

## Original Research Article

# The impact of telemedicine services on primary health care - before and after analysis- Jharkhand digital dispensary model

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## ABSTRACT

**Background:** The service utilization at primary health cares (PHCs) by the rural population is challenging considering the lack of service availability and health care practitioners. Telemedicine and digitization of services have high potential to address the service provision gaps. Government of Jharkhand and Apollo tele health services-initiated PPP project to provide digital healthcare (digital dispensary) services at 100 rural PHCs in the state of Jharkhand.

**Methods:** The research study seeks to explore before and after impact of telemedicine services at the government run PHCs at Jharkhand. This retrospective analysis of health management information system (HMIS) and Jharkhand digital dispensary (JHDD) project data was performed for 19 PHCs out of 100 where JHDD project has been initiated. A pre-post study design was used to understand the impact of JHDD project implementation and uptake of outpatient department (OPD) utilization. The 19 centers were randomly selected using selective sampling, considering the data availability and travelling restrictions. Primary baseline data was analyzed in the excel sheet and secondary data- was entered, verified, and analyzed with statistical package for the social sciences (SPSS) version 25.

**Results:** Patients have to travel up to 75 kms to visit a doctor and avail health services. Medical officer was adequate, but not available for eight hours and every day. JHDD project data have highlighted the prevalence of NCDs in rural areas with significant increase in the diagnosis of diabetes and hypertension. The availability of general physician and specialist doctors virtually, with laboratory tests and medicines were the enabling factors in addressing the NCDs for the rural areas.

**Conclusions:** Telemedicine is strong enabler in addressing NCDs in remotest inaccessible areas. The study has pointed out the importance of available remote workforce, basic infrastructure and technology can strengthen the healthcare system by reaching the unreachable.

**Keywords:** Telemedicine services, PHC, JHDD

## INTRODUCTION

Jharkhand, essentially a rural state of India with population of 33 million, of which 26.2% of population belong to indigenous communities (scheduled tribes).<sup>1</sup> Jharkhand faces a significant shortfall in public health delivery services aggravated by a shortage of general physicians, specialist doctors and skilled auxiliary nurse midwives (ANMs). The lack of comprehensive health services at

rural areas force people either to remain untreated or seek treatment at tertiary health centers and private facilities, while incurring out of pocket expenses and added costs related to travel. According to the rural health statistics, 2018-2019 there was a 49.6% shortfall of general physicians, 30% ANM in primary health cares (PHCs) and 90.6% shortfall of specialist doctors in CHCs (GOI, 2015). Further, there is 72% shortage of functional PHCs in the state.<sup>2</sup> In Jharkhand, accessibility to health services is

inadequate for the rural population. The health indicators as compared to national average, is not satisfactory. Maternal mortality rate 71 and infant mortality rates 37.9 are the highest in the state.<sup>3,4</sup> Blood sugar levels high for 5.4% women and 6.9% for men and mildly elevated blood pressure for 11.1% women and 15.1% for men as per the limited available data.<sup>4</sup>

Further, the state of electricity study reports more than a third (34.55%) of PHCs in Jharkhand have no access to electricity at all and 23.64% PHCs have irregular power supply. This makes it further challenging to provide health services in rural areas. In the absence of regular electricity access in the PHCs, electricity backup is necessary for 24×7 availability of healthcare services and the functionality of medical equipment which incurs additional cost. Although the proportion of the PHCs with irregular or no electricity supply has reduced, much remains to be achieved.<sup>5</sup> Furthermore, for most people, access to medications continues to be a public health issue, and there are growing worries about disparities and inequalities.

PHCs is the first contact point between village community and the medical officer. The PHCs are envisaged to provide an integrated curative and preventive health care to the rural population with emphasis on preventive, curative and promotive aspects of healthcare. PHCs are not fully functional due to lack of infrastructure in Jharkhand. Further, the availability of doctors and skilled nurses is challenging in the rural areas.

Telemedicine and digitization of services have high potential to address the service provision gaps. The service provision of teleconsultation is addressing the scarcity of doctors at the rural PHCs and making health care services accessible. There is lack of evidence/research papers scientifically presenting the role of Telemedicine to fulfil health gaps of the rural population in India.

Government of Jharkhand and Apollo tele health services initiated public private partnership project to provide digital healthcare (digital dispensary) services at 100 rural PHCs in the state of Jharkhand. The centers offer services like, tele consultations with general practitioners, specialist doctors, with the support of trained ANMs physically located at PHCs. Complete digitalization of all data capture has been ensured and patient data is securely stored in cloud server. Internet and uninterrupted electric supply were the major barrier to provide services in the remote rural locations. On an average only 4 hours electricity is available in the centres. With the help of UPS and internet lease lines established along with dongles for backup, regular electricity and uninterrupted internet is ensured. Provision of pharmacy with 58 types of drugs is made available free of cost. Basic laboratory tests which include-malaria, dengue, typhoid, urine, hemoglobin and pregnancy tests are available. Point of care testing (POCT) devices are used for vital examination and diagnostic services.

## METHODS

The research study seeks to explore before and after impact of telemedicine services at the government run PHCs at Jharkhand. This retrospective analysis of health management information system (HMIS) and Jharkhand digital dispensary project data was performed for 19 PHCs out of 100 where JHDD project has been initiated.

HMIS data of 19 centers were analyzed during the timeframe of April 2018, to March 2019, with the break in pre- and post-implementation occurring in April 2019 to March 2020. Analysis was carried out to understand the service accessibility proportion of uptake of OPD service before and after implementation of digital health services at 19 primary health centers. The Apollo Institute of Medical Sciences and Research, ethics committee granted ethical approval for the study (letter no. letter no AIMSIRB/RC2020/10/003-dated 2/11/2020). The 19 centers were purposefully selected out of 100 JHDD centers considering the data availability, travelling restrictions, manpower availability and budget. These centers were randomly selected using selective sampling.

### *Study design and data collection*

A pre-post study design was used to understand the impact of JHDD project implementation and uptake of OPD utilization of 9 parameters. The 9 parameters are from the HMIS data OPD section. The Primary baseline data of 19 centers were collected under the following intrinsic of distance, population coverage and doctors' availability and laboratory services. Before project implementation the data was collected during Jan 2019. The secondary data consisted of HMIS data (pre) from March 2018 to April 2019. Then the JHDD project was implemented. JHDD project data(post) from April 2019 to March 2020 of the 19 centers were analyzed. OPD data of the following diseases (9 parameters) were captured as available in HMIS- dental, acute heart disease, diabetes, epilepsy, hypertension, mental illness, ophthalmic, stroke and RTI/STI.

### *Data analysis*

Primary baseline data was analyzed in the excel sheet.

Secondary data- mean and standard errors of each dependent variable were obtained for the 12 months before and the 12 months after JHDD project. P values were obtained by comparing pre versus post and adjusting for number of OPD visits for each parameter. Any p value <0.05 was considered statistically significant. Data was entered, verified, and analyzed with statistical package for the social sciences (SPSS) version 25.

## RESULTS

The results were discussed under two sections primary baseline data and secondary data analysis.

**Primary baseline data**

The 19 PHCs represented 8 districts from across the state (Table 1). Almost 50% PHC were covering 10000 to 50000 population in their catchment area. Distance to tertiary care hospital (district hospital) from the PHCs is very far. Patients from 8 PHCs have to travel 26 to 50 kms and as far as up to 75 kms from 8 PHCs to visit a doctor and avail health services (Table 2). Distance was a major barrier to avail the health services.

**Table 1: District and intervention PHCs details.**

Name of district	Name of PHC/JHDD center
<b>Dumka</b>	AAMJORA
	Aasanbani
<b>Hazaribagh</b>	Champadih
	Badam
	Charhi
	Daru
	Bankharo
	Pabiya
<b>Jamtara</b>	Anandpur
	Jarikela
	Kharimati
	Sindurgori
	Galudih
	Belajuri
<b>Ranchi</b>	Rahe
	Thakurgaon
<b>Saraikela</b>	Tiruldih
	Chaliyama
	Bansjor

**Table 2: Population and distance coverage.**

Population catered to (nos.) i.e. catchment population	Numbers of PHCs
<b>Population coverage</b>	
<2500	4
2500-4999	2
5000-9999	2
10000-19999	6
20000-49999	3
>50000	2
<b>Distance coverage (PHC distance to DH (kms))</b>	
<25	3
26-50	8
51-75	8

Medical officer was adequate in 17 centers as per the sanctioned positions for the centers. But the doctors are not available for eight hours and every day. There availability was limited. 2 centers had inadequate medical officer to provide health services to the patient. Specialist physician was inadequate in all the centers.

In the laboratory tests section, only 5 centers had all the 7 tests available. Pregnancy test was available in 5 centers and typhoid in 8 centers only. Hemoglobin test was also available in 14 centers only (Table 3).

**Table 3: Availability of lab tests.**

Tests name	Availability of lab test at PHC (N=19)
<b>Malaria test</b>	19
<b>Hemoglobin test</b>	14
<b>Blood glucose</b>	11
<b>Urine analysis</b>	11
<b>Typhoid test</b>	8
<b>Pregnancy test</b>	5
<b>Dengue test</b>	13

**Secondary data analysis**

In JHDD project total 1,75,189 unique patients registered and total 3,07,61 teleconsultations were provided from April 2019 to March 2020. 60.1% female and 39.9% male patients availed the services from JHDD center out of which 13% children and 14% elder population benefitted from the services.

Table 4 and 5 shows the results of the data analysis of the diagnosis from 19 centers from April 2018 to March 2019. The observation of our study covers 24 months (12 months pre and 12 months post). Table 4 reported the numbers of diagnosis from the 19 centers. After implementation of JHDD project there is not much difference in diagnosis of dental and stroke conditions but increase in all other conditions.

**Table 4: Comparison of number of diagnoses.**

Parameters	Baseline (n-429)	JHDD (n-1772)
<b>Dental</b>	120	125
<b>Acute heart diseases</b>	1	7
<b>Diabetes-</b>	61	492
<b>Epilepsy</b>	22	12
<b>Hypertension</b>	175	983
<b>Mental illness</b>	0	4
<b>Ophthalmic related</b>	35	117
<b>Stroke</b>	7	5
<b>RTI/STI</b>	8	27

A total of 2201 diagnosis were reviewed and included in this analysis. Of this diagnosis 429 or 24.2% diagnosis was from HMIS (pre) before JHDD project implementation. During the project (post), 1772 diagnosis or 75.8% were made for the OPD data of the 9 parameters (Table 4).

The average volume significantly changed for diabetes and hypertension (p=0.001) (Table 5). Comparatively, diagnosis of epilepsy (p=0.469), stroke (p=0.805), dental

conditions ( $p=0.934$ ), acute heart disease ( $p=0.30$ ), mental illness ( $p=0.104$ ), ophthalmic ( $p=0.015$ ) and RTI/STI

( $p=0.070$ ) were not significantly different from pre to post implementation.

**Table 5: Details of variables.**

Variables	Mean (standard error)		Mean difference	P value
	Pre	Post		
Dental conditions	6.32 (2.971)	6.58 (0.928)	-2.63	0.934
Acute heart diseases	0.05 (0.053)	0.37 (0.137)	-0.316	0.030
Diabetes	3.21 (1.920)	25.89 (5.225)	-22.684	0.001
Epilepsy	1.16 (0.742)	0.63 (0.157)	0.526	0.469
Hypertension	9.21 (5.666)	51.74 (7.225)	-42.526	0.001
Mental illness	0.00 (0.000)	0.22 (0.129)	-0.222	0.104
Ophthalmic related	1.84 (0.893)	6.16 (1.248)	-4.316	0.015
Stroke	0.39 (0.389)	0.28 (0.177)	0.111	0.805
RTI/STI	0.42 (0.421)	1.42 (0.268)	-1.000	0.070

## DISCUSSION

The present study was conducted to investigate the impact of JHDD project implementation on PHCs. The implementation of this project has been most important considering the inaccessible rural areas and shortages of physicians in the state of Jharkhand. Various studies have shown telemedicine is effective in reaching out to rural population.<sup>6</sup> Several studies have highlighted patient satisfaction with telemedicine.<sup>7</sup>

The base line data shows that the tertiary care hospitals from the PHCs are as far as 75 kms. Further, the inadequacy of general and specialist physicians in PHCs have highlighted the healthcare inaccessibility of the local population (Table 2). The shortages of lab tests in the PHCs contributed to delay in diagnosis of basic health condition. There are no similar studies describing the impact of telemedicine on health outcomes in Jharkhand.

The implementation of JHDD project has been one of the most important initiatives taken by government of Jharkhand considering the health service delivery shortages in rural areas.

Individuals known to have diabetes represent the tip of the iceberg, as an equal or even larger number of patients have undiagnosed diabetes.<sup>8</sup> In addition, these individuals are at increased risk for developing complications due to diabetes. A systematic review and meta-analysis of 142 studies on prevalence, awareness and control of hypertension in India published between 1950 and 2013 showed that only 25 percent of rural and 42 per cent of urban Indians were aware of their hypertension status.<sup>9</sup>

The JHDD project data have highlighted the prevalence of NCDs in rural areas and the service utilization by the population. Table 4 shows that there is significant and strong increase in the diagnosis of diabetes and hypertension in the JHDD center. The availability of general physician and specialist doctors with laboratory

tests and medicines were the enabling factors in addressing the NCDs for the rural deprived areas.

## CONCLUSION

The findings from the study shows that, after the JHDD project implementation, access to healthcare services have increased the diagnosis of NCDs in rural areas of Jharkhand. The JHDD project have highlighted the importance of telemedicine in identification and screening of NCD conditions- diabetes and hypertension which is contributing towards disease burden in Jharkhand. It implies that telemedicine is strong enabler in addressing NCDs in remotest inaccessible areas. The study has pointed out the importance of available workforce, basic infrastructure and technology that can strengthen the healthcare system by reaching the unreached. Health policy practitioners- and healthcare workers should consider the importance of telemedicine or remote health in overcoming the barriers in providing health services in the remotest villages of Jharkhand.

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