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Original Research Article

Use Of Information Technology In CHCs To Improve Quality Medicare

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ABSTRACT

Introduction: India has expanded the three-tier public health system. Community Health Centres are an important link between primary and tertiary healthcare and act as gatekeepers too. Gujarat has functionalized 345 CHCs as per population norms. However it is felt that being in remote areas, there is a significant gap of specialist services. This study was undertaken to understand the magnitude of specialist gap in CHCs affecting the quality and equity of desired optimal healthcare. Strong policy decisions are needed to attract and retain specialist manpower in CHCs. Since that may take its own time, with advancements in information technology in healthcare such Internet of Things etc, it is suggested how implementation of IT infrastructure such as Electronic Health Record, Hospital Information Management System and Telemedicine can bridge the specialist gap and improve the quality of care at CHCs thus making healthcare more affordable, accessible, sustainable and equitable especially in remote areas of Gujarat.

Key words: Community Health Centres, specialists, Information technology, telemedicine.

INTRODUCTION

Government health services in rural India are mainly provided through a three-tier hierarchy of publicly funded health facilities, with community health centres (CHCs) – 30-bed, 24 × 7 rural hospitals that serve about 120,000 people – at the top, primary health centres (PHCs) in the middle, and health sub-centres at the bottom. There are 345 operational CHCs in Gujarat which serves 30-40% of total public health services. Therefore CHC is an ideal place to evaluate the status of existing IT interventions and possible augmentation to be done to ensure accessible quality health services as a part of the Universal Health Coverage (UHC) that can aid assessment, refinement, and optimization of secondary level health services, especially in the outreached area. About 91.85% (HMIS, as on 31 March 2019) posts of specialists surgeon, obstetrician and gynaecologist, paediatrician, physician required as per Indian Public Health Standards for CHCs-2012 [1] are vacant. Non-availability of specialists in many CHCs limits the envisaged role of CHCs for secondary care.

The shortage and unequal distribution of a specialist workforce at the CHC level can have serious implications not only for maternal and child mortality, but also for the quality of health-service delivery at higher levels, such as in district or regional hospitals (Iyengar et al.).[2] Since the rural poor mostly rely on publicly funded facilities for their healthcare needs, the lack of specialists at the CHCs often forces them to either forgo treatment or avail specialist services from the private sector, which is infamous for its exorbitant fees (Shahrawat et al. and Chandra et al.).[3,4] The lack of CHC

specialists may cause higher disease burden and mortality for the rural population, and it could also trap rural households into a vicious poverty cycle due to the high out-of-pocket expenditures faced when seeking medical care.The lack of specialists in CHCs also forces the rural poor to seek specialist services from higher-level, publicly-funded hospitals (such as district hospitals and medical colleges) or other CHCs in proximity (Garg et al.).[5] The influx of those patients who should have been treated at their local CHC, into the higher-level facilities that are meant for complex and serious cases or in other CHCs, often results in overcrowding, long queues, delays in treatment, and untimely deaths (Singh MM).[6] The lack or unequal distribution of the health workforce (for instance, specialists across CHCs) could also lead to the ineffective use of physical infrastructure and equipment, rendering the invested infrastructure and equipment useless (Zurn et al.).[7] As per NFHS-5 (2019-21- Gujarat Fact Sheet, Table 89)[8] 59.6% rural population went to Public Health Sector for Health care and 18.6 went to CHC / rural hospital.

The aim of this study, therefore, is to measure the shortage and inequality in the distribution of a specialist workforce across publicly funded rural CHC in Gujarat as per latest Rural Health Statistics (20-21)[9] and consider IT interventions to overcome the shortcomings of this shortage. There are a plethora of stand-alone IT monitoring systems for various programmes operational in CHCs which are mainly aimed at aggregate data collection and transmission. There is no IT based management system nor any personal Electronic Medical Record (EMR) generated at CHCs.

As per the National Health Policy 2017,[10] a major concern has been emphasized on the health care facilities in a rural area that is affordable and sustainable. Over the past several decades, the use of wireless broadband technology has become more advanced and cell phone and internet use has become nearly ubiquitous (Agarwal et al.).[11] Further advancements in technology resulting in transfer of images facilitate sharing of medical data such as X-rays and scans and real-time audio and video consultations. Improvement in internet infrastructure such as bandwidth communication speeds, information storage databases, web service backups, Internet Of Things, standard formats for data transmission, encryption, password protection, digitalizing information, and establishment of electronic medical records made e-health and telemedicine stress-free and cost-effective. Telemedicine practices in India have slowly and steadily gained foothold. A few noteworthy examples of the successfully established telemedicine services in India include mammography services at Sri Ganga Ram Hospital, Delhi; oncology at Regional Cancer Center, Trivandrum; surgical services at Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, and many more (Mishra et al.).[12] Realizing its potential in health-care delivery, the Board of Governors of Medical Council of India (MCI) has adopted the “Telemedicine Practice Guidelines” which include both the overarching principles and a practical framework of telemedicine. Accordingly, the same has been included as an amendment to the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002, and has been approved by the Ministry of Health and Family Welfare, Government of India officially on March 25, 2020.(Telemedicine Practice Guidelines). [13]

MATERIALS AND METHODS

1. Situational analysis:

A. Specialists availability status in CHCs of Gujarat: More than 30% of workload at government health institutes is being carried out at CHCs. But major human resource gap in specialists is being observed at the level of CHC. In Gujarat, of the 366 posts that are sanctioned in CHCs, 135 were filled up and 231 vacant (Table 1) [9].

Table 1: Specialists status in CHCs in Rural areas of Gujarat

Specialists (Surgeon, OB&GY, Physician, Paediatrician) in Rural CHCs				
	Sanctioned	In position	Vacant	Shortfall %
	S	P	S-P	
Gujarat	366	135	231	63.115
All India	13637	4405	9268	67.962

Further analysis and comparison of specialists in rural CHCs of certain larger states for four basic specialists is as in the Table 2.

Table 2: Status of four basic specialists Surgeon, OB&GY, Physician, Paediatrician in Rural CHCs in larger 15 states:

		Sanctioned	In position	Vacant	Shortfall %
	State	S	P	S-P	
1	Gujarat	366	135	231	63.11
2	Karnataka	462	219	243	52.60
3	Andhra Pradesh	473	322	151	31.92
4	Odisha	1511	309	1202	79.55
5	Rajasthan	1473	479	994	67.48
6	Maharashtra	483	337	146	30.23
7	Punjab	562	153	409	72.78
8	Jharkhand	684	186	498	72.81
9	Telangana	625	258	367	58.72
10	Uttar Pradesh	2902	872	2030	69.95
11	Assam	300	174	126	42.00
12	Chhatisgarh	606	104	502	82.84
13	Madhya Pradesh	945	43	902	95.45
14	Tamil Nadu	326	251	75	23.01
15	Uttarakhand	236	52	184	77.97

It is observed that the states of Tamil Nadu, Maharashtra and Andhra Pradesh have around 30% vacancies of specialists against sanctioned posts, whereas Gujarat has 63.11% vacancies. The state should consider filling up these posts on utmost priority.

B. IT infrastructure of CHCs of Gujarat:

The infrastructure of CHCs is not optimally utilized and one of the key reasons emerges is shortage

of specialists on long term basis and inadequate use of information technology to use established interventions like telemedicine.

Status of health IT intervention utilization at the CHCs

Absence of majority of specialists' services at CHCs, routine health care services during OPD hours only, no system for continuous medical education and specialist' support to the health care service providers, dependence on routine training and ad-hoc adherence to the guidelines and SoPs are some factors that hamper Accessible Qualitative health care services - independent to time and place.
Available limited Health care services that are dependent on availability of transportation and specialists at the CHCs and no access by patients to their health records affect healthcare equity.
Non availability of personal health record, Patients usually wait for OPD hours and availability of doctors and home access to emergency services if required and repetition of entire history taking process by healthcare service providers every time during visit are lacunae in patient centered healthcare services.
There is no IT based Hospital information management system at the CHCs, existing HMIS is only for quantitative data collection and there is no hospital logistic management system.
There are no available measures to know adherence doctor's advice by patients, there is only general Social and Behavioural Change Communication (SBCC) activities for mass impact and no personalized health promotional Information Education Communication affecting effective health seeking behavior.

Key performance indicators of CHCs:

CHCs provide quite significant volume of health services as seen in Table 3.

Table 3: Health Services provided by CHCs in 5 years (State MIS)

Indicator	2015-16	2016-17	2017-18	2018-19	2019-20
OPD	1,20,41,543	1,41,84,130	1,59,55,859	1,62,18,482	1,83,33,935
Indoor Admission	17,48,533	19,15,877	20,77,177	21,12,119	23,74,878
Major Operation	35,172	36,801	31,895	32,230	32,532
Minor Operation	1,22,433	1,28,104	1,43,700	1,60,855	1,85,251
Delivery	1,24,490	1,41,151	1,47,603	1,45,532	1,58,851
Lab Test	53,38,950	75,95,184	92,35,475	95,68,635	1,06,05,966

Performance of randomly selected CHCs using data from Health Management Information System (HMIS)[15] provisional data of 2020-21 is also studied. As per that, the number of patients who come to CHCs is quite significant. However patients treated for various specific conditions such as acute heart disease, stroke, mental illness, epilepsy, hepatitis etc are significantly less due to lack of specialists to treat these conditions.

Discussion

The analysis of factors affecting the distribution of the current specialist workforce in CHCs of Uttar Pradesh by Singh, A[6] revealed that the number of available specialists at a CHC is positively associated with the availability of residences for doctors and regular electricity supply, and negatively associated with CHC location and the distance of the CHC from the district headquarters. In order to improve the quality and spectrum of clinical services at CHCs, multipronged approach is required:

Solution: Use if IT interventions and Telemedicine to overcome critical specialists' gaps in CHCs:

In view of the shortage of specialists in CHCs in particular, the operationalization of efficient and comprehensive Electronic Health Record and Telemedicine will improve the scope and quality of treatment, also reducing referral travel times, out-of-pocket expenditure and possibility of cross infection. Telemedicine will bridge the service delivery gap. It is proposed to utilize Internet of Things i.e. combination of local servers, cloud computing, auto mails, auto SMS, audio and video transmissions, computerized radiography, telemedicine etc to provide a strong IT infrastructure in all CHCs of state.

Implementation of EHR, EMR and Telemedicine in CHCs:

- Comprehensive long term Electronic Health Record ad Electronic medical records will be operationalized.
- The numbers of outpatient cases are quite good in various CHCs even though there are no specialists. This implies that there is an existing unmet need for many these patients of expert opinion by specialists.
- Telemedicine treatment once available, more tribal and poor patients will resort to services of CHC, thereby reducing significantly their out-of-pocket expenditure for consultation at higher centres and eliminate travel time and hardship.
- There are no specialists hence medical care is rendered by medical officers. The quality of care can be improved by specialist consultation especially physician, paediatrician and ophthalmologist. Often there is tendency of relatives from interior rural areas that patient may be treated there and there only, whatever outcome since the relatives have to look after their livelihood, attending family and livestock. Patients will then be treated better, mortality rate will be reduced and referral rate will be reduced.
- No cases of mental illness are diagnosed and treated at the CHCs. Raising awareness in community about symptoms of mental illness, training of medical officers to suspect them and then diagnosis and tele-counselling with psychiatrist and appropriate treatment would be a major step forward by IT intervention for this totally neglected class of patients.
- With a good number of patients diagnosed with Diabetes and Hypertension, it is absolutely essential that they are examined periodically for retinal damages due to these disorders. A trained ophthalmic assistant with a basic portable fundus camera can take images of retina and send to ophthalmologist at a designated hub, thereby diagnosing patients through tele-ophthalmology.

Multi- directional Comprehensive IT based healthcare at CHCs:

Telemedicine Solution to address Specialists Services Gap at CHCs will be the most critical value addition to the services of CHC in view of vital specialists gap as per Figure 1.

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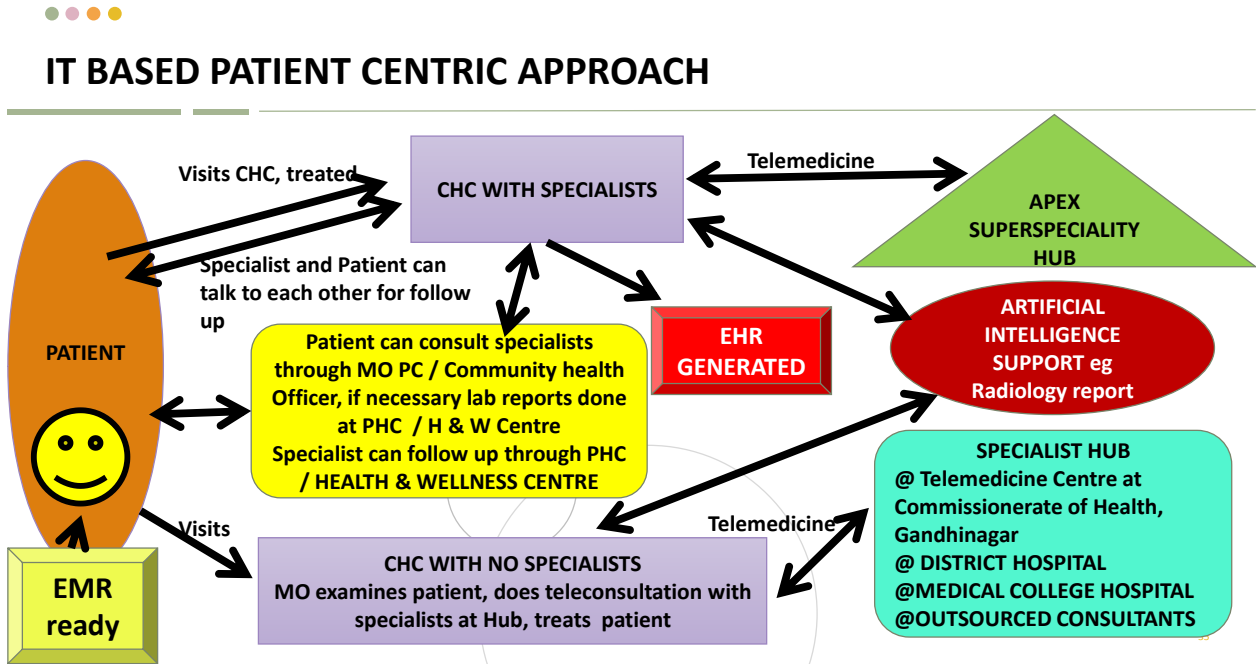
Figure 1: Multi- directional Comprehensive IT based healthcare at CHCs



- The gap in the mandatory specialist services can be partly overcome by consultation through specialists at Hub district hospitals / medical colleges through telemedicine.
- The mode of tele-consultation may range from simple phone calls, exchange of reports and prescriptions by e mails, video calls to complete Telemedicine software which is able to transmit EHR, live video inspection, live physiological parameters such as heart rate and rhythm, heart sounds, respiratory rate, SpO2, haemoglobin, blood sugar levels,, digital x-ray, pulmonary function, ECG, etc with attached sensing peripherals and tele-medicine cart.
- The consultant then can give advice to the medical officer of the CHC for the line of management which can be done at CHC, thus saving the physical and economic hardship of patients and relatives travelling to distant centre with specialists. The medical officer at CHC will dispense / prescribe medicines as advised by specialists at hub.
- CHC functions for fixed hours for OPD. But through simple tele-consultation, patient at odd hours can call and talk to CHC MO or specialist and get advice for medicine which he can get from nearby CHC or generic store.
- Medical officer at CHC can also telephonically talk to the Medical Officer of PHC or Community Health Officer of Health and Wellness centre where the patient resides for follow up and even conduct baseline investigations such as blood sugar and dispense medicines from their centre periodically without the need of patient to travel to CHC.
- Communications can also be done through Whats'App, SMS (eg. reminders), e-mail etc.
- Tertiary care centres are overloaded and end up providing Level II and lower level of care in addition to level III care. Managing patients at CHCs through telemedicine support will reduce the level II care burden on tertiary care centres. Moreover back-referrals of patients discharged from tertiary care centres will make follow ups possible at CHC level without need of patients travelling all the way upto tertiary healthcare centres. All these will lead to decongestion of tertiary centres enabling them to focus more on quality tertiary care as well as reduction in overloaded infrastructure.

Use of IT for Acute Coronary Disease: Tele-ECG:

- The posts of physicians are sanctioned in CHC, however, 97% posts are vacant in CHCs
- Patients often present with acute chest pain to CHC and it would be imperative to decide whether the chest pain of cardiac origin or other mimicking causes.
- ECG machines are present at all CHCs. These ECG on conventional paper may be photographed and sent to physician for immediate opinion by smart phones.
- Digital 12 lead ECG machines can be put in CHC which can transmit digital ECG for immediate opinion.
- The most common form is ST-elevation myocardial infarction (STEMI) in young adult which may be diagnosed by Tele-ECG and protocol based stabilization can be done immediately 24x7 and then patient transferred.

IT in Radiology Services in CHCs- Digital Radiography:

- Images may be captured on digital X-ray sensors and developed and printed digitally to give a standard high quality image. This reduces the quality concerns of X rays
- Conventional / digital plates may be scanned and sent by e-mail or dedicated software to radiologist in earmarked district hospital / medical college hospital / private provider without any limit of distance and reporting can be obtained 24x7 if such system of reporting is put in place.
- Dicom compliant CR system can be set up in CHC along with PACS (Picture Archiving & Communication System) which can directly transfer images to doctor's desk terminal in same CHC or at another radiologist node
- The digital X ray image will form a part of patient's EHR and can be stored, transported anywhere and retrieved anytime in future for comparison and continuity
- Photographs of plain Xray taken after mounting it on a viewer or a digital Xray can be sent by simple vehicle like Whatsapp or email to the treating doctor of CHC who may be at home during emergency hours or reporting Radiologist / other consultants for only reporting or as a part of teleconsultation .

Envisaged outcomes:

- Real-time data from OP clinics will enable timely alerts on outbreaks and Communicable diseases.
- Statistical reports from the Electronic Medical Records (EMR) will provide valuable data on Non Communicable diseases and enable State to proactively intervene to reduce the disease burden.
- Integration with other GoG / GoI applications, thus avoiding duplicate data entry

Key Beneficiaries: As seen in Figure 5 there will be multiple stakeholder beneficiaries-

- Patients - Continuity of Care, Quality of Care, reduced out-of-pocket expenditure, reduce travel time, ease to family members
- Clinicians - Easy availability of relevant data, Adoption of standards, on-line continuous medical education.
- Administrators - Better monitoring & streamlined management
- Policy makers – Availability of robust data for planning and achievement of Universal Health Coverage.

CONCLUSION

The present study has highlighted some critical issues related to the shortages and distributional inequalities of the specialist workforce in the state of Gujarat. Such an analysis could help policymakers decide upon the future roadmap to achieve maternal- and child-health-related and other sustainable development goals. The HR policies in the state should thus focus not only on recruiting more specialists, but also on finding innovative strategies. IT interventions hold a great

potential to improve quality of care, access and affordability in rural healthcare reducing out-of-pocket expenditure of patients. For patients it reduces travel time for access to specialist services. Use of IT interventions such as telemedicine will improve the quality of medicare in CHCs of Gujarat. The future of CHC services can be made brighter ensuring safety, security, equity and patient satisfaction giving more health for money. This will be a strong step towards National Digital Health Mission, Universal Health Care & SDG 3.

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ETHICAL APPROVAL: Not required

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