Internship Training

At

National Health Systems Resource Centre (NHSRC)

A study titled **"Exploring the barriers and enablers in using Digital Health Initiatives among Auxiliary Nurse-Midwives (ANMs) of Delhi"**

Submitted By:

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PG/20/116

Under the guidance of

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PGDM (Hospital & Health Management)

IIHMR DELHI 2020-22

International Institute of Health Management Research, New Delhi

National Health Systems Resource Centre
Technical Support institution with National Health Mission
Ministry of Health & Family Welfare, Government of India

F.No. NHSRC/Admin/Pers./N-0849-PS
Dated: 16th August 2022

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Dr. Priya Singh worked as an Intern in Human Resources for Health/ Health Policy and Integrated Planning Division in National Health Systems Resource Centre, New Delhi from 1st February 2022 to 31st July 2022.

We wish her success in all future endeavours.

Brig. Sanjay Baweja
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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Priya Singh,** a student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone her internship training at **National Health Systems Resource Centre** from **February 2022** to **June 2022.**

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements. I wish her all success in all her future endeavors.

Dr. Sumesh Kumar
Associate Dean
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Certificate of Approval

The following dissertation titled "**Exploring the enablers and barriers in using Digital health initiatives among ANMs of Delhi**" at "**NHSRC Delhi**" is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted. Dissertation Examination Committee for evaluation of dissertation.

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Name of the Organisation in Which Dissertation Has Been Completed: NHSRC

Area of Dissertation: Human Resources for Health and Health Policy

Attendance: 100%

Objectives achieved: Yes

Deliverables: Satisfactory

Strengths: Positive attitude towards work, Punctual and responsible intern

Suggestions for Improvement: -

Suggestions for Institute (course curriculum, industry interaction, placement, alumni): -

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Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Priya Singh,** a graduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. She is submitting this dissertation titled "**Exploring the barriers and enablers in using the Digital Health Initiatives among ANMs of Delhi**" in partial fulfillment of the requirements for the award of the **PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **Exploring the barriers and enablers in using the Digital Health Initiatives among ANMs of Delhi** and submitted by **Dr. Priya Singh,** Enrollment No. **PG/20/116** under the supervision of **Dr. Anandhi Ramachandran** for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from **March 2022** to **June 2022** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Dr. Priya Singh

PG/20/116

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Mentors in IIHMR, Delhi

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Table of Contents –

List of abbreviations:

S. No.	Abbreviations	Full Form
1.	ANC	Antenatal care
2.	ANM	Auxiliary Nurse-Midwife
3.	ANMOL	ANM- Online
4.	ASHA	Accredited Social Health Activist
5	CCH	Cold Chain Handler
6	CCP	Cold Chain Point
7.	CDEO	Computer Data Entry Operator
8.	DHI	Digital Health Initiatives
9.	EC	Eligible Couple
10.	e-VIN	Electronic Vaccine Intelligence Network
11.	FGD	Focused Group Discussion
12.	FP-LMIS	Family Planning- Logistic Management Information System
13.	HMIS	Health Management Information System
14.	HSC	Health Sub-center
15.	ICT	Information Communication Technology
16.	IDSP	Integrated Disease Surveillance Program
17.	IHIP	Integrated Health Information Platform
18.	IT	Information Technology
19.	MCD	Municipal Corporation of Delhi

20.	MCH	Mother and Child Healthcare
21.	MCTS	Mother and Child Tracking System
22.	m-Health	Mobile health
23.	MIS	Management Information System
24.	NRHM	National Rural Health Mission
25.	OCP	Oral contraceptive pill
26.	PHC	Primary Health Center
27.	PI	Personal Interviews
28.	PNC	Post-natal care
29.	RCH	Reproductive and Child Health
30.	WHO	World Health Organization

Introduction

Technology has been playing a crucial role in integration of the three components of healthcare -Health systems, Health providers and Patients, with e-Health gaining greater import and scope with time. The term digital health is rooted in e-Health and, is defined as “the use of information and communications technology (ICT) in support of health and health-related fields.” Mobile health (mHealth) is a subset of eHealth and is defined as “the use of mobile wireless technologies for health” (1)

There have been plenty of advancements in the last three decades regarding the use of ICT in the health sector. The early focus of using technology in the health sector was to monitor national health programmes and schemes like the Pulse Polio Programme and Universal immunization programme (2). The following years witnessed advancements in Health IT (Information Technology) sector including data and management information systems such as the Health Management Information System (HMIS) and e- Sanjeevani the government’s flagship telemedicine program. The Ministry of Health and Family Welfare (MoHFW) also set up a national telemedicine network, to use IT for surveillance and monitoring of the programs across India, use digital technology for capacity building and training, and deployment of IT tools for governance and information dissemination. (3)

In the initial years of its development, data in HMIS was entered in the portal after it was received from the states via mail. With the introduction of web-based technology, the portal allowed the data to flow from the facility level to the subdistrict, district, state, up to the national level. However, with the advent of sea of ICT initiatives brought its own challenges. With tons of data being generated via a variety of web portals, challenges of data redundancy have resulted from the fact that multiple portals collect and feed similar data. Currently, the multiple portals under Health IT are operating vertically, with limited interoperability or data sharing mechanisms. With the increasing scope of Health IT and m-health,

multiple portals have percolated from the National and State levels, till the very grassroots of our public health delivery system, i.e., our community health workers.

Auxiliary Nurse Midwives (ANMs) are a part of the community level health workers under the Indian public health system. They play a vital part in delivering primary health care especially in the rural and peripheral parts of the country. The main job responsibilities of ANMs include 1) maternal and child health, 2) family planning services, 3) health and nutrition education, 4) Preventing and managing communicable and non-communicable diseases, 5) Outreach activities. 6) co-ordination and monitoring, 7) Administrative responsibilities, 8) treatment of minor injuries etc. along with conducting deliveries. (4)

The ANM's roles have evolved over decades in accord with the country's changing disease epidemiology and advancements in the health sector. The initial focus of ANM's training schedule used to be 'midwifery' as they were primarily required to conduct deliveries and take care of pregnant women and the newborn. Later, with the setting up of various committees, revisions in their roles kept happening around the post-independence era. While Mukherjee committee recommended, they also work with the community and act as informants about the public health programmes, Kartar Singh committee expanded ANM's roles to include an entire range of curative and preventive work, integrating family planning and immunization related activities into the MCH program. Around the same time, they were re-classified from nurse-midwives to a multi-purpose health worker (MPW). ANMs were no longer required to undergo extensive midwifery training, and this led to the dilution of their roles as MCH providers. Later, however, with the advent of the RCH (Reproductive and Child Health) program and NRHM (National Rural Health Mission), ANMs were once again mandated to perform MCH services as their key deliverables.

The introduction of Digital Health Initiatives (DHI) for the ANMs have shown to have helped them in bridging service delivery and data management gaps in their routine work. Conventionally, the ANMs would manually record data and maintain registers of the numerous services provided by them. However, over the last few years, multiple DHI like RCH portal, ANMOL (Auxiliary Nurse Midwife-Online), FP-LMIS (Family Planning- Logistics Management Information System) etc., have been introduced to act as job-aids, improve service delivery and streamline workflow. These initiatives are aimed to enhance the quality of data generated, digitalize patient records, and provide real time data monitoring facility. A brief description of the DHI used by the ANMs has been given below-

1. ANMOL and RCH portal

Year of launch: RCH portal – 2013; ANMOL – 2017

ANMOL is a government of India m-health initiative, developed to serve as a job-aid for ANMs. ANMs are provided with tablets in which they will enter and update the records of services provided to the beneficiaries in real time. Before ANMOL, ANMs were maintaining registers for entering services provided to the beneficiaries. Mother and Child Tracking System (MCTS) and RCH portal were the early steps in intervening ICT and MCH services provided to the beneficiaries by the multipurpose workers / ANMs. RCH portal, "an augmented version of MCTS" application was designed for timely registration and tracking of individual beneficiary throughout the reproductive cycle and facilitates safe and timely delivery of the components of antenatal, postnatal, safe delivery and tracking of children for complete immunization. (5) Conventionally, ANMs would provide the data, and it was entered by the data entry operator at PHC in the RCH portal. Although these applications did improve beneficiary satisfaction, the data generated from both the portals faced issues related to data quality. To counter the

problem of data quality, avoiding data redundancy, reducing paperwork, and minimizing errors, ANMOL application was introduced to empower ANMs by streamlining their activities.

ANMOL is a Tablet Based version of RCH portal which tracks Eligible Couple, Pregnant women & Children. ANMOL allows the ANMs to feed data directly in digital form with the IDs and password provided to them and update data directly into the portal. The ANMs themselves generate work plans and feed data without having to visit the PHC and waiting for long hours.

2. e-VIN (Electronic Vaccine Intelligence Network)

Year of launch: 2015

Electronic Vaccine Intelligence Network is an integrated solution targeted at improving programme management and strengthening vaccination logistics across the country. e-VIN technology digitizes vaccine stock inventory and storage temperature from every vaccine store and cold chain point (CCP) situated in peripheral government health facilities using a smartphone, web-based application, temperature loggers, and a cloud-based server.

At the end of each immunization day, every cold chain handler (CCH) enters the net utilization for each vaccine in the standardized registers as a normal operation. Most of the facilities have ANMs as Cold chain handlers while they can be from other cadres as well (supervisors (male and female), pharmacists, block health workers and non-medical assistants) (6). This information is simultaneously updated in the e-VIN application and uploaded to a cloud server, where it may be accessed by district, state, and national programme management via web dashboards. Temperature data is collected by SIM-enabled temperature loggers attached to cold chain equipment via a digital sensor in the ice lined refrigerator (ILR)/Deep fridge (DF). Temperature data is collected every 10 minutes and updated on the server every sixty minutes using the General Packet Radio Service (GPRS). The logger sounds an alarm and sends

email and SMS alerts to responsible cold chain technicians and managers in the event of a temperature breach. All cold chain handlers are given cellphones with the e-VIN app, which allows them to digitize vaccine stock strength. At the end of each immunization day, every cold chain handler enters the net utilization for each vaccine in the standardized registers as a normal operation.

3. Integrated Health Information Platform - IHIP

Year of launch: November 2018.

Integrated Disease surveillance program was launched in the year 2004 with the assistance from World Bank with the objective to detect and respond to disease outbreaks quickly. However, in subsequent years of implementing IDSP, it was felt that the program needed some upgrades. The facility level details took time to reach the system and there was a considerable time lag between the process of data recording and initiation of necessary action (that is informing MO/RRT for). To address these challenges, a revised surveillance program has been launched – Integrated Health Information Platform (IHIP). In April 2021, Government of India launched an information platform that integrates data from various 'registries' to provide real-time information on health surveillance from across India for decision-makers to take action. (7)

IHIP is structurally like IDSP with a few functional changes that have been made in order to achieve the objectives originally envisaged under IDSP. In both, ANMs/MOs are the primary players for providing data to be entered into the system. However, in IHIP, ANM feeds real-time syndromic, case-wise (disaggregated) information through tablets (namely ANMOL tablets) (paperless) along with the geocoded location of the cases for geographic reference. The data entered gets synchronized in near real time. This ensures that data can be viewed and analyzed by the district, state, and central surveillance units simultaneously. The surveillance units will be able to access information as and when required,

including case-based disaggregated data from the facilities. Daily data entry should be done, and back data entry is not encouraged. IHIP has been piloted only in a few states (Andhra Pradesh, Himachal Pradesh, Karnataka, Kerala, Odisha, Telangana, and Uttar Pradesh) as of now, but will soon cover all the states. (8)

4. Family Planning-Logistics management Information System (FP-LMIS)

Year of launch: August 2017.

FP-LMIS is a web based, mobile app based, and SMS based application designed to facilitate management and monitoring of FP commodities. This application has been designed to manage the stock levels of FP commodities and prevent their stockouts and/or wastage from national level up to the village facility level. The application allows making entries for stock updates entries, generation of indents(demand) for required supplies from health workers in facilities from the village level, HSC, PHC, CHC, DH, State level to the national level in a hierarchical fashion. The facility at the higher-level issues (National Level) stocks (indents generated) via the portal against the online indents updated by the lower-level facility (State, district, block, CHC, PHC, HSC, ASHAs)

At the village level, after entering ground stock in the FP-LMIS, ASHA then prepares an online indent of required commodities with their respective quantity needed and updates the same within the portal. At the Sub-center level, after ground stock entry, ANM may send their online indent to the PHC. ANM may issue stocks to the ASHAs against the online indents updated by them. Thus, the data on stocks availability, the contraceptives required in the facilities at all levels, gets uploaded and issued via the portal itself. The application is used once every 2-3 months by the ANMs, depending upon the indents received (9)

With new digital health initiatives coming up at an unprecedented scale, this study aimed to explore the possible barriers and enablers encountered in their adoption by the ANMs.

Aim:

To explore the barriers and enablers in using Digital Health Initiatives among ANMs

Objectives:

The objectives of the study are:

1. To explore the knowledge and perceptions in using digital health initiatives among ANMs.
2. To understand the experiences of ANMs in using digital health initiatives.

Literature Review

A literature review was done using an electronic search engine- google scholar, research gate. The keywords used were ‘digital health’, ‘m-health’, ‘e-health’, ‘mobile’, ‘ANMs’, ‘frontline health workers’, ‘barriers’ and Boolean operators like ‘AND’ and ‘OR’

Global Scenario

It has been highlighted by several studies that introducing technology to the community health workers like ANMs is seen as an intervention to improve their workflow which could lead to improved health outcomes. A study authored by Bakibinga P et al (2020) was conducted among the health care workers of Kenya to assess their experience of using an m-health application. The study findings highlighted prevailing operational challenges to using DHI like the lack of basic literacy ICT skills among the users and concluded how crucial it is to take into account users’ readiness for ICTs before implementing ICT solutions (10). Another study done by Schoen J et al, (2017) to explore the experiences of Brazilian community health workers regarding the use of m-health tools has thrown light onto some of the major benefits perceived by them which were faster access to information, it saved time spent on paperwork, it had lightened the physical load that they used to carry (11)

A study (systematic review) (2015) on the feasibility and effectiveness of mobile-based services for healthcare delivery in developing countries showed that mobile based data collection improves promptness of data collection, reduces error rates, and improves data completeness. The review identified 5 key functions of m-health that are helpful to the frontline health workers in providing care services to the communities namely data collection and reporting, decision-support tools and training, emergency referrals, alerts and reminders, and supervision (12)

Indian Scenario

In a study authored by Modi D et al, an open cluster randomized trial was conducted in the PHCs of tribal areas of Gujarat (2019) to analyze the effectiveness of introducing m-health to community level workers. The study results showed that the coverage and quality of most of the MNCH services were significantly higher among PHCs that were served by Accredited Social Health Activists (ASHAs) who used mHealth as a job aid compared to those who did not. The findings supported the scale up of mobile based interventions as a job-aid for community health workers to improve health outcomes. (13)

Several studies have highlighted that while community health workers employing digital health interventions report some improvements in streamlining their workflow and an increase in self-efficacy, they nevertheless face several individual, technological, and infrastructural barriers. Infrastructural and technological barriers include power shortages, connectivity issues, defective hardware devices and system design issues like devices getting hung in the process, dynamically changing nature of digital health environment, respectively. Individual level barriers include lack of knowledge, training, attitude, and behavior of health workers towards using technology and limited technical expertise, and support from the team. (12) (14). Similar findings were brought about through a study which was conducted by DM Shilpa et al (2019), among the ANMs working in a PHC of Chamarajanagar district of Karnataka regarding the utility of m-health app. The study identified limited internet connectivity, technical expertise, and non-availability of prompt support from the implementers as the major barriers perceived among the ANMs (15).

An in-depth assessment conducted of Mother and child tracking system (MCTS) in Rajasthan and Uttar Pradesh (2015) by Gera R et al. The study highlighted that lack of clear rules and guidelines governing data processes, as well as systematic monitoring and oversight frameworks for MCTS

deployment, were shared issues in both regions. As a result, Front Line Healthcare workers (FHWs) were overworked with data documentation, and data collection took longer than expected. Health workers and officials were not completely trained in using MCTS (16)

Existing infrastructural and technological factors can be both deterring or enabling factors to digital health implementation.

In conclusion, these studies highlighted the benefits as well as the challenges in the integration of digital health technology into our healthcare system. However, a paucity of studies was noted documenting experiences of ANMs in Delhi. This study was thus designed to explore the barriers and enablers in using Digital Health Initiatives among ANMs of Delhi.

Methodology

Research Questions:

1.1 What is the knowledge and awareness of ANMs regarding adopting digital health initiatives?

1.2 How do the ANMs perceive the use of digital health initiatives in performing their job responsibilities?

2.1 What has been the feasibility of integration of DHI in their daily schedule and responsibilities?

2.2 What have been the benefits and challenges faced by the ANMs in using DHI?

2.3 What measures can be taken for better adoption of Digital health initiatives?

Study Design

The study explored the experiences of ANMs using digital health initiatives namely RCH-portal, ANMOL, e-VIN and FP-LMIIS using semi-structured interviews. A qualitative research design was sought to understand the intricacies of the factors that affect the adoption of these digital initiatives in ANM's daily work. The semi-structured interview tool was developed to help us understand the knowledge, attitude, and practices among the ANMs, the difficulties they face while working with different portals and applications, what has facilitated them to perform better and what scope of improvement lies ahead.

Study Setting

The study was conducted in the PHCs and HSCs of selected 3 districts of Delhi, namely North-west, South-west and South-east. While the ANMs and CDEOs were interviewed in the PHCs and HSCs, the interviews with district officials (MIS Expert) were conducted in respective district offices. The permission to conduct study was obtained from the state.

Study population/Respondents

The study population consisted of ANMs, Computer data entry operators (CDEO) and the District MIS experts.

The inclusion criteria was any ANM in a primary care facility from the selected districts using at least 1 digital health portal/app. ANMs who met the inclusion criteria were chosen for the study using convenient sampling technique.

We decided to interview CDEO in each facility to understand the attitudes of ANMs, quality of data and challenges with the digital health systems. We also interviewed District level MIS experts as they provide supportive supervision, training and troubleshooting problems to the CDEOs and ANMs. We visited 1 subcenter and 1 PHC, each, in the three districts of Delhi. Hence, we were able to conduct 5 Focused Group Discussions (FGDs) and 3 Personal Interviews (PIs) with ANMs, 3 interviews with CDEOs and 3 interviews with District MIS experts. The total number of ANMs involved in the study were 18 which provided valuable insights about the knowledge, attitudes, and practices towards digital apps/portals

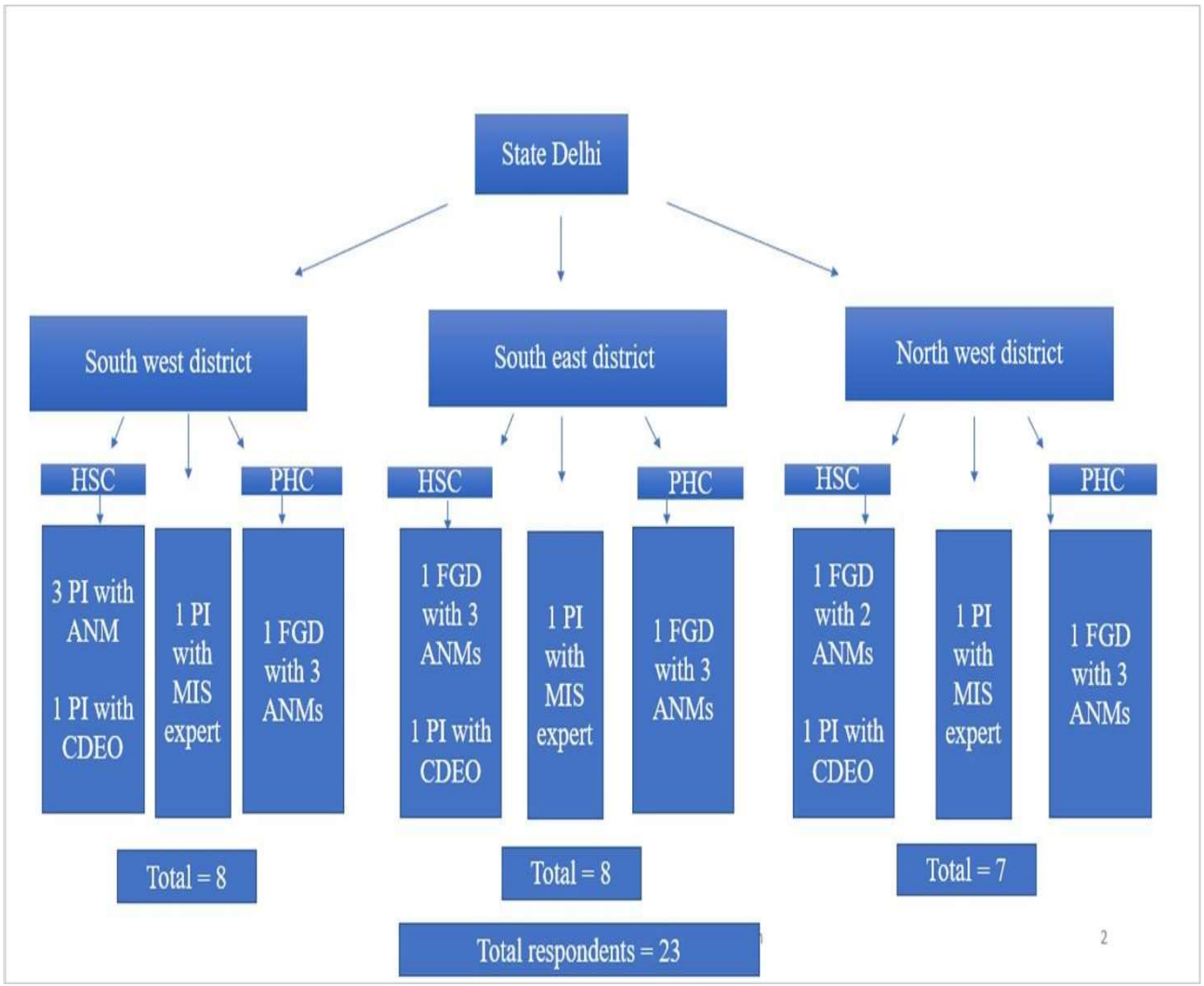

Figure 1: Study participants

Note: HSC: Health sub-center; PHC: Primary Health Centre; PI: Personal interviews; FGD: Focused group discussions

Data Collection and Analysis

Data collection centred around the use of digital health initiatives among the ANMs and what have been their experiences. A semi-structured interview tool was used to collect data. Interviews were conducted with the help of interview guidelines. The interview guideline was prepared according to objectives,

literature review and discussion with professionals. Informed consent was taken and the participants were explained about the nature, purpose, and scope of the study before the interviews. The respondents had a free will to participate, and they were explained that they had the autonomy to withdraw at any time during the study.Audio recordings were taken of the interviews with the respondents which were later used to prepare transcripts. Transcripts of each interview were then analyzed, and various codes were generated from all the different sections to visualize patterns. After creating codes, similar or repetitive codes were merged, which was followed by identification of broader themes. The analysis process was governed by an inductive approach, wherein, based on the responses of the interviewees, emerging themes and areas were identified. While quoting the respondent responses, disclosure of participant's name or identity was avoided for ensuring confidentiality.

Study period

The study was conducted for a duration of 3 months and 15 days starting from 15th March 2022 till June 2022.

Ethical consideration

Informed written consent was taken from each respondent before the initiation of the survey. All the participants were assured that their identity would not be disclosed and the decision to participate in the study is completely voluntary and they can withdraw from the study anytime they want.

Study Findings

Section A: Characteristics of the study participants

Out of the 18 ANMs that participated in the study, 12 belonged to the age group of (31-40) years of age, while 3 ANMs each were from (41-49) and (50 and above) age categories, respectively. The ANMs had varying years of experience of working as ANMs. The ANMs had varying years of experience ranging from 1-21 years, while 8 ANMs had more than a decade of experience. While all the ANMs had a diploma in ANM Nursing, 1 ANM had an MBA as well.

Out of the 3 CDEO interviewed, 1 was female and 2 were male, belonged to the age range of (21-39) and had 3-11 years of experience in their current designation. The 3 MIS experts interviewed were all male, belonged to mid-30s age group, had 5-12 years of experience, and had MBA degrees.

Section B: Results

This section outlines the analysis done of the data that was collected during the study. The responses received from the respondents have been categorized into broad themes describing the knowledge, attitude, and experiences of the ANMs in using these digital health initiatives.

1. Knowledge and awareness regarding the use of digital health portals and applications

The ANMs were comfortably using the RCH and e-VIN portals regularly. However, they had limited knowledge regarding the use of FP-LMIS app and were unable to use it as desired. The use of IHIP portal was also limited. Some ANMs expressed that they often require help in using digital portals from CDEOs (Computer Data Entry Operators) or fellow ANMs. They expressed that they do not feel confident enough to do it by themselves, because they do not know how to use it entirely. Every facility

that was visited had one ANM that would handle the reporting from the facility and sometimes just the CDEO.

> "*Mam, I have only this much idea about the app, because mam it's like we do it together, like that didi (sister)...she handles it (portal and app), then if somewhere like if sometimes she cannot come, then we (with other ANMs) do it together*" She added "*we do more in manual registers, and we have CDEO as well*" another ANM

FP-LMIS app allows the ANM to raise the family planning (FP) commodities-related demands of her area based on the indents (demands) received from the ASHAs. ASHAs send indents using the phone application according to the FP needs of her area's beneficiaries. ANMs frequently complained that they lack the expertise of using this app and that is why they are not able to use this application fully. One of the ANM shared that she distributes the supplies to the ASHAs according to their demand and she enters in the registers as well, but she is not comfortable with indenting and issuing commodities via app yet and that the CDEO works with the app. She was noted saying:

> "*How many contraceptives ASHAs asked me, how many OCPs they asked me, she asks, then we indent them, but this. this is phone related work, we, I am not able to do it, I cannot understand this, CDEO does it*". She added "*yes, I do entry in register, but this (FP-LMIS) I mean is a little, um right now, outside of what I can understand*." - (ANM, PHC)

2. Perceptions and Attitude of ANMs regarding use of digital health portals and applications

Perceived usefulness and perceived ease of use of digital health portals

ANMs shared that they find digital health portals quite useful to work with. Apart from providing easy access to a patient's details, it has made their work efficient and easier. The respondents shared that now their work is updated because they can make entries simultaneously now. Portals have made data entering so easy and time saving because they get automated due lists, auto-generated reports and high-risk cases get highlighted automatically. Digital portals have made it possible to get access to a patient's full records just at the click of a button. An ANM was noted saying-

> "*In that (RCH portal), taking out due list has become much easier, that how much of our data is pending, that had to be uploaded but is not done due to some reasons, all that, I mean has become much easier. And any work I mean we can do on the spot. Earlier, when we had to go to the field, we had to carry so many registers, such heavy registers. Now, it is good, in mobile phone, can quickly open portal and we can make entries as we get ANC simultaneously. If we have immunized a child, we can enter that as well simultaneously, or if any high-risk pregnancy so we enter the delivery details simultaneously. On PNC visits simultaneously we enter details in the portal, There the ASHA weighs the baby in front of us, we update that as well. So many things have become easier than data entering simultaneously, it has become time saving, that data does not remain pending, it could not be done in the field, when will we be back, when we will remember to enter it. All that gets done on the spot now, work is done, its good, its beneficial*"

Other ANMs also shared that uploading data in portals also means that they will always have correct information with them, and that has given them more confidence to decide on a correct treatment plan. Another ANM expressed-

> "*Any patient that visits, their entire updation is done, if she delivers in her village as well, and returns after a year, then also, there are a few who come say we came here during first pregnancy, then also we can track her and add delivery, and connect that child's no. (ID) to the mother, connects mother to child (IDs). Then, if you give child ID, we can find mother's details and ID and from mother's (ID) to child, this is one benefit of RCH portal, I mean there are many more. Like now, if a patient comes, she has 4 kids. Now that this is going, RCH MCTS, maybe from 2011-12, we have all the entries. So, the patient comes, and if they lie to us for getting a delivery in government hospital, she says she has 2 kids or 3 kids, from this number I can find out how many kids she has, then ill connect with the ASHA, asking this patient is from your area, okay. So, she will tell me that she has this many kids and ill update that. Here we get all the details and if anyone is lying, we can treat her correctly, and I have the correct data with me*"

> "*Few of our errors that we make, those also we can find, on the month end we get to know about them. we get messages informing us that these are errors that have been received from your side, the report tells them and then we correct it" - (ANM, HSC)*

A few ANMs also expressed that given the right training and exposure, they have never faced any gross difficulty in using digital portals because it is related to their work. A few ANMs were noted saying that they feel good (Acha lagta hai) about themselves that they are learning new things with the coming up of portals.

"*Apps are related to our work, so we do not face any problem because all the data is our field data, it is related to us, so we don't face such problem. Yes, other than this, like you asked, its functions, phone's functions, not necessary that everyone will know it. Now, there are many those cannot compose mail, they cannot send the mail properly. It's all right, it Google sheet, there are some who cannot upload it after filling it, they know in their RCH portal or FP-LMIS everything fairly they can do it because in that they have their related data, so they all are able to understand it*" - ANM

ANMs had a mixed attitude towards using digital portals. While the majority of them agreed that integrating technology in their curriculum has facilitated them in doing their job, a few experienced and older ANMs stressed that digitization has only increased their workload. An MIS expert was noted sharing-

"*They have a mixed attitude. Many ANMs agree that yes, they want to learn data (entering), however, there are others who have gone a little old, who are not very much involved (motivated) in data, they cannot, I mean they are not able to make an understanding out of it. Then we try to teach or approach them a little with a few jokes and by doing something like that so that they are be a bit (interested)"*

While the majority of the ANMs expressed that the portals and apps have been particularly useful, and have empowered them to work efficiently, others still feel that uploading data on the portals is not their work. They feel it is not their sphere of work, they have too much practical work to do, that they do not have time to focus on the theoretical work of updating the portals. They were noted saying-

"*10 tareeke ke register bharne padta hai, infant ka ek chhota register, ek bada register, same same bachha 4-5 jagah chadhta hai*" (We have to fill 10 or so kinds of registers, we maintain 1 big and 1 small register for infant, a single child gets entered at 4-5 places).

A few ANMs also shared that they feel these portals have improved their work, they are more confident about the data they enter, they become aware of the places where they make errors and are motivated to correct them. One ANM shared that she finds working on portals interesting and that motivates her to make her facility perform better. She said-

"*Experience is good mam because I am a bit more interested in this. Otherwise earlier it used to be all written work, I take a bit more interest because it helps me pass my time good. After going home, there is no point in watching tv all the time and so I do this work, I feel good (using the portals), this is the benefit." She added "because I want, I believe this facility as I am doing work for my family, my work is good, my area's work is good, my dispensary's work should be good, this is my thinking and that is why our work is good. This is the benefit (of* portal/technology)".

The district officials shared that the majority of the ANMs have a positive attitude towards training and they are motivated to learn. They want to know where they make mistakes in entering the data within the portals and how they can improve upon that.

"*It is good otherwise (motivation), like I said see, in every system, you will get 10-20% people like this (poor attitude), 50-60% will be good, it's the 10-20% they create issues, otherwise 70-80% are motivated enough. They enter it (data) correctly and they try if they made any mistakes, they ask about it and they correct it as wel*l" --, an MIS Expert

A couple of ANMs also expressed that they believe, now irrespective of all the work they do, only online entries reflect their work done. They expressed that some days the rush of patients is high and they are busy with vaccinations and outreach sessions, they are not able to enter the data on the portals, they feel that despite doing so much work at the facility their work does not get accounted for, if they do not upload it online

> "*Like now we did vaccination of the children that come today to us but we could not show this on the portal (server down), so mam, that is the issue. If we did not update any entry on the portal for a full month, they feel that we did not do anything. But we do vaccination on normal days na, so I am saying that, mainly, we have to show it on portal*." (ANM, PHC)

3. Perceived enablers of using digital health portals/apps

Originally, ANMs had to collect and enter data related to MCH and other services provided in registers and maintain paper-based records. This would then be reported to the PHCs by the end of the week. This meant preparing and collating several written records in many registers, along with surveying households, organizing outreach sessions, and visiting the PHC every week. This process used to be cumbrous and time-consuming. The integration of digital portals in ANM's daily work has streamlined many of these processes. ANMs identified several benefits of using digital health portals/apps in their daily work. They shared that now they can access any patient records in one click and do not face data loss issues which saves them a lot of time that used to go into finding previous records earlier. Now, they get system generated reports, and due lists which have made their work a lot simpler, which is free of errors because the monthly reports and feedback also allow them to find out about their mistakes and to correct them.

A. Better and faster access to information

Every single ANM expressed that the advent of digital health portals has enabled them to easy and swift access to any past patient record. They expressed that before portals were introduced to them and only manual registers were maintained, finding a patient detail used to be a time-consuming and laborious process which would often lead to frustration. An ANM was noted saying -

> "*Mam, I have been working in this job for 15 years now, earlier when portals were not there, I mean from the time when portals were new, so before that, we used to enter and update registers only, no online work was done. So, when we had to search for any record, registers used to get old and hence at times we could not find the reports. But now, from portals this has become easier for us that we can go as back as we want in the records and get it. Back records can be searched via the portals, we have benefited from this (from the portal)*"

Respondents shared that with portals, it has saved them some time that used to go in finding the past records from old registers and preparing reports

> "*It is a little time saving, like we had to search out in registers, it used to be time consuming, now we feel from adding a single click ID in computer and I can get full details*" - (ANM, HSC)

> "*Reporting used to be, like earlier our reports used to go on paper, on paper only, they do not used to go to the portals. Then if they used to ask us about the past reports, we used to face problems. But now, we can provide the reports when they ask it (from the portal)*" - (ANM, PHC)

B. Beneficiary tracking and minimal data losses

Respondents mentioned that digital portals have made tracking a beneficiary easier and faster. A beneficiary ID helps in accessing patient's past health records and planning future visits. ANMs shared that by maintaining just manual registers there used to be frequent instances of data losses because over time registers used to get old and there were chances of them getting lost as well. An ANM was noted saying-

> "*Before portals came, we did not use to give no.s (IDs) to ANC okay, so we could not track them. Like if they(beneficiaries) go to hospitals after getting a number from here, so the hospital staff can know their details on one click, this was not there before. Earlier, the records used to be only on paper with their details. If they misplace their paper and if we are receiving many ANCs even, we would not be able to find the information, when the beneficiary had come, which vaccine did we give to her, which doses are done etc., so this is the benefit*"
>
> "*With registers what used to happen was, like if our register has become much old, often it used to get misplaced, and we used to face problem in finding the records then. Now we have portals, so we are able to get the past details from it." - (ANM, PHC)*
>
> *"The information gets saved, and we can quickly see that information okay. With registers, it can get misplaced or destroyed in some days, so we will not be able to retrieve that data. But this (uploaded in the portal) data we can retrieve." - (ANM, HSC)*

An ANM shared that generating beneficiary IDs ensures that all the data related to a beneficiary is available at one place.

"I think if someone gets entered once and we are able to continue that at every phase like first EC, then we add them in Family planning that what methods they are adopting and then after, they get converted in ANC, so that one single ID allows us to add all the details of them. Then that EC at one time becomes ANC. Then after getting all ANCs, their PNC visits happen of child I mean that all happens at one place. Earlier it used to be like we had to search month wise that because month wise registers were maintained for children. Now you get full information from the beginning till the end with you" - (ANM, PHC)

C. Autogenerated workplans

The ANMs mentioned that another benefit of using digital portals has been automated workplans which they can access anytime they want from the portal. These workplans also help them in managing high-risk pregnancies and low-birth weight babies by tracking them and by providing them with special attention. An ANM was noted saying-

"*If the data is uploaded the same day, it has this one benefit that we can easily track that child because he is already updated, how many children are vaccinated and the ANMs also try to do this that they upload the same day they have immunized in their tab or app that is provided to them that today I immunized these children, it of course provides me benefit when we ask our CDEO to take out workplans, so it shows the exact children which we otherwise had to search in the register. Like we still do in registers too but it has somehow, through workplans has become easier through computer, through apps*"

"*Even if we have zero stock of the vaccine, they will (state authority) know about it, and we will receive a message saying we see zero stock with you, so what is the reason it is*

showing zero stock and everything rest, they can see that." She added, "*It is that we have this benefit from e-VIN as well that we get to know this from phone itself when we do daily what balance we have and what not (which commodity is stock out) so we easily get updated that suppose we have 80 doses today and we would need 200 doses for tomorrow*"- (ANM, HSC)

D. Avoids duplication of records

The respondents mentioned that earlier when beneficiaries were not provided with unique IDs, data duplication errors were quite common. The patient would get recorded in each facility they visited as distinct records, which lead to the same patient getting recorded with multiple entries. But with the advent of the portals (MCTS, RCH), data duplication errors have been minimized, because each patient gets a unique ID. A CDEO was noted saying-

"*Mam earlier what used to happen was, that the other facilities like your MCD is there and there is central government dispensary or Delhi government dispensary, different-different data used to come from various places okay. So, mam often the patient used to come here as well, second facility as well and a third facility may as well. So that data used to get recorded in 2-3 places. So, after coming of the portal this doubling and tripling has reduced and to most extent has ended, the patient gets a unique ID from RCH portal, from that they can avail treatment anywhere throughout India and doubling will not happen"*

"*The implementation began after 2010, I think from 2010 to today, there has been a lot of improvement. In data, earlier we used to talk about in our district or if we talk about entire Delhi, say it used to have 9lakh ANCs registered. While only 3lakh deliveries used to happen because that duplicity and triplicity were happening because the pregnant*

mother used to go to the dispensary first and then she was also visiting the hospitals. They were registering themselves in hospitals as well and in dispensaries as well, so they were getting registered at two or three places. Now I mean that, we have received orders from Delhi state that you will not say no to provide services, but you will not show that under new registration (with one unique ID) if a mother comes to you for the first time" - *(*MIS Expert)

E. Support from the supervisors and other staff

ANMs perceived a high level of satisfaction with the degree of co-ordination and support they receive from fellow ANMs, CDEOs and district level officials. If they face any issue related to DHI, they first bring that to their CDEO and fellow ANMs and if the CDEO is not able to resolve the issue, district MIS expert is contacted via mail. CDEOs shared a WhatsApp group with district MIS expert, where their queries are shared and discussed. One ANM was noted saying-

"*We work as a team. Our CDEO are very co-operative. If they are free, they do not ask us for anything. If we have ANCs, immunizations, pregnant mothers coming and if there is something related to reporting, and we are busy, CDEO helps us*."

"*We talk among each other, and we talk to sir if we have portal related issue, like sir this is the issue, then he guides us and tells us to do that, or ask CDEO, he asks us to refresh it, or we have to logout or the problem is at their level or state level, and he tells us how long the problem is going to last."* (ANM, PHC)

"Yes, see generally we have 1 (refresher training), but in that we people visit there. All right, so we people do monitoring visit, so what do we do there is, like if I am there so I check everything. RCH, HMIS, FP-LMIS. We have 1 proforma, in this we have all the

indicators, that who is using FP-LMIS, how much they are not using it, what is the reason, is there some issue with the ID, is anyone not able to understand something. The nodal officer also visits, along with RCH madam, NHM nodal also visits. So, all the issues there are portal and digital related, all the issues, we get those resolved."- (MIS expert)

4. Barriers in using digital health portals/apps

A. Individual level barriers

Limited experience:

It was observed that while the ANMs had good experience in using RCH portal, most of them did not know much about how to use FP-LMIS.

"*From phone or through portal, like on portal how should I give them? (indent) Now I have given them (FP commodities) in person, this much, this is yours. I have written in register as well but how to do this on app or phone that? I am still trying to learn" "Mostly, we have not done work on this (FP-LMIS) at all okay, CDEO only does it (indenting via app), but... from now on we need to work on this because if updation is done simultaneously, we face less problems*." - (ANM, PHC)

"*The knowledge they use, the ANMs, their technological knowledge is not that sound that they can grasp these things very quickly" - (*MIS)

Upon being asked about how comfortable they are using their phones, one of the ANM was noted saying-

"*we had to buy phone for our children for online, otherwise just to pass time we see WhatsApp other than that much work, now we have group (WhatsApp group) made, that's okay, that is just it, not deeply than this*" (do not know how to use phone other than to make calls and use WhatsApp)- (ANM, PHC)

Some ANMs expressed that they often require help in using digital portals from CDEOs or fellow ANMs. They expressed that they do not feel confident enough to do it by themselves, because they lack the know-how of these apps. Every facility that was visited had one ANM that would handle the reporting from the facility and sometimes just the CDEO.

The limiting technological literacy of the ASHAs also posed as a barrier in the adoption of FP-LMIS app. The respondents mentioned that most of the ASHAs are not comfortable with using phones and apps. They shared that some of the ASHAs do not even understand certain English terms in the app. Eventually, either the CDEOs or the ANMs make entries using their ID credentials which increases workload of the ANMs. An ANM was noted saying, "*Mam frankly if I tell you they do not even understand those words spelled in English. And mam then CDEO or ANMs do their indents*"

"*They (ASHA) are also given phone or app and everything, so they try indents from their phone. But yes, this is that they are not able to do it. They do not understand this well, we have organized training for them, but they are not able to understand it. That is why the system is not working now, right now we have to do this indent and everything in registers in written form itself. Now we are not doing much work on this. (FP-LMIS)"- (ANM, PHC)*

Under-motivated:

Some ANMs showed low levels of motivation towards using digital health portals. Although there were exceptions, it was a general trend in all the facilities that one ANM would lead the data entry of the facility along with their CDEO. An ANM was noted saying,

> "*What good will it be when the work is increased so much! it will be good when we won't have to do it. If some register work is reduced then we can think that it is good, we just do double work. Now as the clinic will end, now will see the register. And the work that has been done today, everyone will do their work separately and in RCH portal as well.*"

> "*We do the work of patient as best as possible, but this work, when this is not even our field for one? Our work is too much, we do ANC work, full history is to be taken, we have family planning related work, Copper-T, follow ups, immunization, then we have to provide their reporting as well. We are ANM, our work is giving injections and patient related, right? This is technical work, when we came, we had no knowledge about this, yet we took the knowledge and started working on it, we are doing it even at home. In train also, in metro also in bus. Whenever we have time because we have to give work to them on time. If not, we are asked for a reason*." - (ANM, PHC) She added "*I would say that they have mixed digital and health, they have mixed it right? Like we should have...um.., there should be a different person for this (digital data entrying), we should just see the patient*."

Hesitancy in making digital data entry was observed among some ANMs because it is beyond their conventional roles. They believed that data entry is CDEO's responsibility and their job is

that of service provision. They feel that it is technical work and CDEO can perform these tasks better. An ANM was noted saying-

> "they *(CDEO) have more knowledge than us for this (working on portals), they also had training with us, then they were told that you should see... ANMs have a lot of work to do. If we are not able to sit in the dispensary, then we cannot sit on the portal that much either. So that's why most of the work was given to the CDEO.*"

A CDEO shared that although ANMs attend trainings, they genuinely have a lot of work, and they maintain registers as well, so, often they would not have time to do online entries and so he would help them wherever they need help.

> "*They do attend trainings. After doing it, their attitude remains that we did not understand anything. This has happened to me several times. They know (I) have come after doing training and they know that I will take care of it. "- (CDEO)*

B. Technological and Infrastructural barriers

App/portal related

Non-flexibility with certain data elements

Every ANM reported a few recurring app-related issues. They shared that they are compelled to make fictitious entries of patient records as the portals/apps do not provide them the flexibility to make data entries for delayed vaccinations. For those children, who did not get vaccinated before the age of one, ANMs are advised to administer DPT vaccines to them. However, it was observed that in-built data validation would not allow that and hence the ANMs were compelled to make entries against Pentavalent vaccine with different dates, irrespective of the type of vaccine

administered to the beneficiary. Similarly, the app/portal would not allow the administration of Typhoid vaccines to children post 2 years of age. These vaccinations are otherwise allowed under immunization schedule and entered in registers, that the ANMs maintain in the facilities. Thus, this leads to a mismatch between the data entered in the registers and that entered in the portals. An ANM was noted sharing,

> "*This is a wrong thing about it (portal). Computer says that first give PENTA 1, then 2 then 3, then like this then it is wrong but, we have provision that we will not apply PENTA if the child comes after 1 year. We will give DPT to him, but there is no provision of DPT in this (ANMOL/RCH portal). It (portal) is saying that if penta should be given in 1.5 month, then PENTA 1 must be given. Then all entry is wrong, wrong in the sense, we have to complete the child, so the date of the child in the card is something else. He is one plus, one year plus but I have to show him for one and a half months to enter the portal."*

Another issue that every ANM mentioned was that there are certain data fields which once entered cannot be edited. The beneficiaries are usually not very educated, and they cannot tell their correct LMP (Last menstrual period). However, once entered, LMP cannot be changed from the ANM's ID. The changes in the LMP can only be made at the district level. Although, in most of the facilities the process did not take long hours, a few respondents faced some challenges.

> "*The challenges are such that there are some things in this (RCH portal), which we are not able to change, which cannot be done according to us, there are some things, because there is field work, some wrong data also gets entered in field work, many times it is difficult to hear the patient. The problem becomes that if the patient tells wrong LMP,*

and after the patient ultrasound happens etc. then we come to know that they have completed 4 months. and they told (earlier)it is the third month or second month, but once the LMP is uploaded it cannot be changed". (ANM, PHC)

Slow server

All the respondents raised the concern of dissatisfaction felt by the slowness of the portals. They highlighted that portal usually slows down in the last few days and initial week of the month because all the facilities are trying to upload the facility data around that time. This leads to constant delays in uploading the entries within the portals and often leads to frustration among the ANMs because they have to spend twice or thrice the amount of time that goes in doing data entry in registers. At times, the server remains down for days and registration of new beneficiaries and generation of their IDs also gets hampered.

RCH Portal

"*Mam I told that the main issue is that the portal does not run many times. Now as today they have come for vaccination and the portal is not running, so if 20 children come, they are left without getting entered*". - (ANM, PHC)

"*Often times this issue comes with RCH portal in all the dispensaries. Like if we are working, and we are doing someone's entry, child's mothers, so this stops in between and we have to do the entry all over again*"- (ANM, HSC)

"*Mam, the biggest issue comes, the portal is so slow. At the server level, i mean during the day in the working hours, even if they have timing of 8 to 2 o'clock in the morning, there I get multiple times these messages saying that portal is slow, portal is not working, this portal is not working, portal is not working also keep coming on my WhatsApp group.*

I tell them to mail, I forward the mail, but the problem is at the server level. It's not that it is a technical issue, the load is so much, that server is not able to run properly, this is the issue with RCH portal"- (MIS EXPERT)

ANMOL

"*It is slow absolutely; with ANMOL mam it is like there is some issue with the app itself. It keeps circling the cursor, keeps circling only*" - (ANM, PHC)

"*After 11-12 pm the server also slows down a bit. Before this, the server remains slow even on Saturday, that is the problem*" - (ANM, PHC)

FP-LMIS

"Basically, this LMIS portal, it runs very slow and there is a problem in it every day, it does not open. Sometimes doing some work in it takes a lot of time. The portal does not open while we are working, loading or whatever we open."- (ANM, HSC)

Device related

The ANMs are provided with tablets to run RCH portals and other apps. It was a general finding that in every facility, ANMs were either using their phones to do entries or would wait for their turn to work on a single system (computer) provided in the facility. Every ANM shared that they prefer working on mobile phones over the tabs provided to them. The tabs are even slower to work with and would hang more often which gets frustrating because it takes them twice or thrice the time it would normally take to do one entry. The quality of screen display and touch are not up to the mark and some respondents complained about memory and battery issues as well. Another recurring complaint about the devices

stressed by the respondents was that there was no provision for the replacement of broken tablets. The repair costs have to be borne by the ANMs themselves, which are usually quite high.

> "*Mam tabs are provided, but it is for ANC records etc., it is not even that any good, it does not work fine I mean. It has even larger issue of internet. In that I mean, if we take 100 photos of beneficiary slips, it fills up with that itself, then we cannot add records in it*"- (ANM, HSC)

> *"We use this (phone) only, in this work gets done faster. In that(tablet) it is very slow-slow, but we have to do work very quickly*"- (ANM, PHC)

ANMs tend to not carry the devices(tabs) to the field areas to avoid indemnity, theft, and inadequate time for double entries during high patient load. They were seen quoting that most of their sessions are conducted in congested areas, slums and crime prone areas. It is difficult to carry bulky registers and tabs there while managing manual entries during the administration of vaccines and other clinical activities. An ANM expressed-

> *"Mam its very rare that we can use tab in the field, because we go alone (single ANM) in the field for immunization, like it is my outreach session, so I will go, there will be 15-20 children and in multiple lines, and there are lot of problems in field (carrying tabs in field). Because field visits often happen in slum areas, and Aanganwadis, those are so small, and smelly, they do not have space to sit even. Often, we perform immunizations sitting in the temples or in the road. Already we have so much rush there, we must enter in registers as well. We must maintain the crowd as well. So, there it does not seem possible to enter in tab as well in the registers and perform the immunizations as well*."

Repair

"Damage is never in warranty, whether in your laptop, where you put in that laptop ,or pen drive, if that ever breaks by mistake and your laptop is in warranty, then also it will cost you 8 to 10 to 12,000 .So ANMs gave in the warranty, from there the bill came in the form of ₹ 8000, now who has to bear ₹ 8000, who has to do it, ANM has to, she will not ever do it. If this thing happens then it (tab) is a dump now. There is no option for it to get changed. Once you get the tab from the state, then run it for 5 years at least. It has a warranty of 3 years, but it is like the first-time tabs are distributed (so not sure)"- MIS expert

Screen

"*Screen of the tablet mam is a little small, due to this mam or the network issue, but mam tab is a bit of (an issue). Actually mam, we are better able to work on the laptop because the screen is big, touch (screen touch) works fine. I mean, whatever, we are able to use that easily. In that (tablet), we have to make the screen broad, the screen keeps blinking. Often in those few issues arrive*" She added "*and second mam, it takes more time also, since we have shortage of time and in tab it does not work good as we can work in the compute*r" - (ANM, PHC)

"It has problem in its screen, I mean yes, the touch was not working fine, screen, I mean I showed it, and I sent it for repair in the state, so they were saying it might not be in the warranty period, this will cost you this-thousand rupees, I kept it (tablet) back like that"- (ANM, HSC)

Speed

"We are not even able to work in it is that slow, then we think our phones are better. This has more memory(space) than that(tablet)" - (ANM, HSC)

"*Its Net does not work even, so we have to do it on our phone then, no? Now it is like, it happened this one time, for some days our sims stopped working. The sims that we work on, those that are inside our tabs, from the office(those)" - (ANM, HSC)*

"*The entry, mam, which I would have done in 1 minute mam, it takes us a lot more time to do (in the system) because often the system hangs. The server is down, the page that we filled in the data becomes blank, an error comes in the system on its own. L 404 is it right? Then we again have to re-enter our ID and password, in that then I mean, it is that it takes us way long to do it, the entry, which was supposed to be made in 1 minute, it took us 10-15 minutes to do it.*" - (ANM, PHC)

Shortage

"*Well one more thing I would like to mention that the infrastructure (desktops) which is also at the facility level is not very good. We have given a system to the facility, which has been received from NHM. So, if four ANMs have to work on one system then they have tab but earlier they had only one system then who will update that much*" District MIS

C. Organizational barriers

Workload

The ANMs perceived high degrees of satisfaction with the benefits that working with DHI has provided them. Records are readily available to them and now they do not have to waste hours in report generation. However, then the aspect of entering data in registers and in digital form simultaneously was also creating issues of data duplication and dual entry. ANMs shared that they are asked to show registers to district officials and other authorities, and they fear their data might vanish when they face system and server hangs. While few ANMs expressed DHI have reduced their workload, most of them expressed it has had a twofold effect on the workload. An ANM was noted saying, *"It is both ways, where it has been time saving, the workload is also increasing. It is both ways, where we have data available in-hand in one click, there it gets time consuming as well in making dual entries. Often times, we have internet crisis, we face network shortage, our data entry takes time. It's a burden for us. Often times, same thing is favorable for us, that becomes a burden other time because we do not have internet facility. Our time consumption is increasing, like we could enter in one go (in registers), we could document it earlier, for that we have to wait long time now because there is no internet. Often times, we face electricity crisis. But it's both ways (it's been good and bad)*" - (ANM, PHC)

> *"Mam, it (workload) has decreased and increased as well. It is both. Mam decreased because like I said we can easily find records(patient), so it is no problem now. If we are uploading a report for the coming month, and I have to see some details from last month, that I can do easily now. But we have other works as well so we are not able to give*

proper time working on the portal that we can continuously keep working on it, time is an issue" - (ANM, HSC)

"*Many times, mam, we do not get time here, so as i travel in metro, as I do e-vin work in the metro, then I have to take out time like this, I have to complete my work. However, we do. Many times, it happens like Mam, we take work to home, then even in the metro i work, I take photos from here (of the register entries) and then I enter that on e-vin.*" - (ANM, PHC)

"*We work till 9-9,10-10 pm even after going home, because our work is not completed many times, we work at 9:00 at 10:00 in the night even at 11:00 in the night. Even if we work in the metro in the morning, it is very difficult for us because we have to update it. Mam the workload is so much, so much that we are not able to give time to it (FP-LMIS). We do our work our RCH work, we do that a little bit in the metro. We are in call with ASHA even, we are working simultaneously on phones as well. I mean it's a big problem. We have a lot of work, and not enough time that we are not able to work on it*" - (ANM, HSC)

"*If you see, they are doing these things in the entry register as well. Then continue to mount it on the portal as well. Their time goes in this only. If everyone will do his work, then this register is also not just one, either they should have1 register of complete reporting. HMIS is different, FP-LMIS is different, RCH is different, means there will be 100 reports if not at least.*" (MIS said)

"Actually, what I have seen that we ask for data, state level asks for data, ask for district asks for data, Government of India asks for data, so multiple agencies are

asking for same data, so they are reporting same data at 3-4 places. We don't have bonding with each other. The Government of India also has two portals. Three portals are being built. I am doing HMIS myself. An IHIP is also becoming a different one. If a separate MCD portal has to be run, so multiple portals have been created. She (ANM) also has to be in multiple activities, and she is bringing that data and giving it. They are also worried about this thing" - (MIS)

Limited computer literacy of the ASHAs

The respondents shared that the computer literacy of ASHAs is not that good, and they often struggle working with phones and as a result most of the time ANMs or CDEOs are making the entries on their behalf, and it just adds to their workload.

"*It has become challenging (indenting using FP-LMIS), their education level is not only such, that they can give their demand, they need it, there is need (FP commodities) in the area, but if the app is online, their education is not such that they can put their demands, then the ANMs here will help them, favor them. Yes, absolutely, we train them ASHAs. But 100% cannot be trained*". - (ANM, PHC))

ANMs also mentioned that sometimes when ASHA sends indents, and if there is delay due to some reason, ASHAs sometimes raise the same indent again and that leads to doubling of the indents raised. "*And then if suppose the first data took time up to 10 days if it didn't come, then we know the reason from which reason it could not come like told that it is not compiled is one reason, ok, then it got delayed. Those (ASHA) people don't wait that much. What do those people do, they raise indent again, they raise the indent, from there it then leads to doubling.*"- (ANM, HSC)

5. Suggestions and feedback

The respondents shared that overall experience of digitization has been good for them. They will be able to work efficiently and better utilize the DHI provided the server-related problems are resolved. A district level official shared that a successful ANMOL app roll-out will only improve ANMs experience because the app will be easier to use compared to the portal. They shared that regular follow-up should be taken from them where they can share the issues they face while working with DHI in their daily work. Recurring feedback that was received from most of the respondents was that the data entry process should be completely digitized.

> *"Yes, first, that digital is good, it has improved things. Because of this our data is uploaded well. Working has become better, there is one good thing in that, and it should come. And if there are some things then it should be given its respect and if it comes to some problem then the problem is that it should be a little flexible regarding the data which we cannot change, it takes a little follow up in between. If they will help us timely in respecting the problem that is coming to us and solving it, then they also have this advantage and ours too." - (ANM, PHC)*

> *"Right now, we have to do both the things. Register also has to be maintained, portal as well. If all our entry will be on the portal, then anything will be pending for us later like this, otherwise I would like to suggest that the register work will be stopped completely only when we do not have all the entry in the starting or if we do it on the portal in starting. Mam that register work will be completely closed, and all our work will be up to date." - (ANM, PHC)*

The respondents believed that for the DHI to be beneficial to them, entering data manually should be eliminated or they must be provided with more workforce.

> *"First thing is that totally work should be done only on portal basis and all our written work should be removed and we should be given so much manpower that if ANM is there to work in the area. She should only see the area and do not see it, for this we should be given manpower separately and if only those register work is removed then it is very good otherwise mam time consumption and workload is more." - (ANM, HSC)*

> ***"****Mam the main thing is that if the server that remains down every other day, if that is improved, then we will be able to work well. We will be able to give timely report Like there are so many portals that are there, if they are eliminated and reduced to one or two portals, then it is much better if all the reports are taken in that. Because there are so many portals, they have to remember their ID and password many times in it"* (CDEO)

An MIS expert shared that the current portal servers are not equipped to handle huge user loads and they could be dealt with by incorporating technologically advanced solutions. He was noted saying -

> "*If the RAM of server be increased or whatever it is technical team from backend upgrade it so maybe, why not? (The server problem can be dealt). There will be heavy users. Facebook is used by more users anywhere, Won't you say that? So, FB never hangs, it happened sometimes once in three to four years that the server services of Facebook were stopped. If it runs continuously then the load is present of everything, but it works well. This doesn't happen with us here. (With portal)" (MIS)*

Discussion

The study highlights the knowledge, attitude, and experiences of the ANMs in using digital health initiatives and factors affecting their adoption. While all the ANMs felt that digital portals have made tracking a beneficiary much simpler, many had mixed attitudes towards using the digital platforms. Where earlier the ANMs had to go through a magnitude of data to get the information on a patient, the integration of technology has made access to previous records easier for the ANMs.

It was observed that mostly the attitudes of young ANMs were positive towards the utilisation of digital portals especially in some health facilities. It could be attributed to the advent of android phones, ease with technological advances among younger age population or less workload in the health facilities as compared to the health facilities in sub-urban areas. We felt it must be appreciated that ANMs who had better knowledge about the digital portals supported the others. As identified earlier by other researchers, our study also documents the findings that DHI have been useful to the ANMs in getting faster access to past records and tracking beneficiaries. A study done by Kodali and Das, found that perceived usefulness was identified as a crucial factor regarding m-health acceptance among the ANMs of Andhra Pradesh, who worked with RCH portal, ANMOL, ANM Digi etc. (16)

ANMs often possess lesser educational qualification and computer literacy than their counterparts (CDEOs, etc), explaining the hesitation and lack of motivation towards using digital health portals. Data entry is considered the job responsibility of CDEO in the health facility by the ANMs, as most of them complained that they were trained only to support the CDEO initially. CDEOs were also assisting the ANMs to enter the data as they can work easily on computer systems. They feel that entering the data

digitally is not their job and responsibility as they do it manually in registers. The CDEOs are paid for it and ANMs should not be overloaded with the data entry.

In general, the ANMs were experiencing some challenges in working with DHI. They demanded human resources for data entry as it is difficult to work and complete data entry. They were not well-equipped and comfortable in using FP-LMIS. ANMs are burdened with a lot of work and the findings reflected that introduction of DHI (without eliminating the paper record maintenance) has also added to the workload of the ANMs because they have to make multiple data entries (electronic and paper) now. A CDEO mentioned that ANMs often lack motivation because they have a lot of work that needs to be done, so they get dependent on the CDEO for making digital entries. Even though digital health initiatives were introduced to make ANM's work paperless, dual entry still exists. As showed by other studies as well, existence of multiple data entry systems often leads to decreased levels of motivation among ANMs in using DHI. (17)

It was also observed that ANMs felt that their work gets acknowledged only if they are making timely digital entries of their work. The emphasis given to the digital health initiatives under the public health system, made it more of a subjective standard for the ANMs to adopt them. This suggests that government prioritization on digital health can also be attributed as the factor that influences the use of DHI among the ANMs. Demarcation in the attitude that was also found among the ANMs can also be attributed to the co-operative staff, supportive supervision, and effective redressal process. A study done by Zakour (2004) support these arguments saying that technology acceptance among the users is guided primarily by the opinions of the superiors in an organization. (18)

They are provided with tabs to feed data within the portals and apps, but it was observed that they were using the desktops or their mobile phones. They shared that working with phones and desktops is easier for them than working on tabs, because for some reason tablets would hang often, it has poor network

connectivity, and the quality of display and touch was not up to the mark. One of the MIS shared that tab will be particularly useful once they start using ANMOL app, because currently they are using web browser within the tabs, and the app will provide a better user interface.

It was observed that in each health facility, one ANM would be leading the group for data entry. The nominations for trainings at the district level from facilities were made on the basis of positive attitudes and better knowledge. This summed up that only few people would be better at using DHI. District level authorities favoured the training of ANMs who showed better knowledge and attitudes towards the utilisation of the digital portals.

Our study identified technological barriers like slow server speed and system hangs as one of the important barriers among the ANMs in using DHI. Usually, the portals slowdown in the last few days and initial week of the month, as all the facilities are trying to enter data for report generation. Julia Schoen et al, in their study done among Community health workers of Brazil, identified technical inefficiency of the mobile application used by them as an important barrier which led them to switch to other (manual) modes of recording data (11). During the interaction with MIS expert in a district, it was stated that issue of slow servers can be dealt with advanced technological solutions like adding intermediate servers, cloud servers at the state level.

Recommendations

1. Improve Data validation checks

The ANMs mentioned repeatedly that they cannot update certain fields in immunisation for children correctly. Although applying data validation to certain data entry fields within the portal is essential for ensuring data which is error free, alternative responses should be allowed, where appropriate.

2. Provide regular upgradations in IT

A common complaint among the respondents was the frequent system hangs resulting from the slow speed of servers. ANMs felt that this cost them a lot of time and diminished their motivation to use DHI. The MIS experts explained that this is due to the excessive load on the server. ANMs enter data mostly on VHNDs and ANC days. Hence the server gets overwhelming user load around the same time. The slowing down of the servers from excessive user load can be addressed by incorporating advanced technological solutions like installing intermediate servers or cloud servers at the state level.

3. Allow interoperability among platforms

ANMs currently provide data on multiple platforms to functionaries at various levels which becomes a daunting task and often lead to frustration among them, because at times, they have to upload data of a single beneficiary at 4-5 places. If defined formats be developed that can be used for data collection to allow interoperability between different DHI for the various programs, as the ANMs also suggested, the need of entering data on multiple platforms can be avoided.

4. Refresher Trainings

Many of the ANMs interviewed were not fully informed about the features of DHI, especially about how to edit certain data fields and to continue with the once migrated-out beneficiary. As a part of supportive supervision, ANMs can be encouraged to raise their queries at the end of the week via their CDEOs, which is likely to improve their attitude towards using DHI.

5. Provision of Sturdier devices with improved functionality

The ANMs are provided with tabs to feed data within the portals and apps, but it was observed that they were using the desktops or their mobile phones. They shared that working with phones and desktops is easier for them than working on tabs, because for some reason tablets would hang often, it has poor network connectivity, and the quality of display and touch was not up to the mark

6. Appropriate redressal of device-related issues

The respondents shared that tab can be repaired only during the warranty period. There is no knowledge about any provision of replacement of old devices. Even the district officials were not aware of the provisions for the repair of devices after the warranty period. They were paying out of their pockets for cheaper repairs or using their personal devices. Thus, it is recommended that an appropriate redressal process like provision of state-wise help desks can be made available to deal with this issue.

Strengths of the study

This study was the one of the first studies documenting the experiences of ANMS, covering so many DHI, at primary care facilities of Delhi.

All interviews were conducted by a single interviewer, so interviewer bias was minimal.

There was no language barrier as data was collected in the language that respondents were comfortable in.

Distinct types of informants were included in the study for validating data collected.

Limitations of the study

The scope of the study was limited, as limited facilities were visited, thus this study can be rolled out in large scale for generalisability.

This study has reported the findings as shared by the ANMs, but hands-on verification/observation could only be done in some facilities as the server was down.

Conclusion

ANMs are an integral component of Public Health system delivery, and they play a multitude of roles to ensure proper functionality of the HSCs and the PHCs. Digital Health Initiatives were introduced to act as job-aids for them and to streamline their activities. The study re-enforces the potential of using digital health initiatives to facilitate the ANMs to perform their roles better. However, dual data entry, server speed, system hangs, and non-flexible data elements were some of the factors that compromised their complete adoption. The results strengthen the argument for addressing technological, organizational, and individual level barriers by developing defined formats for data collection, to allow interoperability between different portals, adding more flexibility while designing data validation checks. It also calls for making regular upgradations in information technologies by building a resilient IT infrastructure.

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Annexures

Annexure1: Questionnaire for ANMs

Title of the Study: Exploring the enablers and barriers in using Digital Health Initiatives among the Auxiliary Nurse-Midwives

1.	Could you tell me about the online/mobile apps that you are using in your daily work for data entering ! ◌T आप मुझे उन ऑनलाइन/मोबआएल अ2 ि◌ज5े◌आप रोज़ के◌ काम म9 इ◌:े◌माल कर रह9 ह< के◌ बार◌े म9बता सकते ह< ?	Probe: • Names of the apps • Time spent entering data • Pattern of filling
If a respondent is using more than one application, then repeat questions 2-7 for each application		
2	Could you tell me about the different tasks for which you use_____(name of online app) _____(name of the app) एप को आप ि◌कन ि◌कन काय◌ के◌ ि◌लय◌े इ◌:े◌माल करत◌ी ह< , बताइय◌े	Probe: • Beneficiary ID generation • Data entry (Please elaborate on the process of data entering and in which areas do you enter) • Dashboard visualization • Counselling • Workplans • Report generation • Organizing VHNDs
3	In your experience of using online apps, please tell me how it has been helpful to you in your daily work इन ए2 के◌ इ◌:े◌माल के◌ आपके◌ अन◌ुभव म9 य◌े ए2 आपके ि◌लए ि◌कस Dकार लाभकारी रहा है?	Probes: • Saves time • Easy to use • Less errors • Quality of work (Data quality and quality of other services provided) • Automatic workplans

4	In your experience of using online apps has it ever adversely affected your service delivery in any way? Please list the challenges that you have experienced in using online platforms ऑनलाइन ऐG का उपयोग करने के आपके अनुभव म9 कभी भी िकसी भी तरह से आपकी सिवस िडलीवरी पर िवपरीत Dभाव पड़ा है? कृपया उन चुनौितयों को उPQ!खत कर9 िजनका आपने ऑनलाइन एप का उपयोग करने म9 अनुभव िकया है	Probe: • dual entry (workload) (Rewards or recognition?) • dynamic digital health • multiple platforms • power loss • Connectivity • system issues •
5	Could you tell me about the device/s that you use for entering data in these online apps? !ा आप मुझे उन उपकरणों के बारे म9 बता सकते ह< िजनका उपयोग आप इन ऑनलाइन एप म9 डाटा भरने के िलए करते ह<?	Probe: • Operability (All the apps operable in one device) • Ease in using the device • Difficulties faced in using the device (System hangs, gets heated, stops working suddenly, takes longer to load) • What is done to address the above difficulties
6	What do you do when you face difficulty in using these apps? जब आप इन ऐG का उपयोग करने म9 किठनाई का सामना करते ह< तो आप ! <> T करते ह<?	Probe: • Whom do you approach? • Please elaborate on the process of how it's resolved • Any unresolved challenges
7	If you have received any training on using these online apps, please elaborate on that. यिद आपने इन ऑनलाइन ऐG का उपयोग करने के बारे म9 कोई टXेिनंग DाIY की है, तो कृपया उसके बारे म9 िव = ार से बताएं ।	Probe: • Duration of training • Content taught during the training • Kind of training: verbal or hands on training • Supportive supervision after the training • When did you last receive the training?

		• If not, how did you learn to operate these apps
8	What is your overall feedback of using online apps? Could you provide suggestions to improve your experience in using online apps ऑनलाइन ऐG का उपयोग करने के बारे म9 आपकी D◌िति[◌या ! ◌T है ! ◌T आप ऑनलाइन ऐG का उपयोग करने के अपने अनुभव को बेहतर बनाने के ◌िलए सुझाव दे सकते ह<	Probe: Please give your suggestions under the following: • Redressal process • Training • Addressing the workload • Equipment and connectivity related (Dual entry, multiple platforms, dynamic digital health)

Annexure 2: Questionnaire for Computer Data entry Operator

S.no.	Question	Response
1	Name of the respondent	
2	Date of birth	
3	Highest qualification	
4	No. Of years served in NHM	
5	No. Of years served as in the current location	
6	Please tell me about the different Digital health initiatives ANMs are using and for what purposes?	
7	If you monitor data entered by the ANMs, how do you ensure its validity and how often do you do it? If not, who is responsible for validating their work?	
8	If ANMs come to you for assistance related to using these digital platforms, how do you resolve their issues and what are the issues they generally face difficulty in? If not, whom do they approach?	
9	In what form do the ANMs send data (Paper or digital)	

10	If any training related to the use of online platforms for the ANMs is organized (RCH portal/ANMOL), please tell me about it. Probe: Content, duration, and type of training If not, how did they learn?	
11	In your experience, what has been the attitude of ANMs regarding training conducted? (Level of motivation, difficulty level)	
12	Do you think introducing DHI has improved the quality of data they enter? How can you say that?	

Annexure 3: Questionnaire for district MIS expert

S.no	Question	Response
1	Name of the respondent	
2	Date of birth	
3	Highest qualification	
4	Total years of experience in NHM	
5	Total years of experience in current designation	
6	If any training related to the use of online platforms for the ANMs is organized (RCH portal/ANMOL), please tell me about it. Probe: Content, duration, and type of training If not, how did they learn?	
7	What are your thoughts on supportive supervisory visits related to the use of online platforms for the ANMs (RCH portal/ANMOL)? Share your experiences	
8	In what form is the data being submitted by the ANMs?	Registers Digital Both
9	How do you think introducing digital health initiatives has affected the quality of data they enter?	

Annexure 4: ANM consent form and information Sheet

Informed consent

नम#ार!

आज मेरे साथ बात करने केिलए समय िनकालने केिलए, म2 आपको ध6वाद देना चाहती <ँ । म2 डॉ ि@या िसंह
<ं, जो एच.आर.एच (BIC और BIC नीित के िलए मानव संसाधन) िडवीजन के तहत एन.एच.एस.आर.सी (NHSRC) म कायरत ह2। अपने अायन के एक भाग के Lप म, म2 वतमान म एक शोध सवNOण कर रहा <ं, िजसका शीषक है, 'िदSी के ए.एन.एम (ANM)(सहायक नस दाइयो) के बीच िडिजटल BIC पहल का
उपयोग करने म बाधाओं और सुिवधाकताओं की खोज करना।' मुझे यह जानने म
िदलच[ी है िक िडिजटल BIC का एकीकरण कैसे होता है। आपके पा\]म मE की गई पहलों ने आपको अपनी भूिमका िनभाने के िलए @भािवत िकया है और इसके कायाॅयन म सुधार कैसे िकया जा सकता है, इस पर आपकी महaपूण @ित]या @ाb करने के िलए।

अायन को पूरा करने म आपकी भागीदारी बcत ही महdपूण होगी । इस @ि]या म भाग लेने का िनणय पूरी तरह Bैfक है। अायन के िलए आपको ऑनलाइन hेटफाम का इjेमाल करने के अनुभव से जुड़े सवालों का िवjारपूवक जवाब देना होगा। यिद आप भाग लेने के िलए सहमत ह2 तो म2 आपको आाशत करना चाहती <ँ की आपके mारा सांझा की गयी जानकारी गोपनीय रखी जाएगी और केवल अायन करने वाले लोगों के िलए उपलn होगी । कृपया छोटी से छोटी जानकारी भी सांझा करE qोंिक यह जानकारी हमारे िलए महdपूण हो सकती है ।

अपनी गित के साथ ताल मेल िबठाना थोड़ा मुsल होगा, इसीिलए म2 इस ऑिडयो tरकॉडर का इjेमाल कLँगी तािक इस चचा को बाद म uांसि]v कर सकूँ ।

qा आप इस इंटरwू मE भाग लेने के िलए सहमत ह2

यिद हाँ तो इस कंसEट फॉम के नीचे िदए गए जगह पे अपने हjाOर करE ।

@ितवादी के हjाOर _____

िदनांक _____

Background Details:

S.no	Code	Question	Options	Responses
Facility details				
1	A1	Name of the District		
2	A2	Name of the Block		
3	A3	Name of the HSC		
4	A4	Type of HSC		
Basic details of the respondent				
5	A5	Gender	Male Female Other	
6	A6	Date of Birth	DD/MM/YYYY	
7	A7	Highest educational qualification		
8	A8	Total years served as ANM		
9	A9	No. Of years served as ANM in the current facility		

Annexure 5: Key informants Consent form and information sheet

Informed Consent

Greetings!

I want to thank you for taking the time to speak with me today. I am Dr. Priya Singh, from NHSRC, HRH (Human Resource for Health and Health Policy) Division. As a part of my study, I am currently conducting a research survey titled, ' Exploring the barriers and enablers in using Digital Health Initiatives among ANMs of Delhi' . I'm interested to get a critical feedback on the adoption of these initiatives among the ANMs.
Your participation in completing the study will be very important. Before we begin, I would like to inform you that your response will be confidential .The decision to participate in this process is entirely voluntary.

I'll be using this audio recorder to transcribe this discussion later. If you agree to participate in this interview, then put your signature on the space given below this consent form.

Signature of the respondent _____

Date _____

Background Details:

S.no	Code	Question	Responses
Facility details			
1	A1	District	
2	A2	Sub district	
3	A3	Name of the facility	
Basic details of the respondent			
4	A4	Date of Birth	
5	A5	Highest educational qualification	
6	A6	Current designation	
7	A7	Total years served in current designation	
8	A8	No. Of years served in current facility	

priya Singh

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