IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Utilization Of Digital Health Tools For Comprehensive Primary Healthcare: A Situational Analysis Of Uttar Pradesh And Andhra Pradesh, India

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Abstract

A key pillar of Ayushman Bharat is to roll out Comprehensive Primary Health Care (CPHC) by establishing Health and Wellness Centers (HWCs) in the country. The use of digital tools in health services have an enormous potential for improving quality and delivery of primary healthcare. This study aims to investigate the role of digital health tools underlying health system dimensions including health care delivery for Comprehensive Primary Health Care in the states of Uttar Pradesh (UP) and Andhra Pradesh (AP), India. Besides, it explores perceptions of health care providers and beneficiaries on use of digital health tools and to recommended potential solutions for program interventions and integration of Information and Communications Technology (ICT) tools from cross learnings in the study states. A cross-sectional study using a mixed methodology approach has been adopted. Evidence from the field revealed that for delivery of Reproductive, Maternal, Newborn, Child and Adolescent Health services at HWCs, mobiles phones and mobile applications are being used in UP and AP. Nikshay (TB portal) is being used for Tuberculosis both UP and AP. For Non-Communicable Diseases (NCDs), NCD app is being used in UP, while in AP the Mahila Master Health Checkup and the Male Master Health Checkup portal is being used. Service Providers opined that digital health tools are convenient to record and store information, and reduces paperwork load. It can be concluded that there is a need for an integrated system that covers all essential services at HWCs. The study recommends to address gaps in the deployment of digital tools, enhance digital literacy, build capacities of healthcare workers to use digital health tools, promote use of digital tools by the community, enhance e-health tools for supply chain management and promote digital health tools with provision of offline data entry at HWCs.

Key Words: Digital Health Tools, Comprehensive Primary Health Care, mobile phones, ICT, Health and Wellness Centre

Introduction

A key pillar of Ayushman Bharat is to roll out Comprehensive Primary Health Care (CPHC) by establishing Health and Wellness Centers (HWCs) in the country. In Feb 2018, Government of India announced creation of 150,000 HWCs by transforming existing sub-centers (SCs) and primary health care centers (PHCs) by the year 2022 to provide an essential package of 12 services*[1]. The principle behind providing these essential package of services is to bring "time to care" to not more than 30 minutes (NHSRC 2018) [1]. The use of digital tools in health services have an enormous potential for improving quality and delivery of primary healthcare. Available literature suggests, use of mhealth for improved knowledge and skills related to maternal and child health for Accredited Social Health Activists' (ASHAs) in tribal areas of Gujarat (Shah et al.,2018)[2] and under the National Health Mission (NHM (Chib et al. 2012)[3] ; telemedicine for healthcare delivery in underserved rural areas (Mathur et al., 2017)[4] ; and smartphone usage for improved coordination, confidence and performance levels among the front-line workers and impact on beneficiary health behavior in Saharsa, Bihar (Borkum et.al., 2015)[5]. mHealth interventions have also enhanced uptake of iron and folic acid supplementation and self-reporting of pregnancy and delivery related complications in Uttar Pradesh (Prinja et al. 2017)[6]. In July, 2018, NITI Aayog proposed a visionary digital framework, "National Health Stack" aiming to create digital health records for citizens of India by the year 2022 (NITI Aayog 2018b)[7]. In line with this, an Information Technology (IT) System interoperable at the national and state level is also envisioned at the HWCs (NHSRC 2018)[1].

Objectives

The objectives of this study are: (i) to assess the status of Information and Communications Technology (ICT) tools underlying health system components involving RMNCH+A, CDs and NCDs services in Health and Wellness Centres in Uttar Pradesh and Andhra Pradesh, India; (ii) to explore the perceptions of health workers and beneficiaries related to the usage of digital health tools for the RMNCH+A, CDs and NCDs services in Health and Wellness Centres in Uttar Pradesh and Andhra Pradesh, India and (iii) to suggest/recommend potential solutions for program intervention and integration of ICT tools from cross learnings in the study states.

* : Care in Pregnancy and Child-birth, Neonatal and Infant Health Care Services, Childhood and Adolescent Health Care Services, Family Planning, Contraceptive Services and other Reproductive Health Care Services, Management of Communicable Diseases: National Health Programs, General Out-patient Care for Acute Simple Illnesses and Minor Ailments, Screening, Prevention, Control and Management of Non-communicable Diseases, Care for Common Ophthalmic and ENT Problems, Basic Oral Health Care, Elderly and Palliative Health Care Services, Emergency Medical Services including Burns and Trauma & Screening and Basic Management of Mental Health Ailments

Materials and Methods

Study design & Tools

A cross-sectional mixed methodology approach was adopted. Four sets of tools were used to capture information from target respondents identified for the study. For assessment of HWCs with regard to infrastructure, human resources, trainings and availability and use of digital health tools, a structured questionnaire was administered to the facility in charges. Aside, a qualitative in-depth interview tool was used to gain further insights on the availability and usage of digital health tools which was canvased to HWC in charges and to the nodal officers in charge of the program at the state and district level. A third qualitative open-ended questionnaire was administered to front line workers – ASHAs/ANMs (Auxiliary Nurse Midwife) to capture their views on the availability and use of digital health tools. To capture information from beneficiaries on their knowledge, awareness and use of digital health tools, a Focus Group Discussion (FGD) tool was administered to beneficiaries who utilized services from the HWCs. The tools were pretested and necessary modifications made prior to actual data collection.

Ethical approval

The present study was approved by the Institutional Review Board of the Public Health Foundation of India, Delhi (Ref: TRC-IEC 414/19). Formal approvals were obtained from the respective state governments. Written consent was obtained from each of the study participants and they were assured about the confidentiality of the information provided by them. The language of interaction with the participants was either English or the local language. Approval for audio recordings of interviews was sought separately in addition to the consent taken.

Study Location, Sampling Methodology & Sample Size

The study was carried out in two states: Uttar Pradesh (UP) and Andhra Pradesh (AP). From UP, two districts namely Meerut and Shrawasti and from AP, two districts i.e., Kurnool and Visakhapatnam were selected. Districts were selected based on geographic spread and socio-economic criteria including health outcome indicators, per capita GSDP, distance from the capital, etc. Based on the list of HWCs obtained from the selected districts, HWCs were chosen from each of the blocks based on the geographical spread within the district and in consultation with the district authorities.

A total of 60 facilities, i.e., 30 from each state was selected. The list of sampled facilities was finalized in consultation with the district level officials to ensure that only functional facilities were selected for the study. In all, from both the states, 60 facility assessments;65 In-depth Interviews with Facility In charge (comprising of medical officers (MOs), Mid-Level Health providers (MLHPs), Community Health Officers (CHOs), staff nurses and state and district nodal officers);32 In depth interviews with frontline workers including ANMs and ASHAs; and 14 FGDs with beneficiaries who availed services from the HWCs were done.

Results

It is to be noted that in this paper, the terms ICT and Digital Health (DH) tools are being used interchangeably and covers both hardware solutions like mobile phone (keypad phone or smart phone), tablet, Personal Digital Assistant (PDA), computer (desktop/laptop) etc. and software solutions like Email, Short Message Service (SMS), Phone Call, WhatsApp, Skype, Zoom, patient portals, telemedicine software, Electronic Health Record (EHR), Global Positioning System (GPS), etc.

Though electricity connection was available in majority of the facilities in both the states, only one third of the facilities in AP and half the facilities in UP had power backup. Landline phones were almost not available. Internet connectivity was by and large available in most of the HWCs (either official or in most cases, personal on the mobile phone), but less than half of the facilities had good internet speed. None of the HWCs had a helpline/toll free number (Annexure Table1). At the health facilities, 24X7 delivery services were provided in 20 per cent of the HWCs in UP and 37 per cent of HWCs in AP. Most facilities provided RMNCH+A services. Less than 75 per cent of the HWCs provided services for communicable diseases in UP as against 97 per cent in AP. Similarly, screening for NCDs is almost universal (Annexure Table 2). Generally, patients visited HWCs for NCD screening, obtaining medicines, BP/Sugar tests, maternal and child health services or for treatment of minor ailments either for themselves or for their children.

Availability and Usage of Digital Health Tools at HWCs: Perceptions of Service Providers

Personal mobile phones i.e., a smartphone was available with all CHOs in UP and MLHPs in AP posted at SC-HWCs and was extensively used for both official and personal purposes. In UP, all CHOs were provided with an official tablet, however, in AP except MLHPs posted at e-subcentres, none were provided with an official tablet. The only digital tool used for service provision by MLHPs posted at non e-subcentre HWCs were personal mobiles which they extensively used for calling and all other purposes including uploading their daily OPD reports. ANMs, on the other hand, were provided with a tablet.

Commonly used Apps on the phone are WhatsApp, Internet, mails, YouTube and Facebook. SMS is less frequently used. For work related/official purposes, WhatsApp is widely used. HWC portal and NCD App are used in UP while in AP, MMHC (Mahila Master Health Checkup/Male Master Health Checkup) and HWC portal are used. The NCD App is a screening tool under the NCD program to screen men and women over 30 years of age for Diabetes, Hypertension and 3 cancers – Breast, Cervix and Oral. In UP, monthly video conferencing is done using Zoom for CHOs with state officials mainly for training purposes.

Unlike SC-HWCs, all PHC-HWCs have been provided with a desktop. However, in some facilities in UP especially in Meerut, it was observed that though official desktops were provided, they were not being used for safety reasons. Daily and monthly reports are uploaded by the MOs from their mobile phones. Mobile phones are also used by few MOs for following up with their patients, patient tracking, discussion on medication with fellow colleagues, referrals and for health education. Training materials are also shared through WhatsApp. In most PHCs, manual records are maintained and only the daily NCD information is shared through WhatsApp or uploaded by some CHOs using the ID and password of the concerned PHC.

In UP, however, some of the MOs were not too comfortable in using the computer and were of the opinion that a data entry operator ought to be posted for data entry and management. *"I had requested for a laptop. A laptop is better for security purposes, as we can carry it with us. Desktop cannot be left behind in the PHC as it is not safe"* - MO, PHC UP. In AP, unlike UP in PHC-HWCs, desktops are available and used extensively for sending Daily and Monthly Reports and for medicine intending using e-Aushadhi, uploading CBAC forms, entering beneficiary details for PMMVY and JSY. Laptops were also available in some PHC-HWCs. ANMs in the state have been provided with tablets. The desktop is also used for teleconsultations in facilities where teleconsultation services are being provided. Teleconsultation services are being provided in most PHC-HWCs in Visakhapatnam district, but in Kurnool it has been initiated only in selected facilities since October, 2019 only. Videoconferencing was not commonly held in AP. Health providers mentioned that they participated in videoconferencing only during epidemics, disasters like cyclones, floods at MDO/MRO office with District collectors, DMHO and state-level officials. Teleconferencing is also done occasionally with DMHO mainly for review purposes. Sometimes, MOs mentioned using mobile phones for accessing RCH PORTAL, E-VIN, PMMVY and NIKSHAY. Patient follow up is also done at PHCs using landline phones.

Internet connection is available; however, connectivity depends on the location of the facility. Connectivity issues have been reported by most facilities. In Meerut and Shrawasti, UP, CHOs in most cases are reimbursed for their mobile and data usage. However, in facilities where telemedicine is available under public private partnership (PPP) mode, expenses for data usage are borne by an externally agency namely WISH Foundation. PHC-HWC MOs, in UP, on the other hand, are not reimbursed for their mobile and internet usage. *"Internet connectivity is a major problem. It is almost impossible to download" – MO, UP*. In AP, neither MLPHs, ASHAs nor Medical Officers are reimbursed for their mobile and data usage. In AP, the official computers/laptops provided to the facility have internet connection and the internet charges are borne by the government.

Use of Digital Tools for Health Care Delivery

Patient Registration and Record Maintenance

Population enumeration was carried out manually in more than 80 per cent of the HWCs in UP and in all facilities in AP. Electronic registration of patients varied from about 30 per cent in AP to 50 per cent in UP (all NCD patients in UP are electronically registered). Electronic patient calling systems was almost non-existent. More than half the patients were tracked electronically through phone calls. Electronic patient profile records were maintained only for NCD patients for future follow up and reference (Annexure Table 3). Patient reports and diagnostic reports are not shared online in both the states. In AP, at PHC-HWCs, patients are registered manually and also in e-Aushadhi. According to an MO from Visakhapatnam, *"If patients request us to share Patient reports and diagnostic reports online, we share them in such cases using WhatsApp or through emails."* Many of the health providers felt that it was better to register patients digitally as details of the patients can be captured and stored permanently and reduces workload. However, most MOs in UP felt the need for an additional staff to manage data entry work.

Patient Tracking and Adherence

By and large, no digital tools were used for tracking patients at SC-HWCs in UP and AP. In the case of TB, in both the states, some of the CHOs/MLHPs/MOs mentioned using mobile phones to track/follow-up with their patients. PHC-HWC facilities in Meerut, UP and AP mentioned use of mHealth applications to remind TB patients. SMS alerts were also being sent to TB patients in AP and followed up telephonically. 99DOTS was reported to be used in some PHCs in AP. On enquiring about motivating patients on the use of digital health tools, most CHOs/MLHPs/MOs mentioned that they do not really motivate patients to use digital tools "as patients are not so literate, and many do not have mobile phones."

Clinical Decision Making

For clinical decision-making purposes including obtaining knowledge for diagnostics, apps such as Google App/internet or You tube and Wikipedia were reported to be frequently used. Some of them also mentioned using Skype calls or WhatsApp to connect with their friends/colleagues for discussions on medicines, referrals and clinical decision making. In Visakhapatnam, AP, MLHPs and MOs mentioned use of Teleconsultations/Telemedicine for clinical decision making.

Use of Digital Tools for Health Systems Support

Supply Chain Management

Availability of online procurement and supplies management system was higher in AP (47%) as compared to UP (7%). Electronic systems for drug intending were completely unavailable in UP as compared to AP (47%). Electronic systems for dispensing of medicines varied from 7 per cent in UP to 13 per cent in AP. No electronic systems for record keeping of medicines ordered, dispensed and stocked existed in HWCs in UP, while 60 per cent of the HWCs in AP had an e-system in place for the same. Drugs and Vaccine Management System (DVMS) and Electronic Alerts for ILR/Deep Freezer were non-existent in HWCs in UP, while slightly less than half the facilities in AP had such systems in place at HWC. "*For keeping records of pharmacy on medicines dispenses, ordered, stocks etc., until now it is being done manually. But recently we have been told that DVDMS App needs to be used- MO, UP.* " In Kurnool, AP, manual records of the medicines with details of stock, dispensed are maintained at the facility. In PHC-HWCs, records of medicines dispensed, ordered and stock details at the facility are manually maintained on registers and also entered in-eAushadhi. For vaccine management system, "e-VIN (Electronic Vaccine Intelligence Network) is used. Medicines are indented online using e-Aushadhi. e-subcentres in Visakhapatnam.

Human Resources and Financial Management

Slightly more than 10 per cent of the HWCs in AP and less than 5 per cent in UP had online systems for Human Resources (HR) and use of Human Resource Management Systems (HRMS). Online electronic performance review for health workers was available in 20 per cent of HWCs in AP as compared to 3 per

cent in UP. More than half of the health care staff were trained on using ICT tools. However, use of ICT for training outreach staff was low in UP (less than 13 per cent) and higher in AP (37 per cent, Annexure Table 3). Electronic Financial Management Systems were available in less than 5 per cent of the facilities in UP and in more than a quarter of the HWCs in AP. No electronic processing of payments, tracking, monitoring, accounting, reconciliation and reporting of transactions were available at HWCs in UP while one third of the HWCs in AP used an e-system. All facilities reported that payments to beneficiaries for availing services were done electronically. In UP, most respondents mentioned that no electronic systems are being used to manage the HR and performance of staff, processing of payments, accounting and reporting of transitions though *Manav Sampada* existed in the state. Payments are processed only at the CHC level and above. Manual reporting formats are used for assessing Performance Based Incentives for ASHAs (PBI). However, few MOs mentioned "*regarding assessment of staff performance, since last year, all doctors had to submit details online through Manav Sampada."* However, it is interesting to note that many of the MOs interviewed did not seem to be aware of this nor did they mention this. In AP, MLHPs mentioned that there are no online management systems for human resources. However, at PHC-HWCs, in order to manage the human resources at the facility CFMS (Comprehensive financial management system) in which transfers, new appointments of the staff and salaries are managed. Performance of the ANMs were reviewed on the basis of reports uploaded on the RCH portal by assessing whether the given targets were met or not. ASHAs performance was assessed by using a manually filled in format which has a grading system and this was shared by their supervisors to the district officials via email.

Health Management Information System and Monitoring and Evaluation (M&E)

In UP, e-HMIS is operational at the CHC level and above only, while in AP it is operational at the PHC level onwards. HWC portal is used to upload the OPD information including Yoga sessions in both the states. In some of the PHCs, at times the information was shared telephonically and information entered at the district level. Some PHCs also mentioned that OPD information was sent to the CHCs via WhatsApp every month for uploading on the e-HMIS. More than one-thirds of the facilities in AP and only 13 percent of the facilities in UP used e-monitoring tools. e-monitoring for outreach activities, was used in only 7 per cent of the facilities in UP and 23 per cent of the facilities in AP. (Annexure Table 3). Some CHOs in UP mentioned that "Location App is installed and available on the Tablet, so once the CHO signs in the location are automatically tracked." Monthly performance reports are being sent to the Additional District Medical Health Officer and the District Leprosy Officer in the district who are in charge of the HWCs via emails in Kurnool.

Information Education and Communication and Outreach Activities

For Information, Education and Communication, no specific digital health tools are being used in UP and AP. At HWCs, hardcopies of IEC materials in the form of posters, banners, handbills etc. are being used. ASHAs have not been provided with any ICT tools for outreach work but ANMs have been provided with a tablet. Few CHOs in Meerut mentioned the use of short videos on immunization, videos on NCDs such as hypertension and diabetes are shown at Village Health and Nutrition Days (VHNDs) and also during the "AAA" meetings. In AP some of the MLHPs mentioned screening videos on Menstrual Hygiene to adolescent girls in schools. Some of them also mentioned sharing of disease-related information to the patients through WhatsApp. One MLHP from Visakhapatnam, AP said *"I browse through the internet for health-related information and images from my mobile and then take print outs of relevant materials from the internet café and use it for IEC".* Some of the MLHPs mentioned using tablets and projector at the facility, for community outreach activities and school health activities to screen health-related videos, on the Mobile Sanchara (104 ambulances) etc. Many health care providers were of the opinion that people comprehend better when visual media is used.

ICT Tools for Delivery of RMNCH, Communicable and Non-Communicable Diseases

In both Meerut and Shrawasti districts of UP, in most of the sampled facilities, ICT tools for the delivery of RMNCH+A, TB and other communicable diseases are limited in use. Use of Nikshay for online TB notification and TB patient management and monitoring was used in 7 and 40 per cent of facilities respectively in UP and AP. Mobile health applications to remind TB patients on drug adherence and follow up and to remind beneficiaries to visit facilities for ANC, PNC and Child Care was used in only 3 percent of

the facilities in UP and 60 per cent of the facilities in AP. Follow up of the TB patients were mostly done by the ASHAs either through home visits or telephonically. mhealth application to remind TB patients was being used only at the CHC level in UP and in AP and Nikshay is used at PHC and above levels. In some facilities in Visakhapatnam, SMS alerts are also being sent to TB patients. More than 85 per cent of the facilities in AP used MCTS as compared to less than 25 per cent of the facilities in UP. Digital tools for screening and management for NCDs were available in two-thirds of the facilities in UP and more than half of the facilities in AP. e-HMIS was used in less than 10 percent of facilities in UP and in more than one-thirds of the facilities in AP. Provision of online diagnostic reports was available only in one facility each in UP and AP. None of the ASHAs in UP and AP used digital tools for capturing health care data (Annexure Table 3). ANMOL App for RCH has just been initiated, and training was provided to the ANMs a week prior to our study in UP. In AP, for all RCH programs, the RCH portal is being used. For NCDs, NCD App is used in UP and MMHC portal is AP.

Teleconsultations/e consultations/Telemedicine

In Meerut teleconsultations/telemedicine have just been initiated and a one-day training was organized at the CMO office on the 27th of January, 2020. Hence, as per the results that emerged from the first phase of the study, most of the CHOs and MOs have never participated in any tele/e consultations. Service providers were, however, of the opinion that "*E consultations are required in certain cases where in consultations with specialists or senior doctors at district level are required. The reason being senior doctors can be more convincing."* In Shrawasti, Telemedicine services were available in HWCs as a pilot in Sirsiya block supported by the WISH Foundation, under Public Private Partnership, and Mahatma Gandhi Medical College, Jaipur serves as the hub. Shortage of drugs was an issue in Sirsiya. Many a times, patients have to wait at the facility for 2-3 hours to connect to the doctor due to poor network issues or have to visit the facility several times. Hence, this is not "*really successful" as per some of the CHOs. If all norms/criteria including medicines and investigations/diagnostics are fulfilled, then it would run well and will be a success."* The only benefit is that check-up is done more comprehensively. Patients still need to go to CHC/DH for investigations. *So, what is the use? Medicines have always been in short supply- even simple medicines such as PCM etc. "Screening and OPD are supposed to be done electronically however, it is not done as connectivity is an issue."* In the other study blocks, CHOs have not participated in teleconsultations nor received trainings. One of the CHOs from Sirsiya block said *"Previously the patient load was quite high and there were up to 50 patients per month but now it has come down, there are just 5 consultations in this month so far." "Medicines are not available as per the recommendations. If there is no network, details can't be saved and information is lost if it does not get saved."* The process becomes a lengthy and time consuming in case of network issues. "If network is good, waiting time is only about 15 minutes." Another CHO mentioned *"e-consultations are very useful as facility is available in the village itself, patients are attracted by Telemedicine and patients also benefit as they save money on doctors' fees, travel and medicines".* In Visakhapatnam district, AP out of the 236 PHCs, 50 PHCs have telemedicine/ e-sanjeevani facility and the hub is at Andhra Medical college. At the hub services are provided by a team of doctors comprising of a Pediatrician, Gynecologist, General Medicine and 2 Medical Officers. Most MLHPs in Visakhapatnam felt that telemedicine is useful. In Kurnool, telemedicine has not yet been initiated, but, MOs and Staff Nurses from PHCs were trained during the second week of November 2019 (a week before the initiation of our study). However, issues of network persist and it takes about 30-40 minutes per patient for e-consultation if connectivity is poor. As a result, patients are reluctant to wait for long. According to MLHPs from Visakhapatnam e-consultations are useful. *"We can just give primary care but because of e-consultation patients can get advice and suggestions from a specialist". "Elderly people and patients who are unable to travel could get treatment through telemedicine."*

Training on Digital Health Tools

Training on digital health tools in UP were provided to CHOs and ANMs. A three-day training on NCD App was conducted at the district level for all CHOs. ANMs were provided with a two-day training on the use of tablets when tablets were issued to them. This was followed by a two-day refresher training for ANMs. Besides, a one-day training on ANMOL App was provided to ANMs. However, ANMOL is not yet functional. Block Community Process Managers have been trained on using the RCH portal. ASHAs have not been provided with any training on digital health tools and CHOs and ANMs mentioned that they would be trained once they have been provided with a tablet. Medical Officers opined those trainings for ANMs of one- or two-days' duration are not sufficient; it should be at least of one-week duration to equip them in

using digital tools. *"Rigorous trainings for ANMs on use of ICT is essential as she is not mentally prepared to use it- MO, UP."* In AP, ANMs have received training on use of RCH portal, ANM DIGI, ANMOL, PMMVY, IHIP, IDSP and MMHC. Batch-wise trainings were conducted at the District Medical and Health Office. Trainings are being provided twice in a year. MLHPs in e-subcentres in Visakhapatnam were trained on use of tablets, Para Monitor and use of Drug Vending Machine. All MLHPs were trained on use of HWC portal. Pharmacists/ staff nurses were trained on HMIS, e-Aushadi and e-VIN. Medical officers were trained on HMIS, Telemedicine/e-Sangivini, IDSP and HWC.

Digital Health Tool Use among Frontline Workers

In UP and AP, majority of the ASHAs use keypad mobiles for both personal and official use and phones were by and large used for making calls. According to an ASHA Sangini from Meerut, UP *"First provide Smartphones to the ASHAs and then train them. It will help her to procure medicines and supplies easily. ASHAs could share the request details through WhatsApp and medicines could be delivered to her directly without her actually going to the CHC. "Communication* to ASHAs from their supervisors/CHO/MLHPS or ANMs is done through phone calls in most cases whether in UP or AP. ASHAs also communicated to their supervisor through phone calls. *"The educational level of ASHAs is low, they are only 8th pass and not able to grasp the message, so sending messages is not really useful, so I normally call the ASHAs"*. – CHO, UP. In AP too, details regarding monthly meetings or any other information are informed over the telephone by doctors and ANM to ASHAs. ASHA Sanginis/Supervisors have smart phones and they frequently use WhatsApp in UP and AP. ANMs have been provided with an official tablet, however, recently, the tablets provided to ANMs in AP have been withdrawn by the government because of persistent problems. ANM DIGI for MCH services including ANC, delivery and PNC was earlier used and this has now been replaced by the RCH portal. An ANM from Visakhapatnam said - *"Because of frequent change of apps we are confused, unable to do work effectively, only one updated App should be provided".*

ANMs in UP are expected to enter and upload the Community Based Assessment Checklist (CBAC) form collected by the ASHAs on the tablet. However, many CHOs were of the opinion that ANMs were not able to use it in most instances and they were entering the data and uploading the same. However, some of the younger ANMs managed to use the tablets confidently. *"Recording data on tablet is comfortable, but, however, it takes a little more time. Since we have to fill up the forms manually on the hard copy as well as fill up the information on the tablet, the dual process is difficult."* Most of the ASHA especially the older ones in both UP and AP are not comfortable typing on the mobile, hence, messages are not sent/received on the mobile. *"I am not comfortable with typing on the mobile phone and use phone only for either calling or receiving phone calls."* – ASHA, UP; ASHA AP. Many ASHAs expressed their desire and willingness to learn to use tablets/smartphones and use them for delivery of health care services. *"We are used to recording data on paper but if tablet/smart phones are provided it will be useful. We will learn to use it as our children and some of the family members are used to using smart phones and they can help and also teach us."*- ASHA, Meerut, UP.

ASHAs in UP and AP do not use any electronic tools for screening patients for chronic illnesses, NCDs, RMNCH+A and communicable diseases. Electronic tools are not used for providing health care information to beneficiaries nor for referring beneficiaries to health facilities. ASHAs do not send any SMS/alerts to remind patients for treatment. It is done mostly in person by the ASHAs and the ANMs through home visits. While screening for NCDs, the format is filled in manually and suspects are referred to the HWC. Only some of them use the phone to call patients occasionally. According to an ASHA from Kurnool, AP - *"the only electronic tool I use for health care delivery is the Keypad mobile phone which is being used for calling, reminding patients, informing about immunizations, vaccination etc., for the mother and the child."* In AP, most of the ASHAs mentioned that they did not store patient details and mobile numbers on their phone. All patient details including their contact numbers are noted in the dairy. Patients were tracked and followed up manually through home visits. Few ASHAs mentioned that they follow-up with patients over phone that too rarely only during emergencies. *"With the use of digital tools workload has increased, however, it is better as screening is comprehensive" – ANM, Meerut.*

Perceptions of Beneficiaries'

Awareness and Information on Electronic Health Tools

In UP awareness levels among the participants on electronic tools was fairly low. Only half of the respondents owned a mobile phone, male respondents were more likely than female respondents to own a mobile. Of those who owned mobile phones, the majority possessed a keypad mobile. In contrast, awareness on electronic tools among respondents from urban AP was high and most respondents owned mobile phones particularly the male respondents possessed smartphones. Very few respondents mentioned WhatsApp, Facebook, Audio Call/Video Call, Conferencing call using the mobile and use of the internet to search information. Mobile phones, however, were not used for obtaining information on health and none of the respondents reported receiving any health care messages on their phones. In contrast, respondents from Visakhapatnam were more informed and were aware of electronic tools being used at the health facility including Tele-medicines, Drug Vending Machines etc. One of the female respondents when asked whether she uses a smartphone, she mentioned *"I don't even know my number, if you want to see it is written here behind the phone"- (Respondent, UP). "Phones are used only for calling purposes".* Most of them were of the opinion that the phones were used only for communicating with others, i.e., mainly for talking. They did not use them for sending or receiving messages. Most respondents were of the opinion that "*phone calls are more useful than messages*."

"We are not aware of any electronic tools being used at the health facility" - (Respondents at HWCs, UP). None of the HWCs had electronic tools such as display in the waiting area, announcement of OPD number, lab procedures etc. Besides, none of the facilities provided a computer generated OPD slips nor print out of registration. OPD slips provided to them were handwritten.

Use of Electronic tools for Information Education and Communication

Most patients from Uttar Pradesh agreed that electronic tools such as mobiles, videos, short films etc., are good for communicating health information and messages. However, none of them had heard or seen electronic messages on health. They were of the opinion that no e-tools were used for health care communication purposes and that none of them had received any messages on health-related problems on their mobile. Respondents from one of the facilities from Visakhapatnam Andhra Pradesh mentioned that "*we are getting phone calls from the hospital and sometimes messages also regarding child health status and reminder for child immunization."*

Awareness on Government cash transfer schemes (e transfer/DBT) & utilization

Female respondents were by and large aware of government conditional cash transfer schemes i.e., mainly JSY for institutional deliveries and had received money electronically in their bank account in both states. Some of the respondents from Shrawasti district mentioned that there were no delays in transfer and the transfer was done immediately. According to one of the respondents from UP, *"If government hospitals have such services and the government is providing money, we should use the services provided by the government".* However, regarding other cash transfer schemes awareness was quite low, in fact, one of female participants' – a TB patient said *"My account details have been taken and I will be receiving Rs. 500 every month, but haven't received it so far*".

Awareness, use and opinions about e-consultations/telemedicine

In Uttar Pradesh, majority of the patients were neither aware nor ever heard of e-consultations and telemedicine in both districts, except for patients from Sirsiya in Shravasti district where telemedicine facilities were available and services were being provided under PPP mode. Some of the participants from UP mentioned that "public needs to know about the various Apps being used. If they could discuss with a doctor about their health problems sitting here (at the HWC) it would be very beneficial and convenient". Many of the participants from Visakhapatnam district in AP were aware of telemedicine/teleconsultations and had sought telemedicine services mainly for NCDS i.e., mainly treatment for diabetes and they seemed happy with their experiences.

Respondents from Andhra Pradesh said – "if e-consultation or tele-consultations are provided in our facility we will definitely use that kind of services since doctors would prescribe new medicines and we can save our time and money as well as travel". In contrast, a respondent from Visakhapatnam, AP said "Tele medicines are useful only to take suggestions and seek clarifications for doubts as we are living in interior areas, we need Ambulances (108)". Another respondent said, "here some network issues are there, and also some of the people may not understand what the doctor is advising through tele-consultation because of lack of education among the patients ".

Recommendations and Discussions

Our study was conducted during the initial years of roll out of the scheme and hence, the findings pertain to challenges, barriers and realities faced during the early stages of implementation of the program. The study found that mobile phones were the most commonly used digital tool by healthcare providers. Barring ASHAs, all other service providers were using smartphones. WhatsApp is the most common mobile application used by most healthcare workers except ASHAs for uploading patient reports, sharing information, patient follow-up, group calls and chats, health awareness/education etc. ASHAs usually make phone calls through keypad phones to follow up with patients and interact with other HWC staff members. ASHAs were of the view that use of mobile phones makes their work easier and enable them to interact with the patients and other healthcare staff. They even expressed a desire to use smartphones or tablets if given adequate training to work more efficiently. Similar findings were reported from the study conducted by Chib et al. that the use of mobile phones improved the capability, networking skills, and level of knowledge of accredited social health activists (ASHA) working under National Health Mission (Chib et al. 2012)[3]. Our study also found ANMs to be quite active with the use of smartphones and WhatsApp. In fact, many of them were part of different WhatsApp Groups for information sharing purposes which helped them improve work coordination and efficiency. This again goes in line with finding from a study conducted by Borkum et al. which reported that smart phone based tool, Information Communication Technology Continuum of Care Services (ICT-CCS) have the potential to improve the performance, confidence of front-line workers and improve coordination among them (Borkum, Rotz, and Rangarajan 2015)[5]. The healthcare providers across all the study sites including the ones in rural, remote and tribal areas opined that telemedicine is a useful tool for healthcare delivery purposes especially for seeking specialist care. This is consistent with the finding from a study conducted by Mathur et al. which suggests that telemedicine is an effective tool for the delivery of healthcare services in the underserved rural and remote areas (Mathur et al. 2017)[4]. Our study also found that mHealth applications are useful in the delivery of RMNCH services. This is in line with the finding from a study conducted by Mahapatra and Sahoo that e-Mahtari, a mobile phone based intervention is beneficial for the delivery of maternal health services in the rural areas of Chhattisgarh (Mahapatra and Sahoo 2015)[8].

The study revealed some of the issues being faced by the healthcare staff related to the use of digital health tools. One of the major issues reported was about the poor internet connectivity which was prevalent across almost all the study sites, The most common technical problem reported with the use of tablets was that it hangs quite often. Also, healthcare workers expressed the need for high quality tablets. Further, the healthcare providers reported that there are a number of Apps capturing similar information which creates problems like duplication of efforts. Further, there has been frequent changes of data collection apps. Healthcare providers also reported issues related to insufficient training for using digital health tools. Some healthcare providers were of the view that digital health tools increase their work load.

Healthcare facilities in Andhra Pradesh are far more advanced in using digital health tools compared to Uttar Pradesh. Some of the e-health initiatives such as Telemedicine, e-subcentres, MAK centres, e-Aushadhi, e-VIN (Electronic Vaccine Intelligence Network), m-health applications, Drugs and Vaccine Management System (DVMS) and Online procurement and supplies management system are operational at a substantially mature level in Andhra Pradesh. To reach out to the unconnected, remote, hilly and tribal areas and reduce visits to quacks, remote diagnostics and telemedicine solutions as in the case of AP could be adopted by UP. Electronic Financial Management Systems, Human Resources Management System, electronic processing of payments, tracking, monitoring, accounting, reconciliation and reporting of transactions, have begun to operationalize in AP. Initial lessons from AP could be helpful for initiating and implementing such interventions in UP. The study also reveals a few lessons for Andhra Pradesh. Video conferencing through

Zoom conducted for training purposes in UP could be used for capacity building, review purposes and updating knowledge on newer programs etc., for health providers in AP. Deployment of tablets at SC-HWCs as in the case of UP for health care delivery could be adopted in AP.

Recommendations

Based on the findings that emerged from the study, we propose the following recommendations:

Address gaps in the deployment of digital health tools for healthcare

- There should be provision of digital tools like computer (desktop/laptop), tablets etc. at the HWCs to initiate transition from paper records to e-records. In HWCs where safety of desktop is a concern laptop may be provided.
- Digital tools like tablets and smart phones should be provided for outreach activities to reduce the work load of frontline healthcare workers.
- Measures should be taken to address issues related to internet connectivity particularly the speed of internet connection
- Use of digital health tools (software solutions) with the provision of offline data entry should be promoted. This will ensure data capturing in resource poor settings with intermittent power supply and internet connectivity.
- There should be provision of digital tools at the HWCs for patient registration, electronic patient calling system, electronic display of information like OPD number for patients etc.
- Establishing helpline/tollfree number in the HWCs would be helpful in the utilization of services at the HWCs by the beneficiaries

Capacity Building of Healthcare workers on the use of Digital Health Tools

- Refresher trainings should be provided periodically to ANMs on the use of tablet and healthcare apps to improve their work efficiency
- Arrangements for hands on training of ASHA workers on use of smart phones/tablet and mobile/tablet apps should be done
- Refresher training of MOs and other HWC staff on the use of web apps/mobile apps should be provided
- Supportive Supervision of healthcare workers for acceptance and use of healthcare apps should be done

Promote use of digital tools by the community for healthcare

- Efforts should be made to improve awareness among the community on the importance of digital health tools for healthcare purposes
- Promote use of mobile and related services like SMS, phone calls, mobile apps like WhatsApp, You tube, Google apps etc. by the community for health care purposes

Address Gaps in the deployment of Telemedicine facility

- One of the primary reasons for use of Teleconsultation is to reduce patient visits to quacks. Hence, remote diagnostics and telemedicine solutions need to be scaled up.
- There should be provision of telemedicine equipment at the HWCs: computer, telemedicine software installation (like e-sanjeevani) etc.

- Healthcare staff needs to be trained for providing telemedicine services to the community. Arrangements should also be done for refresher training at regular intervals.
- Measures should be taken to spread awareness and promote use of telemedicine facility by the community
- It is recommended to addressing issues related to internet connectivity for efficient utilization of telemedicine facility

Enhance Digital Literacy

- Enhance digital literacy among service providers especially the medical officers as they consider it an additional chore. This can be achieved through various measures like regular training, workshops, sharing of Standard Operating Procedures (SOPs), audio-visual aids etc.
- It is recommended to promote use of digital tools for health education and awareness among the community. Use of videos, short films, mass media technologies, mobile applications like WhatsApp, SMS etc. should be promoted for health education and awareness purposes.

Provision for Offline Data Entry, Open-Source Platforms and Maintenance

- To aid data capturing in resource poor settings with intermittent power supply and internet connectivity, Apps designed/used should allow offline data entry to automatically sync with the online system when an internet connection is available.
- Maintenance of hardware and software are essential. Call centres for addressing challenges of hardware and software need to be established.
- Design ICT Tools that are modular and flexible and encourage open- source platforms as there are frequent changes with regard to digitization by the center, newer services, indicators being added, constant changes in guidelines, variations in terms of health priorities in given contexts based on epidemiology, capacities of staff vary, program dynamics, periodic changes in system requirements etc.
- Digitalization of CBAC form should be done to improve the services. ASHAs will be provided with smartphones soon, but training them is a very challenging task. The population-based data could be uploaded on ASHA mobiles, who can then validate the data. Else, if ASHAs would have to feed the data by themselves, it would take a lot of time.

Enhance E-Systems for Supply Chain Management

- Medicine supply needs to be strengthened, if facilities have to be truly operational and beneficial and to attract and retain patients
- Promote e-systems for procurement, management and supply of drugs, consumables and vaccines
- DVDMS/e-Aushadhi and eVIN (Electronic Vaccine Intelligence Network) needs to be operationalized at the HWCs in UP to ensure that essential drugs and supplies are provisioned

Work towards integration of multiple similar e-platforms into single e-platform

- Existing multiple web or mobile applications capturing similar data add problems like duplication of data and efforts. It is recommended to integrate multiple e-platforms (web or mobile applications) into single e-platform to enhance the work efficiency of healthcare workers.

Limitations of the study

Several ongoing digital health initiatives are being implemented in various states across the country, however, the focus of this study is only to examine the various exiting digital health platforms for health service delivery in two states in India. Therefore, the study findings are not generalizable. The study does not attempt to assess the efficiency, effectiveness and cost effectiveness of existing digital health interventions. Additionally, our study was conducted during the initial years of roll out of the program and hence, the findings pertain to challenges, barriers and realities faced during the early stages of implementation of the program.

Conclusion

Though deficiencies exist in the current health care systems, the most pressing need is to shift from existing silos systems to a holistic and comprehensive health care system built on the latest digital architectures and technologies and elevate the existing systems from providing disparate electronic services to integrated digital services to improve efficiency in healthcare delivery, extend healthcare to rural areas and provide better quality services at low cost. However, multiple applications are currently available, and hence, there is a need for an integrated system that covers all essential services provided at primary health care level and also ensures sustainability. Nevertheless, while recognizing the innovative role digital health tools can play in health systems strengthening, it is also equally important to evaluate the contributing effects of digital health tools.

ANNEXURES: DESCRIPTIVE STATISTICS

Table: 1: General Information about the facilities

S. No	Description	Uttar Pradesh N = 30	Andhra Pradesh N = 30
1	Population covered (range, mean)	3540-43000 13924	2835-78030 26036
2	Population Enumeration –Digital (%)	16.7 (5)	0 (30)
3	OPD Patients (range, mean)	15-150 44	8-290 58
5	Power-cut in hours (range, mean)	2- 6 hours 10.3	0-2 hours 1.2
6	Power Back-up (%)	50 (15)	36.7 (11)
7	Availability of functional telephone (%)	3.3 (1)	3.3 (1)
8	Availability of functional computer/Tablet (%)	66.7 (20) Only Tablet 33.3 (10) Both	43.3 (13) Only Computer 10.3 (3) Only Tablet 3.1 (1) Both 43.3 (13) None
9	Availability of Internet Connectivity (%)	86.7 (26)	96.7 (29)
10	Good Internet speed (%)	40.0 (12)	30.0 (9)
11	Employees with mobile (range, mean)	6-21 11.3	2-91 14.6
12	Employees with smart phone (range, mean)	2-21 5.7	1-20 8.4
13	Availability of Toll-free helpline (%)	0 (30)	0 (30)

Table: 2: Availability of Services

S. No	Description	Uttar Pradesh N = 30	Andhra Pradesh N = 30
1	24 Hours Delivery service (%)	20.0 (6)	36.7 (11)
2	24 Hours Emergency service (%)	13.3 (4)	36.7 (11)
3	Care in Pregnancy and Child-birth (%)	83.3 (25)	96.7 (29)
4	Neonatal and Infant Health Care Services (%)	80.0 (24)	86.7 (26)
5	Childhood and Adolescent Health Care Services (%)	66.7 (20)	100 (30)
6	Family Planning, Contraceptive Services and other Reproductive Health Care Services (%)	70.0 (21)	90.0 (27)
7	Management of Communicable Diseases (%)	73.3 (22)	96.7 (29)
8	Screening, Prevention, Control and Management of Non-communicable Diseases (%)	96.7 (29)	100 (30)

Table: 3: Use of Digital Health Tools

S. No	Description	Uttar Pradesh N = 30	Andhra Pradesh N = 30
1. **Registration and record maintenance**			
1.1	Electronic registration (%)	56.7 (17)	30.0 (9)
1.2	Electronic OPD Patient call system (%)	3.3 (1)	0 (30)
1.3	e-tracking of registered patients (%)	60.0 (18)	53.3 (16)
1.4	e-records (%)	56.7 (17)	30.0 (9)
2. Drug records and dispensing			
2.1	Availability of online procurement management supply system (%)	6.7 (2)	46.7 (14)
2.2	Availability of e-system for indenting medicines (%)	0 (30)	46.7 (14)
2.3	Availability of e-system for dispensing medicines (%)	6.7 (2)	13.3 (4)
2.4	Availability of e-system for keeping record of medication dispensed, ordered and stock control (%)	0 (30)	60.0 (18)
2.5	Use of Drugs & Vaccine Distribution Management System (DVDMS) (%)	0 (30)	46.7 (14)
2.6	Availability of electronic alert system for ILR/Deep Freezer (%)	0 (30)	46.7 (14)
3. **Human Resources and Training**			
3.1	Availability of online HR System (%)	3.3 (1)	13.3 (4)
3.2	Use of Human Resource Management System (HRMS) (%)	0 (30)	13.3 (4)
3.3	Availability of online e-performance review System (%)	3.3 (1)	20.0 (6)
3.4	Use of ICT tools to provide training to healthcare staff (%)	53.3 (16)	63.3 (19)
3.5	Use of ICT tools to provide training to the outreach workers (%)	13.3 (4)	36.7 (11)

4. Finances			
4.1	Availability of electronic financial management system (%)	3.3 (1)	26.7 (8)
4.2	Availability of electronic processing of payments, tracking, monitoring, accounting, reconciliation and reporting of transactions at the facility (%)	0 (30)	33.3 (10)
4.3	Availability of electronic transfer of money to the beneficiaries availing services at the facility (%)	100 (30)	100 (30)
5. Delivery of RMNCH +A, CDs and NCDs services			
5.1	Use of "Nikshay" for online patient notification for TB (%)	6.7 (2)	40.0 (12)
5.2	Use of "Nikshay" for online patient management and monitoring of TB (%)	6.7 (2)	40.0 (12)
5.3	Use of m-health applications to remind TB patients on drug adherence and follow-up (%)	3.3 (1)	60.0 (18)
5.4	Use of m-health applications to remind patients to visit facility for ANC/PNC/Child care (%)	3.3 (1)	60.0 (18)
5.5	Use of "Mother and Child Tracking System (MCTS)" (%)	23.3 (7)	86.7 (26)
5.6	Use of "National Malaria Information System (NAMMIS)" (%)	3.3 (1)	33.3 (10)
5.7	Use of "Pregnancy Infant Cohort Monitoring & Evaluation (PICME)" system (%)	0 (30)	3.3 (1)
5.8	Use of "Digital Life Care" platform for screening and management of NCDs (%)	66.7 (20)	53.3 (16)
5.9	Use of "electronic Health Management Information System (e-HMIS)" (%)	6.7 (2)	36.7 (11)
5.10	Use of "Facility Based Newborn Care Database" (%)	3.3 (1)	10.0 (3)
5.11	Use of "M-Sehat" application (%)	0 (30)	0 (30)
5.12	Provision of online diagnostic reports (%)	3.3 (1)	3.3 (1)
5.13	Use of e-Health applications (messages/phone/calls/e-mail/mobile phone) for IEC activities (%)	3.3 (1)	56.7 (17)
5.14	Use of mobile/PDAs/Tablets by ASHA workers for capturing health care data (%)	0 (30)	0 (30)
5.15	Use of mobile by ASHA for health care communication (%)	33.3 (10)	70.0 (21)
5.16	Use of e-monitoring tools at the facility (%)	13.3 (4)	36.7 (11)
5.17	Use of e-monitoring tools for outreach activities (%)	6.7 (2)	23.3 (7)

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Acknowledgement: The authors wish to specially acknowledge the State level officials from Uttar Pradesh and Andhra Pradesh and District level officials from Meerut, Shrawasti, Kurnool and Vishakhapatnam for providing the necessary approvals and for their valuable support in carrying out this study. Our sincere thanks are also due to Mr. E. Ravikant and Ms. L. Sravani, Field Investigators for assisting us with field work and data entry for Andhra Pradesh and Mr. Rajeev Kumar, Sr. Research Fellow, for assisting us with the field work in Uttar Pradesh and data processing activities. Last but not the least, credit goes to all the respondents who spent their valuable time and responded with patience without any expectations from the study. Funding for this study has been obtained from The Energy and Resources Institute (TERI). PHFI would like to acknowledge this support.

Conflict of Interest: The authors declare that there is no potential conflict of interest concerning the research, authorship and/or publication of this article.