

## ORIGINAL ARTICLE

## Challenges in managing telemedicine centers in remote tribal hilly areas of Uttarakhand

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|--------------------------|------------------------------|-------------------------|------------------------|----------------------------|----------------------------|--------------------------|------------------------|
| <a href="#">Abstract</a> | <a href="#">Introduction</a> | <a href="#">Methods</a> | <a href="#">Result</a> | <a href="#">Conclusion</a> | <a href="#">References</a> | <a href="#">Citation</a> | <a href="#">Tables</a> |
|--------------------------|------------------------------|-------------------------|------------------------|----------------------------|----------------------------|--------------------------|------------------------|

### Article Cycle

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### Abstract

**Background:** Healthcare Information Technology advances in the Information, Communication and Telecommunication (ICT) sector have made telemedicine a common and alternate medical service delivery in remote areas. Indian Space and Research Organization (ISRO) established village resource centers managed by Non-government Organizations (NGO's) all over the country in 2010. While ISRO provided satellite connectivity and required equipment for communication, tele-education, and telemedicine in Uttarakhand, Himalayan Institute Hospital Trust provided primary health care through tele-consultation to remote tribal hilly areas through village resource centers. This paper features the technical and financial challenges faced in providing tele-consultation. **Methods:** A cross-sectional study of 115 clients, 4 health supervisors and co-ordinating doctor from three districts was done using semi-structured questionnaires for interview. Parameters at both doctor's and patients' end for communication, costs involved, quality of doctor-patient interaction and patient satisfaction from Tele-consultation sessions were assessed. **Results:** Video quality was more satisfactory than audio. The physical presence of a doctor was felt necessary only in 33/115 (30%) of the time. The average cost for telemedicine consultation works out to just Rs. 15 per patient. Around 48.7% of the queries were processed in less than 10 minutes of satellite time. Around 67% of the beneficiaries felt that their privacy was not maintained as per their expectations. The request to extend the timing of the session was made by 85% of the clients. **Conclusions:** Long periods of non- connectivity due to satellite failure, lack of technical staff, lack of patient's privacy during sessions, lack of income generation for self-sustainability, were the major challenges faced. However many patients benefitted, did not have to travel long distances for medical advice and easy follow ups were facilitated. Telemedicine centres can sustain themselves by ensuring uninterrupted connectivity, trained staff, good quality user- friendly instruments and exploring multiple financial sources for sustainability.

### Key Words

Telemedicine; Tele-consultation; Rural Healthcare; Uttarakhand

### Introduction

One of the first published accounts occurring in the early 20th century is of electrocardiograph data getting transmitted over telephone wires

(1). Telemedicine, in its modern form, started in the 1960s, was largely driven by the military and space technology sectors, and a few individuals using readily available commercial equipment (2, 3). Recent advancements, increasing availability and utilization of Information, communication and Telemedicine (ICT) by the rural population have been the biggest drivers of telemedicine over the past decade, creating new possibilities for health care service and delivery. Uttarakhand, as a hilly state has not been able to experience benefits of telemedicine advances to the fullest. The major cause is being lack of infrastructural support and inadequate bandwidth availability to telemedicine care providers. There is also a lack of specialized human resources and competent workers in rural areas. There is however, a critical gap between needy population and public health service provision and inadequacy in provision of timely health services is the major cause of the poor health status in the State.

Today, the use of ICT tools is providing remarkable support for a wide variety of medical and healthcare service interventions to remote communities. Telemedicine uses modern integrated approaches of healthcare IT for providing the correct support based on the diagnosis with help of advanced equipment. The telephone and the video links between the clinic and the hospital enables the physician at hospital to see the condition of the patient at the clinic so that the medical staff at the clinic can be advised for appropriate intervention (4, 5). This medical branch is emerging as one of the most cost effective methods of healthcare delivery system around the globe as it doesn't involve transportation cost and within a fraction of time the rural patient is directly connected to a specialist present at a tertiary level Centre.

Indian Space and Research Organization (ISRO) set up the Village resource centers (VRC) with a view to integrate its expertise in satellite communications and satellite based earth observations with Rural Development Institute – Himalayan Institute Hospital Trust (RDI-HIHT) in Uttarakhand to disseminate a variety of services using this unique system and other IT tools to address the changing and critical needs of the rural community. The objective of these Tele-consultation services in the 18 Village Resource Centers (VRC) that was established was to support primary health care by Tele-consultation mode in rural tribal hilly areas where other primary health care facilities were non-existing.

The expert center at HIHT was linked with all the other VRC's in the network. HIHT through its NGO wing the Rural Development Institute had established 6 VRC centers called telemedicine nodes in districts of Dehradun, and Tehri each being at a distance of more than 100 km from the medical college. RDI set up the required infrastructure, human resources and provided the finances to successfully manage the VRCs.

To add to the dynamism of this project, queries from the community on not only health but also agriculture, livelihood and education services were incorporated in the tele sessions by all the VRCs'.

Local volunteers and field supervisors were trained to operate the systems at the tele-center. They were trained to organize and plan tele health sessions and their communication skills were enhanced to communicate with local people in their language and dialects. The publicity for these sessions was done either by phone or personal visits to the homes of people by field supervisors. A fixed time slot of 2.30 to 4.30 pm was allotted for Tele-sessions by ISRO per working day.

On the first visit of every patient, the supervisor at the center created the patient's record file and after filling the consent form, they were instructed about how to use the tele-center instruments.

Since there was no specialized telemedicine software installed, records were maintained in either excel file or in patient records register. The more complicated cases were referred to higher centers after primary treatment. The supervisor was instructed to visit the patient at home after consultation for a follow-up to enquire about the recovery of the patient.

Every month telemedicine centers were visited by personnel from the coordinating agency. The tele sessions were of two types, online and offline consultations. Offline consultation was performed with single ended connectivity. A supervisor would state the query on the patient's behalf and the consultant provided necessary advice to the patient via the supervisor either by phone or message facility available in the system.

In online consultation after each session, we provided necessary comments/advice including prescription of locally available medicines by sending electronic message to that center. In case of non-connectivity or disrupted connectivity alternate communication mode of mobile phones was used by both sides.

In those cases when no trained medical staff was available, supervisor from the VRC was the key person responsible for providing necessary advice to the patient. The community was also oriented about common health conditions and health education along with Tele-consultation in each session.

A schedule of health education sessions was sent to all linked VRC's and the community was motivated to participate in these sessions. These sessions were organized by a selected

team including a Doctor, Pharmacist and Health educator.

## Methods

We did a cross-sectional descriptive study based on the interview of health supervisors, patients from the two districts and co-coordinating doctor in the study area using semi-structured questionnaires between January to October 2010. We evaluated the program on parameters at the doctor's end on audio/video quality, health supervisors knowledge and confidence in conveying patient's complaints, whether patient needed physical examination and/or investigations and client-complaint processing time. The evaluation criteria at patients end taken were costs involved including cost of travel to telemedicine centre waiting time, quality of audio visual communication, quality of doctor-patient interaction and patient-satisfaction including willingness to motivate others to use this facility and revisits for tele consultation sessions. Proportions for each criterion were calculated using MS excel software and self-analyzed by RDI personnel.

## Result

We interviewed 115 patients, 4 health supervisors and one coordinating doctor. Female patients were higher in number especially in the age group 19-49 years. ([Figure 1](#)) As per this study amongst all the sessions held, 58% consultations had satisfactory audio and 68.7% had good video quality. Amongst the staff involved 70% had adequate knowledge and confidence in conveying patient's problems in the sessions online in the patient's presence or off line in their absence. The physical presence of a doctor was felt necessary only in 33/115 (30%) of the time. 70% of the queries/consultations did not require patient-doctor contact and could be handled without detailed physical examination

of the patient .Hence the cost and time saving for the patient for travel to a hospital was significant. (Table 1) The average cost for telemedicine consultation works out to just Rs. 15 per patient. The average waiting time for any patient to get consultancy was around 20-40 minutes. Around 48.7% of the queries were processed in less than 10 minutes of satellite time.

Around 22.6 % of the respondents said that this service was helpful, 67% of the beneficiaries felt that their privacy was not maintained as per their expectations. The request to extend the timing of the session to at least 6 hours of the day against the existing 2 hours was made by 85% of the clients. (Table 2)

## Discussion

The sustainability of any program depends on its integration with other mainstream activities. Telemedicine interventions are expanding its capacity not only in terms of time and resources that is saving time to see more patients in a given period but also improving communication. This can enable experts to make more timely adjustments to healthcare service, which reduces the number of hospitalizations and hospital visits, thereby creating new horizons (6).

VRC's were established in the hope that they will grow in demand and popularity and eventually be sustained by the community after initial years of management support by NGO's. Currently global healthcare organizations are shifting their focus towards integrated care concept. Focus is much more on creating developed health information system which is broader than current hospital information system. Some developed countries have also constituted a legally approved and financially supported infrastructure in their national health system

(7). In this study no financial sustainability option for VRCs was available. The Tele consultation centers were understaffed in the hilly tribal areas. Some centers had a single health supervisor with multiple responsibilities or remained vacant. Such centers were managed by locally available volunteers who were trained in dealing with telemedicine equipment but had insufficient knowledge about health issues.

In order to fulfil commitments to society there is a need to adopt changes in technical advances, state of mind and adaptation in slowly changing approaches of healthcare delivery in traditional attitude from user prospective(8). Thus the adoption of telemedicine systems requires acceptance by both the patient and the health professional involved. Both patients and doctors require some orientation to better utilize these services by reducing unnecessary questions and answers in the limited time of satellite connectivity to gain maximum benefit of this high cost telemedicine infrastructure (9). Based on previous experience there is a gap observed in existing knowledge between healthcare providers and its beneficiaries i.e. patients. This offers present health technological advances to bridge this gap in broader perspective (10). Community perceptions about the necessity of the physical presence of a doctor during treatment, lack of investigation facilities at centers and community disinterest in taking up activities on themselves were the drawbacks of this initiative in some VRCs. The high cost of instruments and also the high cost involved in repair of the sophisticated instruments lead to sporadic episodes of non- repair due to which there was underutilization of available IT resources. Most information technology based health projects face challenges in compatibility issues with other systems. This can be tackled

by providing an integrated solution in order to provide well managed healthcare (11).

The telephone and the video links between the clinic and the hospital enabled the physician at hospital to see the condition of the patient and advise the medical staff at the clinic for appropriate intervention. It is important to note that telemedicine services are designed to add-value to other health care services and not to provide exclusive services (12). During this study frequent power failure was also common in intervention areas. The condition worsened when the battery life of the equipment ended. After three successful years in spite of many hindrances the satellite connectivity could not be re-established due to satellite failure and the project came to a halt. Over time the unutilized instruments have become dysfunctional and some centers had to be closed due to long periods of non-provision of Tele-consultation services. Centers operated by regular supervisors of HIHT were able to run VRC's in villages (Nagthat and Kwanu) but centers (Lakhamandal and Thanu) but where local volunteers were managing the show, centres had to be forced to close. Services from one VRC center at Chamba, Tehri Garhwal were not rendered due to instrument malfunction requiring high cost for repairs. Designing systems that enhance rather than dislodge current work practices and effectively communicating them to practitioner's presents a challenge and an opportunity to ensure appropriate and meaningful uptake of telemedicine systems within low-income settings (13). An overall lack of evaluation data, trials, and published results concerning telemedicine initiatives in developing countries has limited the amount of evidence on the impact and effectiveness of telemedicine (14).

## Conclusion

- As per our experience there is a scope of further research and innovative work by finding alternate ways of self-sustainability and community involvement in the functioning of VRCs. There is tremendous scope for Public Private Partnership where government centers are already available and private organization can use its expertise in Telemedicine by using public infrastructure thus imposing less burden on the community for its self-sustainability.
- Poor and interrupted connectivity lead to failure of the programme. Telemedicine program depends upon internet connectivity, so for successful implementation there must be uninterrupted connectivity.
- Expensive instruments, poor audio quality, lack of locally available service engineers and lack of training manuals with visuals for easy hands-on orientation of the patients were hindrances in project implementation leading to under-utilization of the system.
- Session timings could not be extended due to lack of satellite connectivity this led to decrease in male participation.
- Lack of privacy could not be dealt with due to unavailability of separate consultation room and villagers could not handle equipment independently.
- Capacity building of community and staff for full utilization of telemedicine system was needed. Community were not oriented to take benefit on multiple technical and non – technical subjects like agriculture, livelihood, publicity of job opportunities etc. via telemedicine centers in addition to medical support.
- Health Education as an integral part of Tele-sessions and the latest available technical advancements by video clips was limited as non –health staff was involved in operating the system in very remote centres.

- Timely expansion of Rural telemedicine centers was not done especially in some identified areas where should be established where public health facilities were nonexistent but infrastructure and other paramedical / nursing staff could have been arranged. There was limited use of these centres for epidemics /disasters.

- However, this initiative showed that directly and indirectly the number of referrals to existing health facilities and the need for patient transfers in some diseases / cases are reduced increasing its cost-effectiveness. Health supervisors were better able to utilize available resources on the advice of the consultant doctor. Most cases could be managed easily without referral due to lack of technical knowledge and confidence of health supervisors.

### Recommendation

- For sustaining VRCs and rural telemedicine centers, nominal facilitation fees of Rs. 10 can be charged per patient to contribute to the supervisor's salary. This will incentivize the supervisors (100 patients in a month can work out to Rs. 1000) to motivate more patients to use this service.

- Presently this ISRO based service can be supplemented by mobile service and 3G wherever the services are available. Technical inputs to further improve audio-visual quality are needed.

- Sessions timings can be made patient friendly like mornings on some days, evenings on other days and some sessions on weekends to promote male participation.

- There is a need to spread awareness about Telemedicine among the serving doctors. Patients who come to the OPD's to meet a doctor can be told about telemedicine in the OPD so that subsequent follow ups can be

done using this facility at the village itself. This will reduce the load on the hospital OPD's

- To allay the lack of privacy, provision of a closed/locked room can be made.

- Telemedicine tools and technology can help epidemiological surveillance by assisting in identifying and tracking public health issues and illustrating trends in future.

- These sites can be used as sites to provide a "first-response" to epidemic outbreaks; if managed effectively. This could bridge the gap of non-availability of medical staff thus strengthening our public health system.

- The telemedicine centers should be established with the target of being a knowledge resource for disaster management with such IT tools which function even in adverse environmental conditions.

- Simultaneously it is important to consider legal and ethical issues surrounding patient privacy and confidentiality, competing health system priorities in telemedicine implementation.

(The results reflect the data collected and analyzed during functional VRC centers in Uttarakhand, technically supported by ISRO).

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## Tables

**TABLE 1: FEEDBACK TAKEN FROM ONE CO-ORDINATING DOCTOR HANDLING THE 115 TELEMEDICINE PATIENTS IN THE MAIN TELEMEDICINE CENTER OF RDI-HIHT**

| Criteria assessed  | Result         | Frequency | Percentage |
|--|----------------|-----------|------------|
| Audio quality  | Satisfactory   | 66        | 57.4       |
|  | Unsatisfactory | 49        | 42.6       |
| Video quality  | Satisfactory   | 79        | 68.7       |
|  | Unsatisfactory | 36        | 31.3       |
| Confidence of VRC staff in helping patients define his problem to the doctor at the main center. | Confident      | 85        | 73.9       |
|  | Not confident  | 30        | 26.1       |
| Cases in which the need for a specialist was felt  | Yes            | 33        | 28.7       |
|  | No             | 82        | 71.3       |
| Cases in which patients Investigations were needed before medical advise                         | Yes            | 56        | 48.7       |
|  | No             | 59        | 51.3       |
| Process Time   | < 10 min       | 56        | 48.7       |
|  | > 10 min       | 59        | 51.3       |

**TABLE 2: FEEDBACK TAKEN FROM CLIENTS WHO HAD AVAILED OF THE TELE-CONSULTATION FROM VARIOUS VRC CENTERS OF THE FIELD. (N=115)**

| Criteria assessed  | Results            | Frequency | Percentage |
|--|--------------------|-----------|------------|
| Conventionally used Health Services in the absence of telemedicine center by patients. | Government         | 22        | 19.1       |
|  | Home remedy        | 33        | 28.7       |
|  | RMP / Local doctor | 37        | 32.2       |
|  | Others / Undefined | 23        | 20.0       |

|  |                |    |      |
|--|----------------|----|------|
| Average waiting Time at the VRC center   | 5-10 min       | 06 | 05.2 |
|  | 10-20 min      | 39 | 33.9 |
|  | 20-30 min      | 48 | 41.7 |
|  | > 30 min       | 22 | 19.1 |
| Percentage of clients who found the services helpful                                   | Excellent      | 26 | 22.6 |
|  | Very Good      | 54 | 47.0 |
|  | May be         | 24 | 20.9 |
|  | Bad            | 11 | 09.6 |
| Clients feedback regarding Telemedicine services versus face to face visit to a doctor | Exactly        | 26 | 22.6 |
|  | Similar        | 50 | 43.5 |
|  | Different      | 25 | 21.7 |
|  | can't say      | 14 | 12.2 |
| Whether client felt comfortable during the Tele-consultation duration.                 | Yes            | 59 | 51.3 |
|  | No             | 56 | 48.7 |
| Audio quality of the connection.   | Satisfactory   | 58 | 50.4 |
|  | Unsatisfactory | 57 | 49.6 |
| Video quality of the connection.   | Satisfactory   | 84 | 73.0 |
|  | Unsatisfactory | 31 | 27.0 |
| Privacy of the client compromised.   | Yes            | 38 | 33.0 |
|  | No             | 77 | 67.0 |
| Whether clients are willing to motivate others to avail of such a service.             | Yes            | 56 | 48.7 |
|  | May be         | 42 | 36.5 |
|  | No             | 17 | 14.8 |
| Whether clients are willing to revisit the center again.                               | Yes            | 60 | 52.2 |
|  | May be         | 37 | 32.2 |
|  | No             | 18 | 15.7 |
| Regarding fixed Tele-consultation time   | 2.30pm-4.30pm  | 17 | 14.8 |
|  | 12 pm- 4.30.pm | 44 | 38.3 |
|  | 10 am- 4.30 pm | 54 | 47.0 |
| The distance travelled in kilometers by the clients to the VRC center.                 | 0-3            | 23 | 20.0 |
|  | 4-8            | 19 | 16.5 |
|  | 9-12           | 37 | 32.2 |
|  | 13-100         | 35 | 30.4 |
| Total expense in Rupees for the patient  | 0-25           | 70 | 60.9 |
|  | 26-50          | 39 | 33.9 |
|  | 51-100         | 05 | 04.3 |

## Figure

FIGURE 1.1 AGE – WISE DISTRIBUTION OF BENEFICIARIES BY GENDER (N=115)



