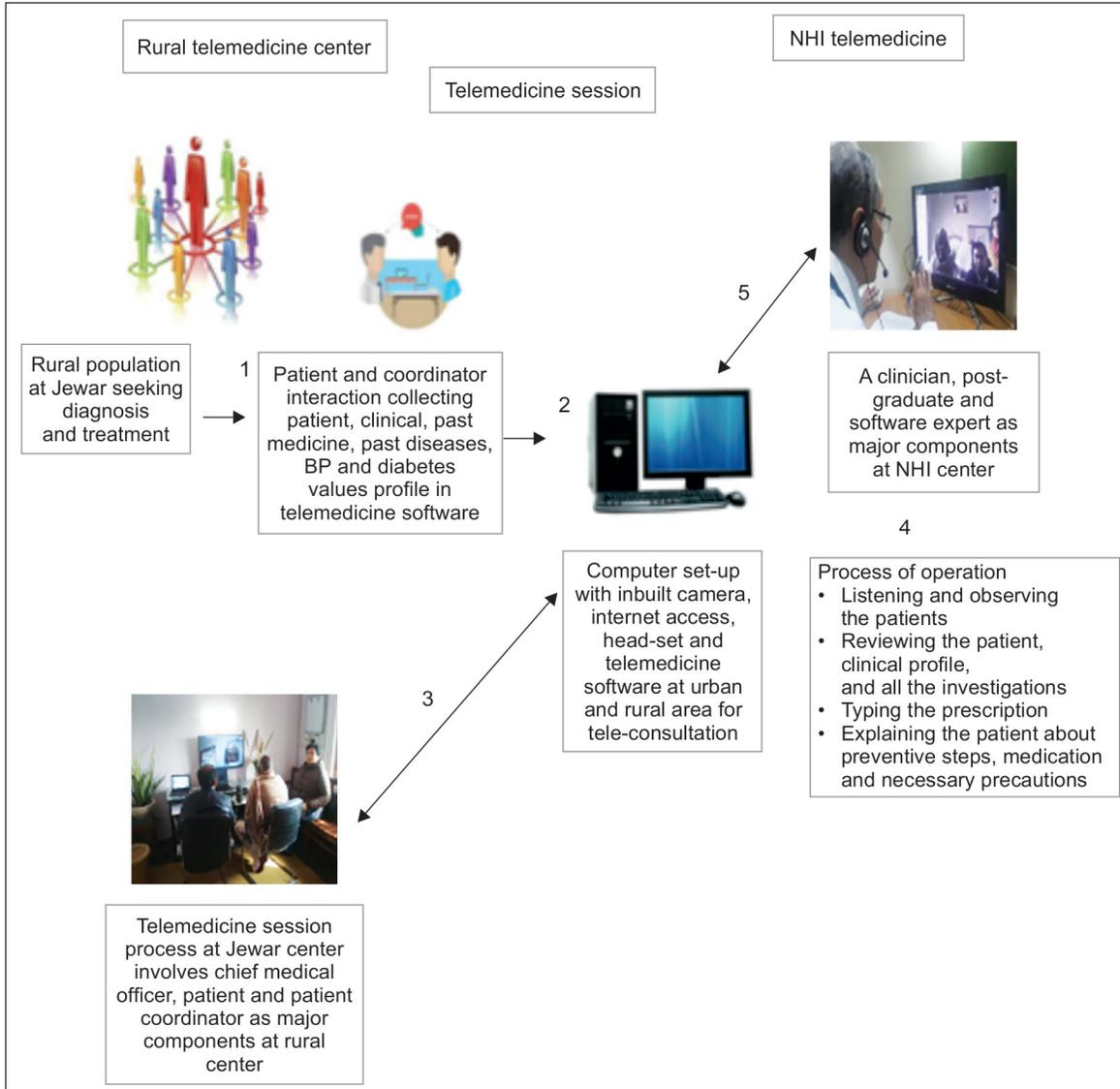


Table 1: Cost calculation and cost calculation formulas<sup>16</sup>

Direct cost:

Average medical cost = Total medical cost of telemedicine patients affected by specific disease/Total number of patients affected by the disease.

Average non-medical cost = Total cost non-medical items for patients affected by a specific disease/Total number of patients affected by the disease.

Indirect cost:

Average of indirect cost = Total cost of productivity loss for telemedicine patients and attendants/Total number of patients affected by the disease.

Total healthcare cost of respective diseases:

Average total cost of all CVD = Total of all direct and indirect cost for all patients affected by CVD/Total number of patients affected by the disease.

was found to be  $55.29 \pm 11.6$  years respectively (male 55.29 year, female 55.19 year). The majority (81%) of patients were between the ages of 41 years and 70 years. More than half (53%) of our patients were noted to have a higher BMI, of which 29% were males and 24% females. About 79% of patients belonged to socioeconomic

status IV, while 21% were from socioeconomic status III. None of our telepatients belonged to status I and II. The majority (81%) of them were Hindus, while 19% were Muslims. An estimated 77% of patients visiting these sessions were below the matrix, of which 46% were females. About 52% of patients were found to have the

**Table 2:** Demographic profile

Gender	Male (%)	Female (%)
Count (100)	53 (100)	47 (100)
Age		
≤30	1 (1.87)	–
31–40	4 (7.54)	6 (12.7)
41–50	12 (22.65)	13 (27.64)
51–60	20 (37.74)	16 (34.04)
61–70	9 (16.99)	11 (23.50)
71–80	5 (9.43)	0 (0)
≥80	2 (3.78)	1 (2.12)
BMI (kg/cm <sup>2</sup> )		
Underweight >18.5	2 (3.78)	1 (2.12)
Normal 18.5–24.9	22 (41.51)	19 (40.42)
Overweight 25.29.9	22 (41.51)	14 (29.79)
Class I obesity 30–34.9	7 (13.20)	10 (21.28)
Class II obesity 35–39.9	–	3 (6.39)
Class III obesity ≥40	–	–
Socioeconomic status		
III	18 (33.97)	03 (6.38)
IV	35 (66.03)	44 (93.62)
Marital status		
Married	53 (100)	47 (100)
Unmarried	–	–
Emotional stress		
Widow/widower	2 (3.77)	13 (27.65)
Religion		
Hindu	45 (84.90)	36 (76.60)
Muslim	8 (15.10)	11 (23.40)
Education		
Postgraduate	1 (1.87)	–
Graduate	1 (1.87)	–
Intermediate	7 (13.20)	–
Metric	13 (24.57)	1 (2.12)
Below matrix	31 (58.49)	46 (97.88)
Occupation		
Government job	8 (15.09)	–
Private job	8 (15.09)	–
Business	7 (13.20)	–
Farmer	23 (43.39)	–
Housewife	–	47 (100)
Retired	1 (1.87)	–
Unemployed	6 (11.36)	–
Blood pressure (mm Hg)		
Normal (120/ 80)	23 (43.39)	25 (53.19)
Pre-stage (120–139/80–89)	10 (18.87)	9 (19.15)
Stage I (140–159/90–99)	10 (18.87)	10 (21.28)
Stage II (≥160/≥100)	10 (18.87)	3 (6.38)

blood pressure at the pre-stage, stage I and stage II as per JNC VII guidelines; majority of them were males (30%).

**Disease Profile**

Diabetes, hypertension, coronary artery diseases, hypothyroidism, and combinations were found to be the most prevalent diseases.

It was found that diabetes alone (48%) was the most commonly occurring disease; diabetes and hypertension (24%) together with the second observed condition; hypertension (9%) and diabetes with other comorbid condition (9%) was next to diabetes. Diabetes and cardiovascular diseases (4%); diabetes and hypothyroidism and cardiovascular diseases (3%); hypertension and coronary artery disease (2%); coronary artery diseases (1%) were found to be less prevalent (Table 3). Hypothyroidism along with the other CVS disease was another important condition noted through telesessions.

**Cost Computations**

The average cost of disease and total cost of disease (within brackets) for a 10-months duration have been mentioned. The cost of treating diabetes alone was INR 6,302.22 (INR 3,03,758.16). Diabetes and hypertension together cost INR 10,546.71 (INR 2,53,122.27). Diabetes with other comorbid conditions required INR 12,086.62 (INR 99,944.47). Hypertension costs INR 15,505.63 (INR 56,949.08). Diabetes with two cardiovascular diseases cost 8,376.91 (INR 33,507.66). Diabetes and hypothyroidism and cardiovascular diseases cost (INR 13,899.80). Hypertension and coronary artery disease cost 8,844.33 (INR 17,688.65). Coronary artery disease costs 2,125.34 (INR 2,125.34) (Table 4). The cost of additional stuff such as setup (One time cost) was INR 1,20,000 and total Internet charges was INR 20,000 for 10 months, including both the rural and urban side. Overall, the total cost for this telemedicine project was around INR 9,09,095.63 for 10 months.

The individual cost per month for diabetes alone was found to be around INR 630.22; diabetes and hypertension cost INR 1,054.67; diabetes with another comorbid condition cost INR 1,208.66; hypertension INR 1,550.57; diabetes with two cardiovascular diseases cost INR 837.69; diabetes and hypothyroidism and cardiovascular diseases cost INR 1,389.98; hypertension and coronary artery disease cost INR 884.43; coronary artery disease cost INR 212.53. A linear relationship was observed between cost and number of comorbid conditions (Table 5).

**DISCUSSION**

Telemedicine has spread over various parts of the world and is being used for more than two decades in our country. Various academic and corporate hospitals have started many patient-centered initiatives using this new tool.<sup>17</sup> Furthermore, it has also penetrated its roots in many Indian states through close networking. However, there is a paucity of literature on the economic burden over patient and government in treating cardiovascular diseases using telemedicine as a tool for health care. This is a boon for elderly and female patients in rural areas because they have to travel long distances for their cardiovascular problems.<sup>18,19</sup> Telemedicine is a strong means of women empowerment. In our study, almost 47% of the cases belonged to the fair sex. Our study brings out the cost of different cardiovascular diseases in rural India, using telemedicine.

The high prevalence of diabetes and hypertension alone and in combination in our study indicates the emergence of non-communicable diseases deep into the rural India. This is an important observation because cardiovascular conditions and diabetes are the main cause of death in all parts of India, including the poorer states and rural areas in India.<sup>20,21</sup> More than half (51%) of patients accepted the telemedicine very well as the visiting frequency of individual patient in a short span of ten months was more than three times.

**Table 3:** Cardiovascular and comorbid disease profile observed in rural population

<i>Disease profile</i>	<i>Male (%)</i>	<i>Female (%)</i>	<i>Total visits completed by patients in 10 months</i>
Diabetes alone (48%)	23 (47.92)	25 (52.08)	119 (39.9)
Hypertension and diabetes (24%)	11 (45.83)	13 (54.17)	84 (28.18)
Diabetes and other comorbid conditions (9%)	05 (55.55)	04 (44.45)	32 (10.7)
Hypertension alone (9%)	06 (66.67)	03 (33.33)	26 (8.72)
Diabetes with two cardiovascular diseases (4%)	04 (100)	0	12 (4.02)
Diabetes, hypothyroidism and cardiovascular disease (3%)	01 (33.33)	02 (66.67)	16 (5.36)
Hypertension and coronary artery disease (2%)	02 (100)	0	08 (2.68)
Coronary artery disease alone (1%)	01 (100)	0	1 (0.33)
<b>Total</b>	<b>53</b>	<b>47</b>	<b>298</b>

**Table 4:** Overall economic burden for 10 months on rural healthcare—direct and indirect cost (INR: Indian rupees)

<i>Disease profile</i>	<i>Direct medical av. cost (total cost in INR)</i>	<i>Direct non-medical av. cost (total cost in INR)</i>	<i>Indirect cost av. cost (total cost in INR)</i>	<i>Total cost av. cost (total cost in INR)</i>
Diabetes alone	5,802.91 (2,78,792.37)	44.18 (2,209.15)	455.13 (22,756.64)	6,302.22 (3,03,758.16)
Hypertension and diabetes	7,660.31 (1,83,848.04)	38.50 (924.23)	2,847.9 (68,350)	10,546.71 (2,53,122.27)
Diabetes and other comorbid conditions	9,712.60 (87,413.41)	1104.4 (1104.4)	1,269.62 (11,426.66)	12,086.62 (99,944.47)
Hypertension alone	6,179.72 (55,617.66)	5.91 (295.87)	9,320 (1,035.55)	15,505.63 (56,949.08)
Diabetes with two cardiovascular diseases	6,155.66 (24,622.66)	38.75 (155)	2,182.5 (8,730)	8,376.91 (33,507.66)
Diabetes and hypothyroidism and cardiovascular disease	12,834.57 (28,503.93)	31.90 (95.71)	1,033.33 (3,100)	13,899.80 (31,699.64)
Hypertension and coronary artery disease	8,244.33 (16,488.65)	0 (0)	600 (1,200)	8,844.33 (17,688.65)
Coronary artery disease alone	2,125.34 (2,125.34)	0 (0)	0 (0)	2,125.34 (2,125.34)
Overall total medical and non-medical cost	28,715.44 (6,77,412.06)	1,263.64 (4,784.36)	17,708.48 (1,16,598.85)	77,687.56* (7,67,095.63)*

\*Cost of setup (1,20,000 INR) and internet (20,000 INR) at both the centers are excluded. Overall cost 9,24,795.27INR

**Table 5:** Average cost per person per month in (INR: Indian Rupees)

<i>Disease profile</i>	<i>Per month cost (av. cost in INR)</i>
Diabetes alone	630.22 (6,302.22)
Hypertension and diabetes	1,054.67 (10,546.71)
Diabetes and other comorbid conditions	1,208.66 (12,086.62)
Hypertension alone	1,550.57 (15,505.63)
Diabetes with two cardiovascular diseases	837.69 (8,376.91)
Diabetes and hypothyroidism and cardiovascular disease	1,389.98 (13,899.80)
Hypertension and coronary artery disease	884.43 (8,844.33)
Coronary artery disease alone	212.53 (2,125.34)

This observation is in accordance with the study by Khadanga et al.<sup>22</sup> The better response on behalf of the patients is due to several reasons, namely the easy accessibility of a consultant ant’s opinion, enjoying the pleasure of high technology, free investigation, almost free drugs for 4–12 weeks depending upon the case, and repeated counseling about the disease and risk factors such as tobacco, smoking, a lack of physical exercise, and alcohol. These may be the reasons that more than 72% of females were regular in their visits. In our study, another significant finding is that the patient is not only satisfied with the treatment but also aware of disease risk-factors such as smoking, tobacco, and alcohol intake. Our model also provided the random blood sugar and blood pressure

levels to the patient at the arrival so that they get sensitized about the status of their blood sugar and blood pressure. Patients with uncontrolled sugar and blood pressure were found to be faltering on taking medicine.

Patient awareness does play an important role in its treatment, thereby helping them to gain the knowledge, education, and training for the prevention of the diseases that are supported by various studies. The village environment is considered to be simple and less stressful. Notwithstanding this usual notion, 15% of patients were found to be suffering from some form of emotional stress (such as being single due to spouse death, no family support, and no children to take care); moreover, 13% were widows.



This promising joint venture will also help the e-data-collection of all patients such as patient demographics, disease profile, prescriptions, lab investigations, all visit follow-up date, and consultant opinion. This will go a long way in fulfilling the principle of a smart card.<sup>23</sup>

The individual cost per month was calculated; the cost of diabetes alone was around INR 630.22, diabetes and hypertension cost INR 054.67, diabetes with other comorbid condition cost INR 1,208.66, hypertension INR 1,550.57, diabetes with two cardiovascular diseases cost INR 837.69, diabetes and hypothyroidism and cardiovascular diseases INR 1,389.98, hypertension and coronary artery disease cost INR 884.43, and coronary artery disease cost INR 212.53. An almost linear relationship was observed between cost and a number of comorbid conditions. As the comorbid condition increases, the average cost per the person also increases. Telemedicine is found to be the most economical way of treating and diagnosing patients in rural areas.<sup>24</sup>

Our Telemedicine initiative has provided an opportunity to use generic medicine available at rural health center, thus reducing the cost of drugs. It is a better and convenient method for patient treatment, as all the medication (mostly generic cost with the assumption of a 40% discount for cost calculation from the government side) and lab investigations (done at the center or nearby hospitals considered at CGHS rates for cost calculations) provided to them are free. Only traveling and productivity losses were borne by patients, which were very minimal. The out-of-pocket expenditure is found to be less than that in the conventional settings, which provides the patients some relief.

A model like ours will help policymakers to provide health care to remote corners of the rural areas. This can be easily replicated in other parts of the country using the services of apex hospitals/ medical colleges adopting a rural center for extending telemedicine facility to the adjacent villages. Such a venture costs less than ten lakhs for all sessions, including medical cost, non-medical cost, and indirect medical cost for a 10-month period.

## LIMITATION

The study has been conducted on a pilot basis. The cardiovascular and diabetes patients were primarily brought for teleconsultations. High-Tech Technologies such as echo and CT were not available for further workup.

## CONCLUSION

This study provides an insight into prevalent cardiovascular diseases in rural areas adjacent to the National Capital Region. It is clear that diabetes and hypertension are no more diseases appearing only in cities. It is an issue spreading to villages also. Furthermore, they no longer present as a single disease entity but as a cluster of diseases such as coronary artery disease, cervical spondylitis, hypothyroidism, benign prostatic hypertrophy arthritis, which ultimately increases the economic burden of the patients. In view of the paucity of specialized health services in rural areas, telemedicine is a useful, beneficial, and economical way of creating awareness among people, including healthy lifestyle and cost-effective medical treatment and prevention. The study site is a less researched area in India. Telemedicine also provides medical and paramedical staff a convenient platform for teaching and learning opportunities and for acquainting themselves with a rural healthcare picture.

Despite the current health policy for rural health in India, infrastructure, medical and paramedical staff, and availability of specialist medical services are still big concerns. It all requires a huge cost, other than those involved for curing the disease occurred. The study provides a model wherein a telehealth session provided by government initiative, NGO and hospitals will provide cardiovascular OPD care, reducing the maximum cost burden over the patients and families. Private corporate hospitals will certainly reduce the maximum cost burden of the patient and his/her family. Telemedicine is an emerging tool to handle most of the cardiovascular diseases. More such initiatives will help the rural India to stand equally for specialized medical services, diagnosis, and treatment. This study will help the policymakers to add some values to implement effective health planning in rural areas.

## ACKNOWLEDGMENT

Authors are extremely grateful to Mrs Indritta Singh, NGO head and coordinator, Community Health Center, Kanigarhi road, Jewar, NOIDA. Thanks are also due to the Information Technology team of NHI headed by Sri Mahipal Pilkhwil.

## REFERENCES

1. Dasgupta A, Deb S. Telemedicine: A New Horizon in Public Health in India. *Indian J Community Med* 2008 Jan;33(1):3–8. DOI: 10.4103/0970-0218.39234.
2. Benschoter RA, Wittson CL, et al. Teaching and consultation by television. i. closed-circuit collaboration. *Ment Hosp* 1965;16(3): 99–100.
3. Murphy RL Jr, Bird, KT. Telediagnosis: A new community health resource. Observations on the feasibility of telediagnosis based on 1000 patient transactions. *Am J Public Health* 1974 Feb;64(2):113–119. DOI: 10.2105/AJPH.64.2.113.
4. Craig J, Patterson V. Introduction to the practice of telemedicine. *J Telemed Telecare* 2005;11(1):3–9. DOI: 10.1177/1357633X0501100102.
5. Bashshur R. Technology serves the people: the story of a cooperative telemedicine project by NASA, the Indian Health Service and the Papago people STARPAHC. Superintendent of Documents. Washington DC: US Government Printing Office; 1980. p. 115. Available at: <https://eric.ed.gov/?id=ED225794>.
6. Faruqi A. Role of telemedicine in indian healthcare system. *Int J Manage* 2018 Jan-Feb;9(1):42–49.
7. Mishra A. Tele-Medicine: A new healthcare opportunity. *J Rural Development* 2018 Nov;01:50–53.
8. Mexrich RS, DeMarco JK, et al. Radiology on the information superhighway. *Radiology* 1995 Apr;195(1):73–81. DOI: 10.1148/radiology.195.1.7892498.
9. Brown N. Telemedicine coming of age. *TIE* 1996 Sep 28. [Google Scholar].
10. United Nations, Department of Economic and Social Affairs, Population Division. *World Population Prospects 2017*. New York City: United Nations; 2019. Available at: <https://population.un.org/wpp/DataQuery/>.
11. Mathur P, Srivastava S, et al. Evolving Role of Telemedicine in Health Care Delivery in India. *Prim Health Care* 2017;7:260. DOI: 10.4172/2167-1079.1000260.
12. Golechha M. Healthcare agenda for the Indian government. *Indian J Med Res* 2015 Feb;141(2):151–153. DOI: 10.4103/0971-5916.155541.
13. Byford S, Torgerson DJ, et al. Economic note: cost of illness studies. *BMJ* 2000;320(7245):1335. DOI: 10.1136/bmj.320.7245.1335.
14. Rice DP. Cost of illness studies: fact or fiction? *Lancet* 1994 Dec;344(8936):1519–1520. DOI: 10.1016/S0140-6736(94)90342-5.

15. Scott Kruse C, Karem P, et al. Evaluating barriers to adopting telemedicine worldwide: a systematic review. *J Telemed Telecare* 2018 Jan;24(1):4–12. DOI: 10.1177/1357633X16674087.
16. Biswas A, Singh RK, et al. Medical and non-medical cost of hypertension and heart diseases in India. *Cogent Social Science* 2016;2(1). DOI: 10.1080/23311886.2016.1250616.
17. Pal SK, Pandey GS, et al. Telemedicine: E-health and hospital of the future. *J Sci Ind Res* 2002;61(6):414–422.
18. Zulfiqar AA, Hajjam A, et al. Telemedicine and Cardiology in the Elderly in France: Inventory of Experiments. *Adv Prev Med* 2019;2019:2102156. DOI: 10.1155/2019/2102156.
19. Malik K. Impact of Telemedicine on Rural Women's Health. *Human Rights International Research Journal* 2016;4:170–176.
20. Prabhakaran D, Jeemon P, et al. Cardiovascular Diseases in India Current Epidemiology and Future Directions. *Circulation* 2016 Apr;133(16):1605–1620. DOI: 10.1161/CIRCULATIONAHA.114.008729.
21. Griffith ML, Siminerio L, et al. A Shared Decision-Making Approach to Telemedicine: Engaging Rural Patients in Glycemic Management. *J Clin Med* 2016 Nov;5(11):E103. DOI: 10.3390/jcm5110103.
22. Khadanga S, Khan A, et al. Telemedicine for reach, education, access, and treatment: Structural analysis of the pilot data. *Astrocyte* 2014;1(3):211–217. DOI: 10.4103/2349-0977.157765.
23. Secure Technology Alliance. Smart Cards in Healthcare FAQ Series – Smart Cards and Patients. New Jersey: Secure Technology Alliance; 2019. Available at: <https://www.securetechalliance.org/publications-smart-card-technology-in-healthcare-series-smart-cards-and-patients-faq/>.
24. National Rural Health Association. The Role of Telemedicine in Rural Health Care- An Issue Paper. Washington, D.C.: National Rural Health Association; February 1998. Available at: [https://www.ruralhealthweb.org/getattachment/Advocate/Policy-Documents/Archive/ipaper7-\(1\).html.aspx?lang=en-US](https://www.ruralhealthweb.org/getattachment/Advocate/Policy-Documents/Archive/ipaper7-(1).html.aspx?lang=en-US).