

PERSONAL VIEW

Biotelemetry: could technological developments assist healthcare in rural India

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ABSTRACT

Context: In India 60-70% of the population live in rural villages. The rural population suffers from a burden of disease and disorders due to the non-availability of appropriate healthcare personnel and facilities. Since 1950, the Indian Government has responded with a series of five-year plans but has been unable to address the lack of healthcare professionals prepared to work in isolated and rural areas.

Issue: The use of biotelemetry is proposed as a solution, its advantages and disadvantages are discussed.

Lessons: The development of biotelemetry in India will improve healthcare for the rural and remote population and ease the effects of the shortage of rural healthcare professionals. However, a number of questions remain and require further consideration.

Keywords: biotelemetry, rural India, healthcare, telemetry plan.

Context

In India 60-70% of the population live in rural villages. The rural population suffers from a burden of disease and disorders due to the non-availability of appropriate healthcare personnel and facilities^{1,2}.

In Indian rural areas, there is a preponderance of certain health problems, such as a high suicide rate, incidences of certain types of mental health problems and degrees of health problems associated with the physical nature of work in rural primary industries^{1,2}. In addition, a range of social, economic, geographic, infrastructural and cultural factors affect the health of Indian rural individuals and the adequacy of rural health services³⁻⁵.



The Indian rural population has a higher proportion of elderly people compared with the national average^{1,3}. Abuse of alcohol and the use of smokeless tobacco is a significant problem among rural youth. Rural hospitals are half as likely to provide emergency mental health care as are urban hospitals¹⁻⁶. Rural residents have greater transportation difficulties for health care compared with urban residents and this is particularly so for vulnerable groups such as the elderly or disabled persons. Rural residents have difficulties accessing food retailers for fresh fruit and vegetables which has implications for diet-linked diseases⁶. Rural housing difficulties associated with the limited supply of low cost housing and the poorer quality of housing in rural areas (especially in relation to dampness) may be associated with homelessness, asthma and respiratory infection, and certain other infections such as tuberculosis⁶. Unemployment is higher in rural areas and linked with limited employment opportunities, seasonal and part-time work, low wages, decline in agricultural labour force, and work-related stress and risks¹⁻⁶.

Some villages have a medical facility available but few doctors are willing to accept posts in these rural hospitals^{3,5,6}. Doctors who do work with rural patients may be professionally isolated and lack the opportunity for continuing education.

Government policy response

In the period 1951-2000, using a series of five-year plans to effect health sector reform, the Indian Government established a number of small hospitals and dispensaries in small rural villages (Table 1)^{1-3,5}. However, the operation of these hospitals was compromised by the lack of medical staff^{1,2}. By the Tenth Plan (1995-2000) manpower still fell short of what was sanctioned and required (Table 2)¹⁻³.

Policy shortfalls

In India, interaction among components of the healthcare system has been suboptimal. There are no well organized referral linkages between primary, secondary and tertiary care institutions^{2,5}. Gaps persist in manpower and

infrastructure function in the government sector, especially at the primary healthcare level in remote, rural mainly hilly areas where tribal people live in the forests, and in urban slum areas where healthcare needs are greatest¹. The referral structure is poor, as is the coordination of government, voluntary and private sector services^{2,3}.

Among the plethora of hospitals there are massive inter-state, inter-district, urban-rural differences in appropriate management and distribution of manpower, diagnostic and therapeutic services, and pharmaceuticals¹. The availability and utilisation of services are poorest in the most needy remote rural areas in districts or states^{2,5}.

Issue

- *Biotelemetry* is the remote detection and measurement of a condition, activity, or function relating to a man or animal.
- *Telehealth* is the process of telemetering and controlling health related data.
- *Telemedicine* is the telepresence of medical experts with the ability to act and interact in an offsite environment by making use of virtual reality technology. Telemedicine reduces the cost of medical practice and brings expertise into remote areas⁷.

Advanced technologies have been developed to eliminate the barriers of distance and topography. Telehealth programs have been formulated in many countries¹⁻²⁰. In the USA, Europe, Australia, Canada and other countries, successful biotelemetry programs, or obtaining biological information at a distance, have been implemented^{5,6}. Analytic surveys on telemedicine and doctor-patient communication, uses of telemetry in health care, clinical telemetry and patient monitoring, teleradiology, telesurgery, implant biotelemetry and telemetry of medical signals have been detailed by various researchers⁹⁻¹⁵. Such technological developments have assisted health care in rural India^{5,6}.



Table 1: Progress in establishing healthcare centers in Indian rural areas (1951-2000)

Health facility	Health reform year		
	1951	1981	2000
SC/PHC/CHC	725	57 363	163 181
Dispensaries & hospitals	9209	23 555	43 322
Beds (private & public)	117 198	569 495	870 161
Doctors	18 054	143 887	737 000
Nursing personnel	61 800	268 700	503 900

CHC, Community healthcare; PHC, primary healthcare; SC, secondary healthcare.

Source: refs 1-3.

Table 2: Healthcare during the Tenth Plan (1995-2000): health manpower in primary healthcare centres

Staff positions	Required clinicians	Sanctioned clinicians	In-place clinicians (serving)	Gap, required & in-place	Gap, sanctioned & in-place
Doctors in PHC	25 663	29 702	22 506	3157	7196
Specialists in CHC	22 348	6579	3741	18 607	2838
Nursing staff in SC	134 108	87 504	73 327	60 781	14 177
Lab. technicians in PHC	27 936	15 865	12 709	15 227	3156
Specialists in PPC	3100	–	–	–	–

–, Not available.

CHC, Community healthcare; PHC, primary healthcare; PPC, private and public centres; SC, secondary care.

Source: refs 1-3, 5.

Telehealth offers a solution to the problems of health care in rural and remote India where there are already many telehealth programs operating^{5,6,8}. Existing telecommunication systems are being used to transmit clinical data from remote areas to major hospitals, and to transmit and receive specialist advice or consultation^{13,15}. Radiotelemetry as well as the use of satellite and internet media are being used successfully in some areas^{1,2,16}.

World Bank loans have been used in India to initiate projects to build up district hospitals. During the Tenth Plan it was resolved that optimal use would be made of facilities available

in tertiary care institutions, and that the quality of services in and strength of linkages with secondary care institutions would be enhanced. Efforts are currently under way for the development of appropriate two-way referral system utilizing IT tools to improve communication, consultation and referral right from primary care to tertiary care levels.

Integration of all aspects of current healthcare programs requires a progressive convergence of funding, implementation and monitoring of all health and family welfare programs under a single field of administration beginning at and below district level. To this end, tele-



linkages must still be built among villages, sub-centres, and primary healthcare centres. In addition, links from remote areas must be made with secondary healthcare centres, district and tertiary care centres, and major super-specialty institutions in other regions.

Advantages of rural telemedicine

The advantages of the use of telemedicine include improving care for rural patients and reducing professional isolation of healthcare professionals.

Providing healthcare services via biotelemetry makes specialty care more accessible. Video consultations from a rural clinic to a specialist can alleviate prohibitive travel and associated costs for patients. The existing problems of insufficient physicians will be eased by offering diagnostic consultations at a distance, and will facilitate access to distant colleagues. In this way, expert advice will be readily available to assist local health professionals. Rural telemedicine will also provide training opportunities for isolated or rural health practitioners. The building of a telecommunications infrastructure presents a vehicle for a disease surveillance and response at the district, state and national level.

Disadvantages of rural telemedicine

Among the disadvantages of telemedicine are increased expectations of health care, physician licensing issues, resistance to the technology, and the costs associated with installation.

Telemedicine widens the spectrum of possible interventions and increases service awareness and expectations of the population. However the escalating cost of health care is widening the gap between what is possible and what the individual or the country can afford¹¹.

For an all-India telemedicine system to be successful, state licensing of physicians, with the impossibility of all specialists being registered in at least 20 states in order to treat patients

India-wide, requires legislative reform by the Indian Government.

Until there is widespread acceptance of the technology, patient and physician resistance may be expressed in fear of malpractice suits due to lack of 'hands-on' interaction with patients.

Among barriers to the practice of telemedicine, the cost of installation, including hardware and infrastructure, is the greatest. To overcome this, installation should be staged. Once the system is installed, the cost of operation is low in terms of ongoing input, manpower and capital costs. Healthcare may be linked into already developed infrastructure. In terms of a reduction of morbidity and mortality of those living in rural India, the cost-saving would be high¹⁴.

Many potential telemedicine projects have been hampered by the lack of appropriate telecommunications technology. Regular telephone lines do not supply adequate bandwidth for most telemedical applications, and few rural areas have the cable wiring required for telemedicine. However, private corporations, telecommunications companies and technology manufacturers may produce the low-cost equipment and bandwidth for tele-internet usage under the auspices of corporate philanthropy. Once a telemedicine system is in place, a radical change is forecast and transition from the current grant- and self-funded projects, to a major self-sustaining industry within the healthcare field⁸.

Lessons

An overview of health related problems in rural India has been given with the possible solution of biotelemetry. In line with the current international debate²⁰ on the cost-analysis of such an approach, the initial costs for any biotelemetry program may be prohibitively high. However this must be set against the long-term advantages of improved health care in rural India.



However, research questions remain, among them:

- What is the cost of setting up a telemetry link between a single village and an urban hospital?
- Would better use of such funds be to increase the pay of rural health professionals, and so make a rural posting more attractive?
- How much will it cost to maintain the links?
- Are there technicians capable of maintaining the system?
- Which aspects of medical care will show a measurable improvement in healthcare status for the rural population?
- Will health indicators (access to clean water, access to better housing, dental care, suicide prevention, prevention of substance abuse, prevention of spousal abuse etc) be improved by telemedicine? Would it be better to provide training and employment for rural individuals already resident in the village who could apply their training for people they know well and whose language they understand?

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