Internship Training

At

HISP India

Design and Development of Patient Centric System for Primary Health Center

By

Deepika

PG/15/024

Under the guidance of Dr. Anandhi Ramachandran

Post Graduate Diploma in Hospital and Health Management 2015-17

International Institute of Health Management Research, New Delhi

(Completion of Dissertation from respective organization)
The certificate is awarded to

Deepika

in recognition of having successfully completed her
Internship

and has successfully completed her Project on

Design and Development of patient centric system for primary health center

13.2.2017 to 13.5.2017

HISP INDIA

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning

We wish her all the best for future endeavors

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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.

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Certificate of Approval

The following dissertation titled **"Design and development of Patient centric system for Primary health center"**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 **Post Graduate Diploma in Health and Hospital 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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This is to certify that **Ms. Deepika,** a graduate student of the **Post-Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled "Design and Development of patient centric system for Public Health Center" at "HISP INDIA" in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.**

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FEEDBACK FORM

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None

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ABSTRACT

Primary health centers (PHC) plays a major role in healthcare sector in providing initial point of contact to healthcare services. Services provided in PHC are for minor services for preventive care and treatment for minor illness. PHC in states of India is very important aspect in health industry as it is providing a initial platform for a patient to reach the service. Many PHCs are running without using the technologies for providing patient care.

Patient records are being maintained manually without using any technical system. This is the major area of concern. Health information system uses the IT based technology and maintains the healthcare service within a system. This helps in maintaining the record, tracking the patient, increases the connection between the patient and the doctor, increases interoperability and also helps by providing the data for secondary research. Patient centric system is required for the process to be converted into electronic process. This would increase the quality of care. This study covers all the aspect of what is the need of patient centric system at the PHC and how the system is being designed and developed. For carrying out the process requirements were gathered at the PHC. Accordingly, a system is planned to be designed and developed during this study. For this process DHIS2 is being used and customized according to the requirement of the PHC. DHIS 2 is the preferred health management information system at the PHC. DHIS 2 helps governments and health Organizations to manage their operations more effectively, monitor processes and improve communication. DHIS 2 is typically used as national health information systems for data management and analysis purposes, for health program monitoring and evaluation, as facility registries and service availability mapping, for logistics management and for mobile tracking of pregnant mothers in rural communities.With DHIS 2 Data can be captured in any type of device, including desktops, laptops, tablets, smart phones and feature phones. Most solutions work-offline, making them ideal to improve reach in locations with poor connectivity

Part 1

ORGANISATION INTRODUCTION

HISP India is a not for profit NGO specializing since more than a decade in designing and implementing solutions in health informatics for the public health sector in Indian states, and also recently in Bangladesh and Sri Lanka. They are not a solely technology focused Organisation, and pride ourselves for being multi-disciplinary and seeking to the knowledge domains of public health and informatics. They have a strong commitment to free and open source technologies, and work with a global perspective of the Health Information Systems Programmes (HISP) network, coordinated by the University of Oslo, Norway, and active in more than 20 countries in Africa and Asia.

The District Health Information System (DHIS) is a highly flexible, open-source health management information system and data warehouse. It is developed by the Health Information Systems Programme (HISP).The core development activities are managed and coordinated by the Department of Informatics at the University of Oslo, and supported by The Norwegian Research Council,NORAD, The University of Oslo, and The Norwegian Centre for International Cooperation in Education.

The solution covers aggregated routine data, semi-permanent data (staffing, equipment, infrastructure, population estimates), survey/audit data, and certain types of case-based or patient-based data (for instance disease notification or patient satisfaction surveys). The system supports the capture of data linked to any level in an organisational hierarchy, any data collection frequency, a high degree of customisation at both the input and output side. It has been translated into a number of languages.

PROFILE

HISP India is both a node in a global network called HISP Global coordinated from University of Oslo, Norway, and is helping to create a regional node around Health Information Systems for South East Asia. HISP India is comprised of a dedicated team of professionals from the domains

of informatics and public health, and also draws upon the global HISP network for specific expertise as and when needed.

Likewise, HISP India contributes to strengthening the global HISP network when its expertise is required.

HISP India subscribes to and supports the broader HISP agenda of creating "networks of action" which seeks to strengthen collaborative action by learning and sharing about health information systems, including around software, training material and implementation experiences, in a collective network. Learning in collectives is more effective than that done in singular sites, as we learn from each other and don't reinvent the wheel. This supports Global HISP and HISP India's strategy towards addressing challenges of scale and sustainability.

Vision:

To strengthen the development and use of integrated health information systems within a public health inspired framework in India and the South Asian region.

Mission:

To enable networks of collaborative action with like-minded actors who aspire to the ideology of open source software, open standards and decentralized decision-making to create complementary strengths in providing integrated and public health friendly health information systems.

OBJECTIVES OF THE ORGANISATION

- Create and contribute to advocacy networks that promote Open Source software and Open Standards in Public Health Systems.

- Contribute towards research related to integrated Health Information architecture that has at its core, routine aggregate reporting systems, patient-based integrated District Hospital systems, Human resource for health information system, mobile-based reporting systems, and Geographic Information Systems (GIS).

- Contribute towards the design, development and implementation of integrated Health Information architecture including the core components described above.

- Processes of design, development and implementation are based upon and guided by principles supporting participatory design and mutual learning.

- Actively promote the cultivation of an information culture in Public Health Systems, such that health information becomes a strategic resource that contributes towards improving health outcomes, and is not just used for upward reporting.

- Contributing to building internal capacity in health systems, such that they are able to internally sustain systems of assured quality, and scale them geographically and functionally based on their evolving needs.

SERVICES

- DHIS2 (District Health Information System)
- DHIS2 Mobile
- DHIS2 Tracer
- DHIS Hospital

DHIS 2

Collect, manage, visualize and explore your data

DHIS 2 is the flexible, web-based open-source information system with awesome visualization features including GIS, charts and pivot tables.

Data management and analytics

DHIS 2 lets you manage aggregate, routine data through a flexible meta-data model which has been field-tested for more than 15 years. Everything can be configured through the user interface: You can set up data elements, data entry forms, validation rules, indicators and reports in order to create a fully-fledged system for data management. DHIS 2 has advanced features for data visualization, like GIS, charts, reports, pivot tables and dashboards which will bring meaning to your data.

GIS

DHIS 2 features awesome web-based GIS features that lets you do thematic mapping of areas and points, view facilities based on classifications, visualize catchment areas for each facility. You can define custom legend sets and link them to indicators. The DHIS 2 GIS lets you put labels on areas and points and search and filter based on various criteria. You can overlay multiple layers and use Google Maps as background layer. You can move points and set locations on-the-fly. Maps can be saved as favorites and shared with other people.

Charts

DHIS 2 provides nice charting capabilities. It supports all the standard chart types like column, line, pie, stacked column and area charts. You can display trend lines, legends, titles, labels, target lines and baselines. Select easily from all of your indicators, Organisational units, time periods and other dimensions, and flip categories and series around as you like. Charts can be saved as favorites and shared. You can write interpretations of your chart data and discuss with colleagues. Charts can be downloaded as images and PDFs.

Pivot Table

DHIS 2 features a fully web-based pivot table which lets you analyse data along all data dimensions and arrange these on columns, rows and as filters at demand. You can include totals and subtotals and remove empty rows, and control display density, font size and digit group separator. Pivot tables can be saved as favorites and be downloaded and used as basis for offline MS Excel pivot tables.

Dashboard and social features

DHIS 2 provides a personal dashboard where you can put your favorite charts, maps and reports for fast access. You can search directly from the dashboard for analysis related to a particular subject or for other people. The dashboard features integrated messaging functionality which lets you communicate directly with other users. From the dashboard you can view the data interpretation feed - data interpretations shared from the various analytics modules will appear here so that you can better understand your data and your Organisation. From the feed you can comment on other people's interpretations and start discussions.

Data entry and validation

DHIS 2 lets you capture aggregate data on a variety of devices - it even works offline. If Internet connectivity drops during capture, data will be stored locally in the browser and you can continue working as before. When connectivity is back you can push data up to the online server. DHIS 2 can generate data entry forms automatically based on your data model, or you can design highly customized forms to cater for special needs. You can define auto-calculated fields inside the form, logical validation rules and set min and max values to improve data quality.

Tracker system

DHIS 2 enables you to collect, manage and analyse transactional, case-based data records. It lets you store information about individuals and track these persons over time using a flexible set of identifiers. You can capture information about anonymous events and cases as well. DHIS 2 lets you configure SMS-reminders, track missed appointments and generate visit schedules. You can create dynamic reports based on cases and generate on-the-fly statistical reports. For all programs you can easily create statistics and summaries on participation and completeness.

The DHIS 2 Tracker is an extension of the DHIS 2 platform and supports management, data collection, and analysis of transactional or disaggregated data. The Tracker shares the same design concepts as the overall DHIS 2 - a combination of a generic data model and flexible metadata configuration through the user interface that allows for rapid Customization to meet a wide range of use cases.

Common for all the use cases is that the transactional data can be easily aggregated and fed into the main aggregated data warehouse in the same DHIS 2 system, making complicated inter-operability setups redundant.

In addition to being a powerful HMIS tool for following up health programs, DHIS2 Tracker is also a simple tool for sharing critical clinical health data across multiple health facilities. The DHIS 2 tracker currently does not aim at becoming an advanced EMR system to support clinical care, but rather a basic transactional system that is easy to set up and that builds on an existing and proven platform and available technical capacity. On a national level, one may wish to combine the use of DHIS Tracker for some facilities with more advanced EMR systems for other facilities.

Features

- Collect transactional data - set up automated aggregation queries - populate the aggregated data warehouse directly - all in one system!
- Enroll individuals into longitudinal and chronic programs - schedule visits - set up automated SMS reminders - track missed appointments - improve retention.
- Define your own programs with stages - decide what to collect at each stage - all through the user interface.
- Generate daily or weekly visit schedules (work plans) for your facility or community health workers.
- Tools for tracking and following up patients who do not come to scheduled visits.
- Collect detailed ICD-10 codes for inpatient admissions and deaths to enhance data analysis of morbidity and mortality.
- Set up detailed maternal or neonatal death audits - analyse your data using the tabular reports with both case-based data and ad-hoc aggregation.
- Collect detailed health facility surveys (e.g WHO's SARA) - link to aggregated indicators - analyse your results on maps, dynamic charts, and pivot tables
- Collect data using mobile phones - online in web browser or offline with java clients

PART 2

DISSERTATION REPORT

INTRODUCTION ABOUT PRIMARY HEALTH CENTER

Patient centric system

Patient-centered systems are those information systems and devices that are operational in the clinical environment. A computer-based personal health support system can improve a patient's quality of life and promote more efficient use of health care. Patient centric system help to enhance the health care services by developing a connection between the patient and the healthcare providers. Patient centric system maintains the continuity of care by tracking the patient through the record maintained within the system.

Primary health centers

Primary health centers are the state-owned rural health care facilities in India. They are essentially single-physician clinics usually with facilities for providing initial treatment. They are part of the government-funded public health system of India and are the most basic units of this system.

Primary Health Centre is the cornerstone of rural health services- a first port of call to a qualified doctor of the public sector in rural areas for the sick and those who directly report or referred from Sub-Centres for curative, preventive and promotive health care.

The objectives of PHCs are:

i. To provide comprehensive primary health care to the community

ii. To achieve and maintain an acceptable standard of quality of care.

iii. To make the services more responsive and sensitive to the needs of the community.

Services at the Primary Health Centre:

Medical care Essential

OPD services: Total of 6hours of OPD services is given for the patient at PHC. There are different time schedule which vary from state to state. Minimum of 40 patient per day per doctor is expected within PHC OPD service.

Emergency services: A PHC should have 24 hours of emergency services which includes management of injuries and accident, first Aid, stitching of wounds, stabilization of condition of the patient before referral and other medical conditions. These services is provided by the nursing staff and when further in need Doctors is present.

Maternal and child Health Care

- Antenatal care

Antenatal care is type of preventive healthcare which aims of providing regular check-ups that allow doctors to treat and prevent potential health problems throughout the course of the pregnancy and promotes healthy lifestyle. In antenatal care early registration of all the pregnancy in the first trimester is done. During this care minimum of 4 antenatal checkups is given to the pregnant women.

Suggested schedule for antenatal visits:

1st visit: Within 12 weeks—preferably as soon as pregnancy is suspected—for registration of pregnancy and first antenatal check-up.

2nd visit: Between 14 and 26 weeks.

3rd visit: Between 28 and 34 weeks.

4th visit: Between 36 weeks and term.

Nutrition and health counseling is important for a pregnant women, which is being provided within the Primary health center for better point of care and services. At the PHC, there is tracking of the missed out and the left out ANC is being taken under care of service provided.

- Post natal care.

Post natal care is the period which begins immediately after the birth of the child and extends for about six weeks.At a PHC Post natal care service is provided to mother and child which ensures care for 0 and 3 days at the health facility both for mother and new-born and send direction to ANM of the concerned area for ensuring 7^{th} and 42^{nd} day post-natal home visits. During this period, Breast-feeding within one hour of birth is initiated. There are counseling on nutrition, hygiene, contraception, essential new born care and immunization is being provided to the mother. Provision facilities under Janani Suraksha Yojana(JSY) is being explained.

- New Born care

During the new born care, breast feeding within one hour of birth is initiated. This care requires the management of neonatal hypothermia, infection protection, cord care and identification of sick newborn and referral

- Care of the child

Routine and emergency care of sick child is provided during this care. During this phase counseling is given on exclusive breast-feeding for 6 months. The growth and development of the child under 5 is also being assessed and timely referral is made.

Full immunization of the infants and children against preventable diseases is given. There is also the management of severe acute malnutrition cases and referral of serious cases after initiation of treatment present.

Nutrition Services

There is diagnosis of malnourished children and nutritional advice is also being provided to children, pregnant women and others. There are provisions of diagnosis of anemia and vitamin A deficiency.

Functions:

- The main function of Primary Health Center is to provide good quality of medical care
- PHC provides Maternal-child health including family planning
- PHC initiates the safe water supply and basic sanitation
- PHC prevents and control of locality endemic diseases
- It collects and reports vital statistics
- It educates about health
- PHC initiates national health programs
- It provides referral services
- Training of health guides, health workers and health assistants is given
- There are basic laboratory workers present at the PHC

ABOUT PUBLIC HEALTH DISPENSARY (PHD), SECTOR 25 - CHANDIGARH.

The Public Health Dispensary at Sector 25, Chandigarh is one of the 4 urban dispensaries falling under the ambit of PGI, Chandigarh. This facility caters to a catchment of 31,000 individuals with a daily patient load o f30-35 patients. The facility also has an MCH center that provides immunization, ANC checkups and family planning counseling to its patients. The MCH is the only computerized unit using the National MCTS portal for mother and child tracking for name based data and the DHIS-2 application for sharing monthly statistics with state for services rendered at the MCH facility.

The facility is manned by a MPW, who is also responsible for registration of patients along with drug dispensing. Annual and monthly CR numbers are given to each patient. A register is maintained for capturing registration; the demographics captured are: Registration Number, Date, Name, Age, Sex and Address. For a revisit patient, the number of the patient is tracked

from the register and a new slip bearing the same number is issued to him with the old registration number.

The facility receives drugs and items from the Directorate of Family Welfare(DFW) and from Post Graduate Institute of Medical Sciences, PGI. All drugs are dispensed free of cost to patients. The Drugs and items are received by the facility on raising an Indent to both agencies on varying frequencies. A Drug consumption report is shared with both agencies on a monthly basis. Some of the laboratory tests such as Blood sugar using glucometer, Hemoglobin using Sahli's Method, HIV test using rapid test kit, Pregnancy test using Nischay pregnancy test kit (Government pregnancy kit) and Urine analysis for glucose & protein using urine reagent strips are conducted within the facility. The facility is manned by two doctors a Senior and a Junior resident. If required, the patients are referred to: Civil Hospital/CHC, Sector -22 ,Govt.Hospital/District Hospital Sector 16 or GMC&H Sector 32.

Data on two reporting formats is shared by the facility with the UT

1. On a weekly basis, form P is sent to the UT for sharing the morbidity pattern.
2. On a monthly basis, an RTI/STI report is shared.

The ANM prepare monthly reports as per the requirement of National Health Mission and forward the same to NHM, office in sector-22. In addition, a compiled monthly report is also shared with PGI

There are4 ANMs and 4 ASHAs in the Public Health Dispensary. They carry out the programs which are a part of this Public Health Dispensary. They are responsible for maintaining registers and generating reports which has been detailed in the previous section. The ANMs and ASHAs have the following weekly schedule as detailed in the table below:

Day	Work
Monday	Field day-ANC, PNC and Immunization drop out Visit (Upto 10 Visits)
Tuesday	ANC Check-up and MCTS report
Wednesday	Immunization
Thursday	Field day- ANC, PNC drop out and MCTS report
Friday	Field day- ANC, PNC drop out
Saturday	Immunization

Key actors and work processes in the PHC sector

Given the focus of the project on patient centric systems for PHC actors, we identified the following actors within this sector whose work the proposed system should support.

- **Anganwadi worker**

The Anganwadi worker provides basic health care in Indian villages and they work at the village level. They are part of the integrated child development services (ICDS) program and they come under the Ministry of Women and Child Development. They provide care for newborn babies and ensure that all children below the age of 6 are immunized. They provide antenatal care for pregnant women and post-natal care to nursing mothers. The required nutrition to children, nursing and pregnant women is also provided by them. They ensure that regular health and medical check-ups for women take place and that all women and children have access to these check-ups.

An Anganwadi worker usually takes care of a population of 1000 people. She is usually supported by a helper. The Anganwadi worker lives in the same village where she provides health care services and maintains the most comprehensive record of the demographic information and services provided to the people in the village. They also assist the ANM and ASHA workers by sharing records of the population and other health services they provide.

The Anganwadi workers have a paper based recording system. Some of the registers they maintain are as given below:

- Family Register
- Supplementary Food Stock (English)
- Supplementary Food Distribution (English)
- Preschool Education (English)
- Pregnancy & Delivery (English)
- Immunization & VHND (English)
- Vitamin-A Bi-Annual Rounds (English)
- Home Visits Planner (English)
- Referrals (English)
- Summaries (Monthly and Annual) (English)
- Weight Records for Children (English)

- **ASHA**

The ASHA is a community health volunteer instituted by the Ministry of Health and Family Welfare (MoHFW) as part of the National Rural Health Mission (NRHM). They are volunteers and receive financial compensation for the services they provide. The ASHA workers support the ANMs. The ASHA and Anganwadi workers work together to motivate and mobilize women to avail the health services.

The ASHA also work closely with the ANMs for taking surveys, providing antenatal and postnatal care, immunization services. The ASHA workers act as a link between the village and the ANM. The ASHA maintain a register or assist the ANM to maintain registers. On a monthly basis, they provide data on the services they provide to the ANM, who takes this into the monthly reports.

- **ANM**

The ANM workers are a part of the Ministry of Health and Family Welfare (MoHFW). The ANM workers work as part of a sub-center and they are the first contact person between the community and health services. All programs in the PHC are implemented by the ANM and they have predefined formats for their registers and monthly reports. The ANM workers go on field visits to provide health services. They enter the details in a field work diary. After coming back to the sub center, they enter these details in various registers. They maintain around 28 registers and also prepare monthly reports for various systems which use these data.

The ANM maintains paper based registers of the population similar to the Anganwadi worker. The register maintained by ANM is available to the health department and has a few additional columns. The work plan is ANM wise. The ANM , looks up at the various registers and marks the status in the work plan. The ANM together with the ASHAs maintain the following paper based registers:

- Survey & Eligible Couple Register
- Prenatal & Birth Register
- IUD/Still Birth Register
- ANC Register
- Death Register
- MTP Register
- Family Planning Register
- JSY Register
- Home Visit Register
- RCH Register
- NPCDCS Register
- Tracking of Children
- Daily Attendance register, ANC, PNC, Child Immunization
- Nutrition & Health Education Register
- Health Talk
- Stock Register
- Register for Growth monitoring

- Register for Immunization
- Register for Malaria cases (passive surveillance)
- Register of accounts including untied funds.
- Register for water quality and sanitation
- Register for Minor ailments
- Registers for National Health Program guidelines (NLEP, RNTCP, NVBDCP, etc.)
- Register for Equipment Furniture and other accessories

The various reports generated at the sub-center include

- Monthly RCH Report
- Maternal Death Report
- NPCDCS report
- Monthly Birth Report
- Monthly report of family planning
- Monthly Vaccine report
- IUCD report
- Home Delivery reason report
- Severe anemia report
- Child death review report
- LBW birth report

- MTP report
- RT/STI
- IUD/Still Birth
- HMIS report
- Annual survey report
- High Risk Pregnancy Report
- JSY report
- Worker wise Report
- National Immunization Program report
- Monthly report of performance of ASHA worker
- Incentive report of ASHA
- Morbidity Report
- IDSP Weekly report

- **Medical officers in PHC**

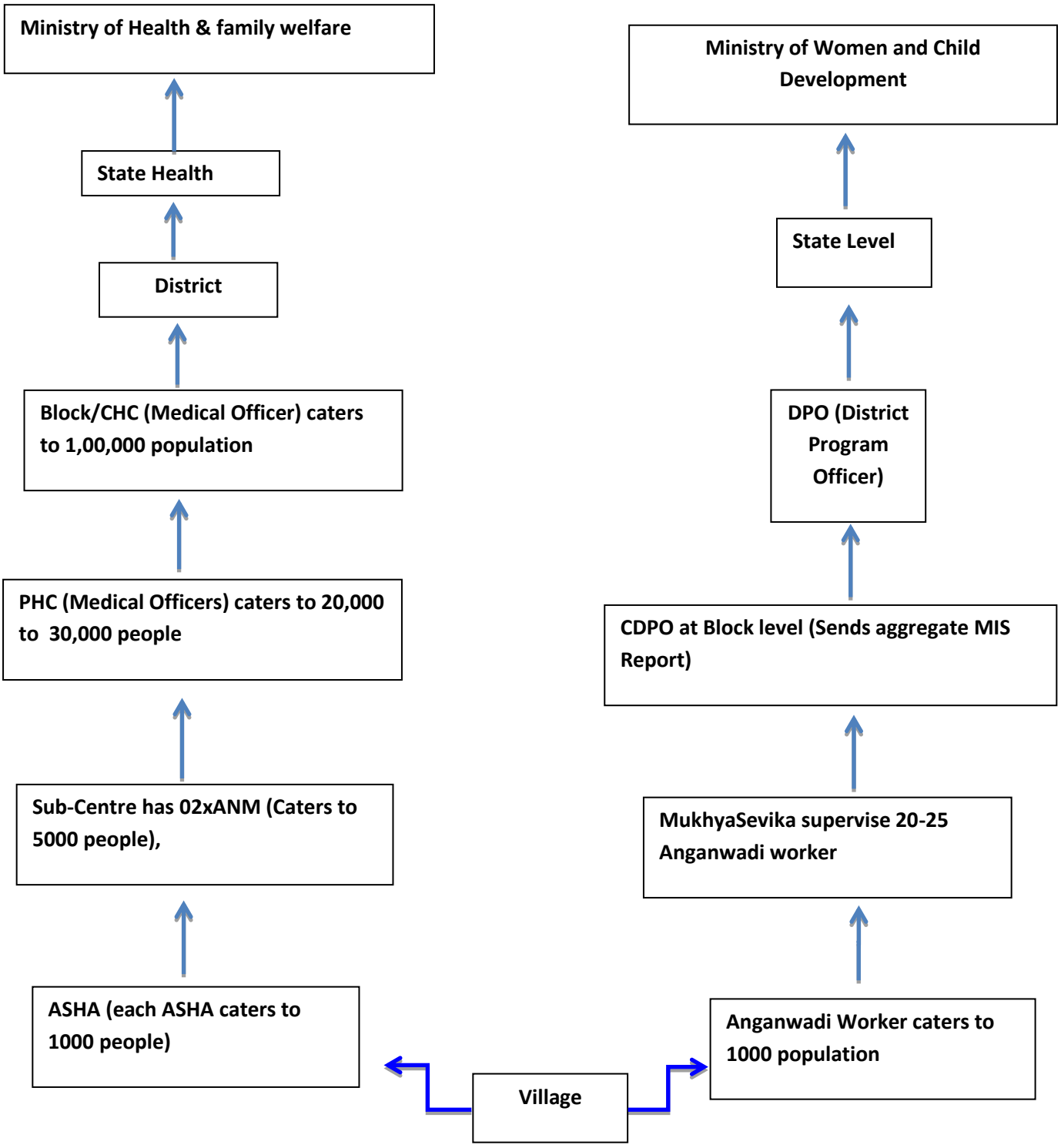
The primary health centers are the first point of contact between the Medical officer and the community. The PHCs cater to a population of 20000-30000 people. The functions of a PHC include:

- Medical Care
- MCH and Family Planning
- Safe water supply and basic sanitation

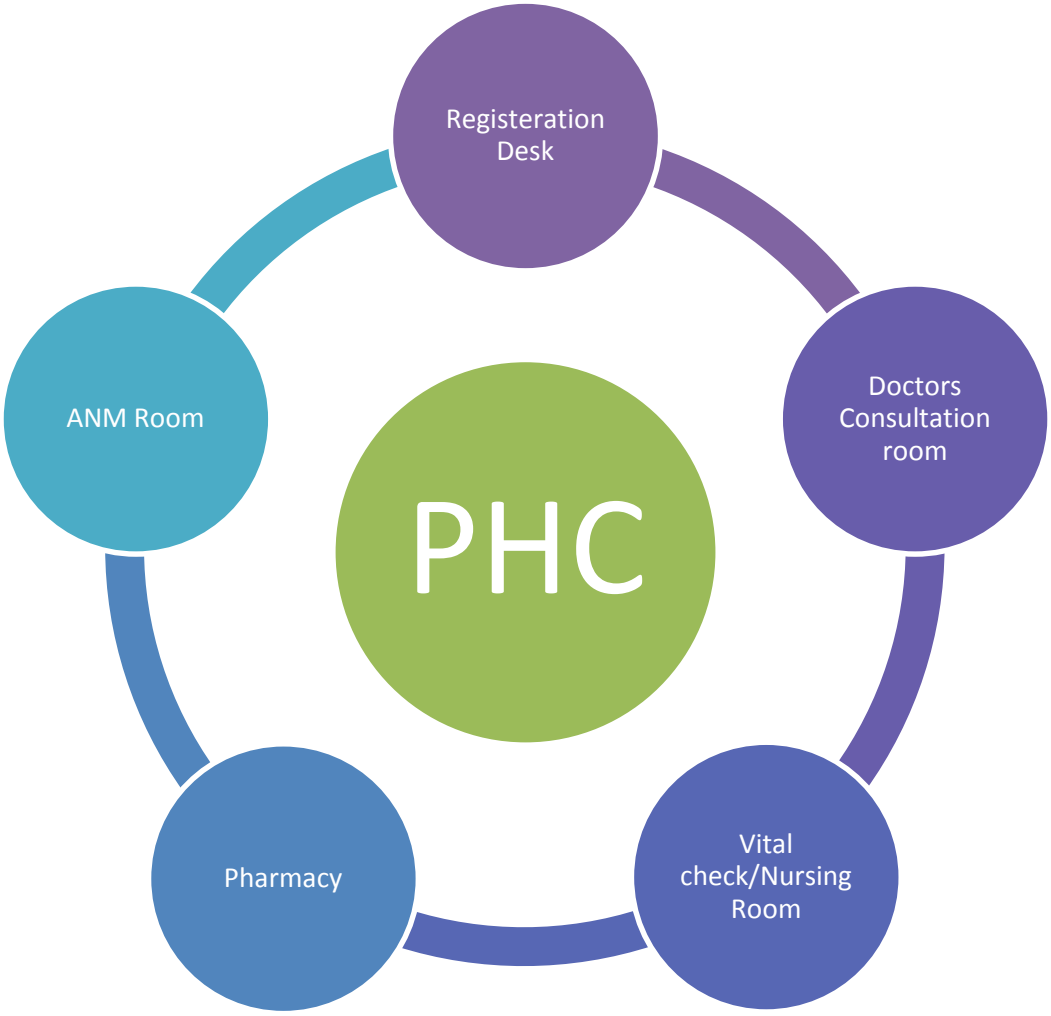
- Prevention and control of local endemic disease
- Collection and reporting of vital statistics
- Education about health
- National health programs
- Referral services
- Training of health guide, health worker etc.
- Basic laboratory services

The medical officer screens the patients for various chronic diseases. The patient is then diagnosed and prescribed medicines. They maintain their own set of registers for chronic diseases like Blood pressure, Diabetes. The medical officers also refer patients to higher medical institutions (Ex: District level hospitals) for diagnosis and treatment. All these details are recorded in various paper based registers. The medical officers send a monthly electronic summary report to PGIMER. This is based on the monthly morbidity report.

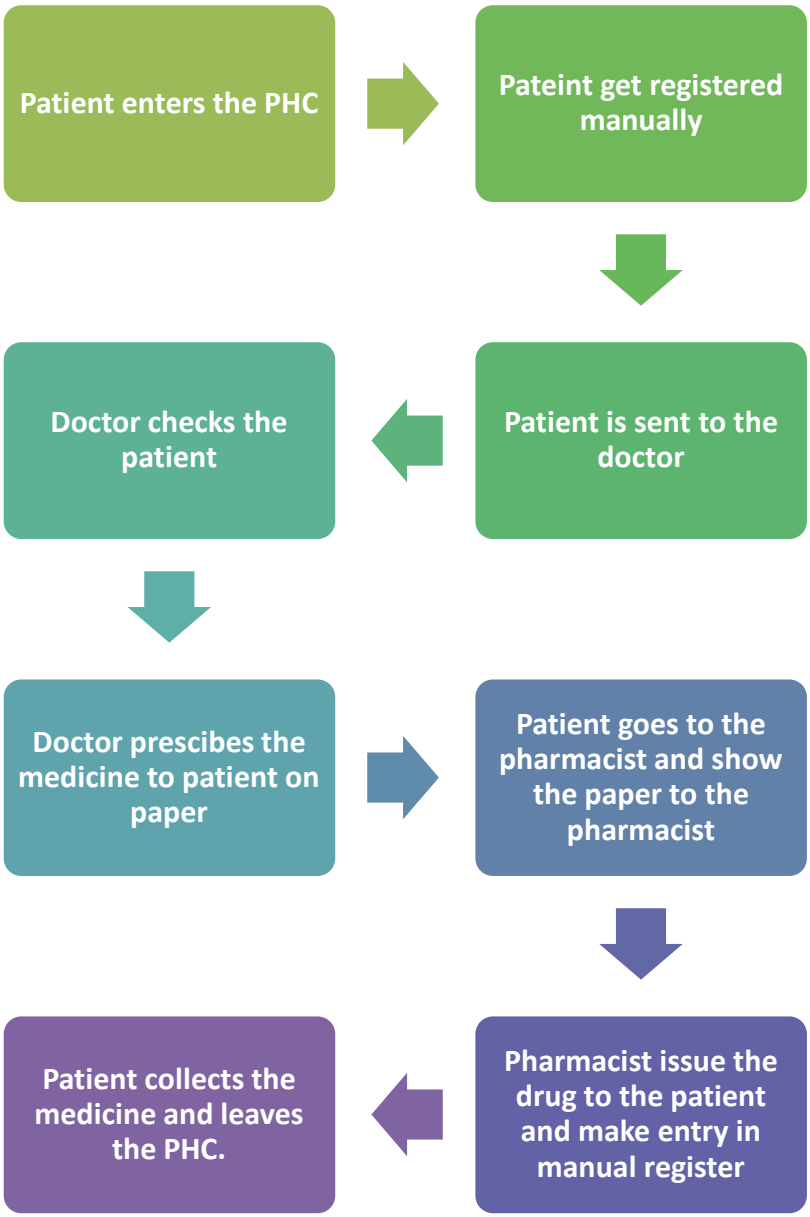
Interconnections and information flows



Departments within the PHC

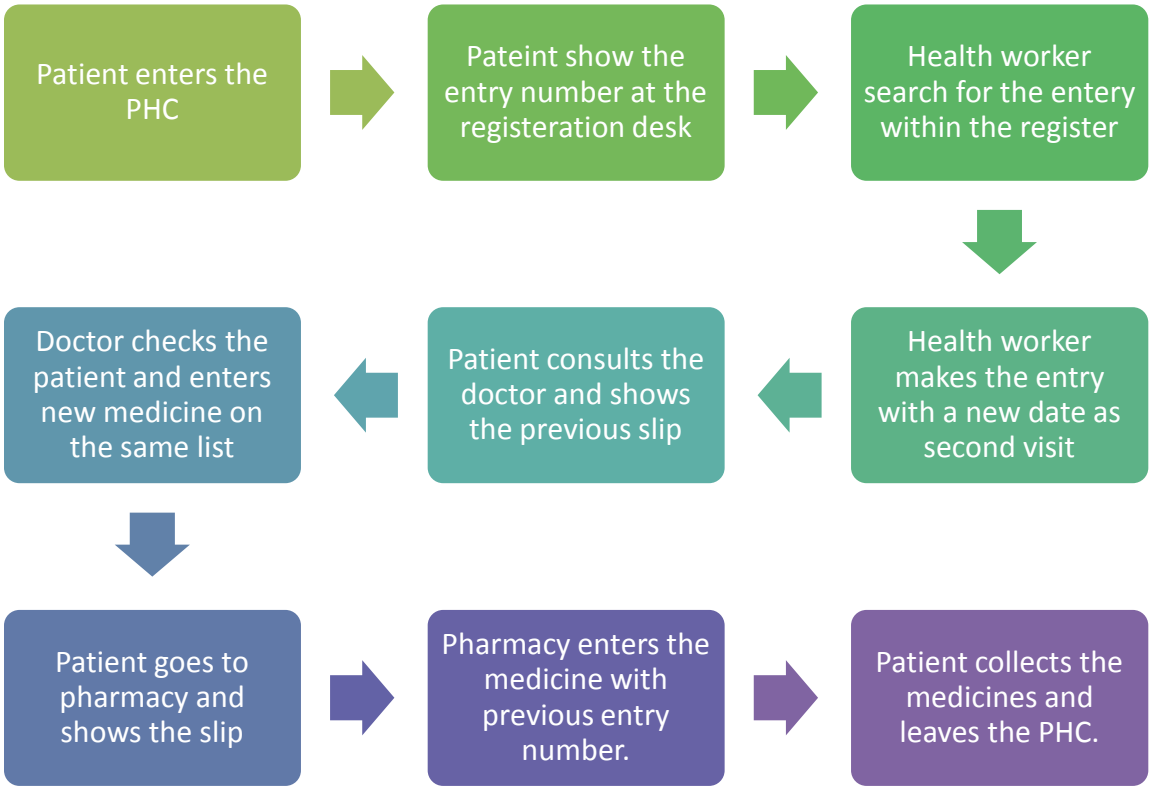


Workflow within the PHC for a new patient



Patient care within the PHC is being provided without using any computer based technology. When patient comes to the PHC for the first time, patient gets registered by the health worker within a registered which is being maintained manually. New entry is made within the register, entry number is being issued to the patient. The health worker takes the demographic information from the patient which generally includes patient name, address, age, sex etc. The information is stored within the registered within the PHC. The patient then consults the doctor. The doctor checks the patient and prescribes medicine and some test, if required. Doctor provides the prescription on a slip. The patient takes the slip to the Pharmacist. Pharmacist checks the medicine and makes a new entry of the patient within the pharmacy register. Patient collects the medicine and leaves the PHC.

Workflow within the PHC for follow-up patient



When a patient comes for follow-up at the PHC, the person on the registration desk search for the patient previous entry within the register. The worker makes the entry as second visit with the same registration number. The patient visiting for follow-up carries the same slip of last visit. Patient goes to the doctor with the same slip. The doctor checks the patient and prescribes medicine to the patient. The doctor makes the entry on the same slip. The patient carries the slip to the pharmacist. Pharmacist checks the slip and issue the medicine to the patient and makes the entry as second visit. The record is maintained within the register manually. The entry for follow-up is maintained separately which is only being linked by the registration number.

The PHC register consist of different formats. These formats are:

- Child health
- Eligible couple
- Household
- Household member
- Maternal health
- NPCDCS

ABOUT PROJECT

INTPART

International Partnership

INTPART is a collaborative project between School of Public Health (PGIMER), University of Oslo (UiO) and HISP India. The projects aim to carry out collaborative research on the design, development and use of health information systems to strengthen health services delivery in primary healthcare setting. It involves carrying out empirical studies for understanding existing systems and developing of patient centric system in field practice areas of PGIMER. The project started in April 2016 and will further continue for next two years.

Research partners and Collaboration

- Post Graduate Institute of Medical Education Research (PGIMER), Chandigarh, India Centre of Excellence, Medical Education .Interest to strengthen their informatics expertise.
- University Hospital, Oslo, Norway. C3 (Centre for Connected Care project) .Interest to learn about Connected care in LMICs.
- Department of Informatics, UiO and HISP India. HISP project – focus on aggregated system . Interest to strengthen knowledge of patient centric systems

RATIONALE OF THE STUDY

Current process do not enhance the quality of care

Patient care at the PHC is being provided to the patient at a very base level. The record at the PHC is maintained manually, entering within the register. The PHC is present in between the slum area. Different types of patient visits the PHC for the treatment. The patient registers himself within the registration desk. There is no proper entry being made within the PHC. There are different registers present, where patient health information is stored. The register mainly consists of demographic information of the patient. There a new entry being made for the follow-up patient with only same entry number. The records do not link to previous visits of the patient. Doctors prescribe the medicine on a paper slip. There no record of the patient present with the doctor. There is no proper record maintained about the drugs issued to patient and treatment given to the patient. This process decreases the quality of care provided to the patient.

There is need to develop a system where proper health information of the patient can be stored, the patient can be tracked, linking every visits of the patient to the PHC, linking household members with each other, patient history can be maintained. The system should be able to track the patient, data can be entered and maintained, it should be easy to use.

This study is being proposed to conduct the task mentioned. This study requires the gathering of the requirements from base level to design the system. There are different actors performing within the system. The workflow from the current manual system requires the need to be changed to electronic patient information flow. The rationale of this study is basically to change manual patient task performing process to electronic one.

OBJECTIVE

To design and develop a patient centric system using information technology for primary health center

Specific Objectives

- To study the existing manual workflow of the PHC and identify the problem
- To gather the requirements
- To design the patient centric system according to the requirements gathered.

SCOPE OF THE STUDY

"Designing information systems for strengthening patent-based care"

PHCs are the first contact point that provides comprehensive Health care to the community Primary Health Center plays a major role within the healthcare sector. It requires proper functioning so as to provide a good quality of care to the patient. PHC consist of proper workflow within the system. There are actors present within the PHC, who perform various task accordingly. The PHC of Chandigarh of consist of a manual system. The patient record is maintained manually. There is no specific tracking of the patient. The medical information is stored within the PHC using manual maintained registers. This study gathers the requirement for the need of developing a patient centric system. Patient centric system would convert the process of maintaining the record manually into electronically. Tracking of patient would be possible in the system. Presently the systems are only serving for the purpose of the administrators, and there is need to have a system which will empower the consumer.

PROJECT MANAGEMENT PLAN

Project Desired outcome

1. The system should be integrated with existing systems and work processes, seeking to rationalize, and not becoming yet another system.
2. The system should aim to reduce the work burden of the PHC workers.
3. The system should strengthen the use of information for local action.
4. The system should be user friendly and easy to use even for level of ANMs/ASHAs.
5. The system should be scalable, and present a model which could potentially be taken up at the state level and more.
6. The system should be such that it can be primarily managed and evolved by the state system, and not be reliant on external consultants.

Constraints

Population database - As the project focus is to capture and provide health services to each and every citizen of the population, during the workshop in PGIMER, discussion on population database was held. During this discussion, several options were discussed which can be used as baseline database e.g. Aadhar database, Ration card, survey of households etc.

Eventually, it was decided to use either Aadhar database or else a new survey needs to be conducted for all the households. Aadhar database has already covered 95% of the total population but as per guidelines of government of India Aadhar database cannot be used for any of the application without consent of individual for using his/her data. So Aadhar database cannot be used for this purpose and we have to find some other alternate for population data.

Proposed Approach

As per our understanding from the information shared during the workshop, PGIMER needs a system in Sector 25 PHC and Khera PHC which can cater as the solution to duplication within the different registers used to capture information. The meta data will be created in the application(DHIS2) after rationalisation of the registers so that duplication can be removed. There will be another system(OpenMRS) for EMR where 3 modules will be functional

1. Registration
2. OPD
3. Pharmacy

But there will be certain stages in development of both the systems

Requirement analysis

Development of new functionalities will be based on a detailed functional requirement by talking to concerned stakeholder and the study of different formats and information flows. This understanding will be taken and documented which will be used as basis for the design document to guide the development and testing process.

Design and Development

Data model of existing DHIS application will be used to cater the requirements. All the functionalities and reports would be developed, using the existing core DHIS2 functionalities. All additional functionalities and features, including reports would be created by the team. HISP India will work in collaboration with the DHIS2 core team in Oslo.

Testing

Once the prototype is done, testing of the base functionalities would be done to make the application free of errors. Different types of testing and test deliverables will be applied depend on the phases and test plan. Testing will be started from the first phase of the development this

will include Unit test, Integration testing, Functional testing and User acceptance testing. For user acceptance testing, the application will be hosted on a test server and access to the same will be given to PGIEMR team to test. Once the test application is tested okay with all the test phases it will be ready to host on main repository.

Documentation

User guides and documentation will be provided with each release or prototype. Along with manual release notes will be made available in order to better understanding and smooth release of each prototype.

Implementation

The tested application will be hosted on main production server and HISP India will continue to provide technical support remotely as and when required.

Quality Management Process

The meta data is first created on Excel and verified at different level to maintain the quality, once the meta data has passed with the quality assurance process then the meta data will be created in the application. Different cycles of functional testing will be performed on the product at different levels. Once the product will pass all the phases of testing and quality assurance then only the product will be deployed production environment.

Data Migration (Population Survey)

Population Survey data need to be migrated into DHIS2, before that the data need to be collected.

METHODOLGY

Study Design - Descriptive study

Sample - Doctors, ANMs, ASHAs

Method - Discussion, Workshop for Requirement gathering

Tools used

- Flow chart
- Architecture diagram

WORKSHOP

A team from HISP India visited PHD-25 & PHC Kheda to workout the infrastructure requirement and workflow. Two day requirements analysis workshop conducted in PGIMER on December 21-22 including staff from PGIMER, UiO, HISP India and community health workers from the Punjab health system. During the workshop different stakeholders (National Ministry, NIC, CDAC, UiOetc.) presented experiences related to various patient centric systems. The workshop thus helped to gain experiences related to such a system, best practices, challenges, and approaches all of which help to provide design inputs shaping the system development process being proposed under this INPART project.

PROPOSED PROCESS

In the community the ANMs, ASHAs and the Anganwadi are part of Health Department and Ministry of Women and Child development. Both work towards improvement of Health status in

the community, the ANMs and ASHAs provide holistic healthcare the Anganwadi worker task is focused more towards improving the nutritional status and providing non-formal education to vulnerable population.

ANMs maintain registers for all types of services provided through Sub-center and PHCs. All the registers have predefined fields. The registers are usually very large in size so during field visit ANMs write the visit details in diaries and copy them in registers after coming back. ANMs spent 2-3 hours every day for making entries and 3-4 days are spent entirely on making reports at the month ends. On an average 40% of ANMs time is spent on making register entries and preparing reports. The register helps them in determining the services due to the beneficiaries. ANMs have to maintain large numbers of registers for each service as one registers can have entries for only 2000-3000 population and during the ANC, PNC and immunization clinic they have to keep all registers open to search out the individual entry who has come to receive the due service. They have about 16-18 different registers and demographic details of the individuals have to be entered in all of them. Two newly introduced registers RCH and NPCDCS also needed to be maintained. The RCH register was found to be very comprehensive and have various sections such as eligible couple, ANC section, PNC section, Child immunization section.

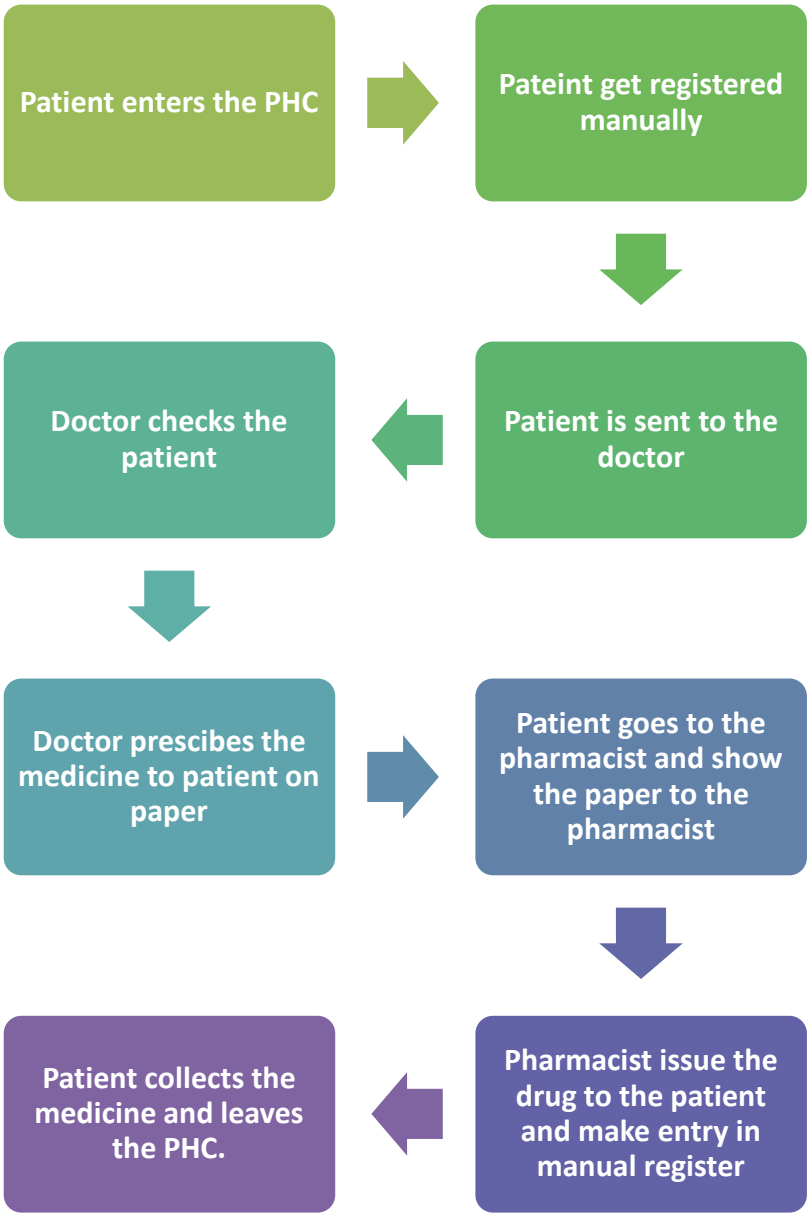
A electronic database of all individuals in a community is to be developed by integrating all registers. ANMs will convenient to use workplans generated through computers as they would not have to open registers. The Informatics system can be designed which can be user friendly and able to integrate the information contained in the PHC registers.

Presently each mother is given a mother child card in which manually entries are made for the services provided & services due and a system is needed where an similar electronic card can be generated and individual should have access to see his record through his login user id and password. Each chronically ill patient maintains a copy of his treatment record, a possibility should be wherein patient gets the ownership of his data recorded electronically.

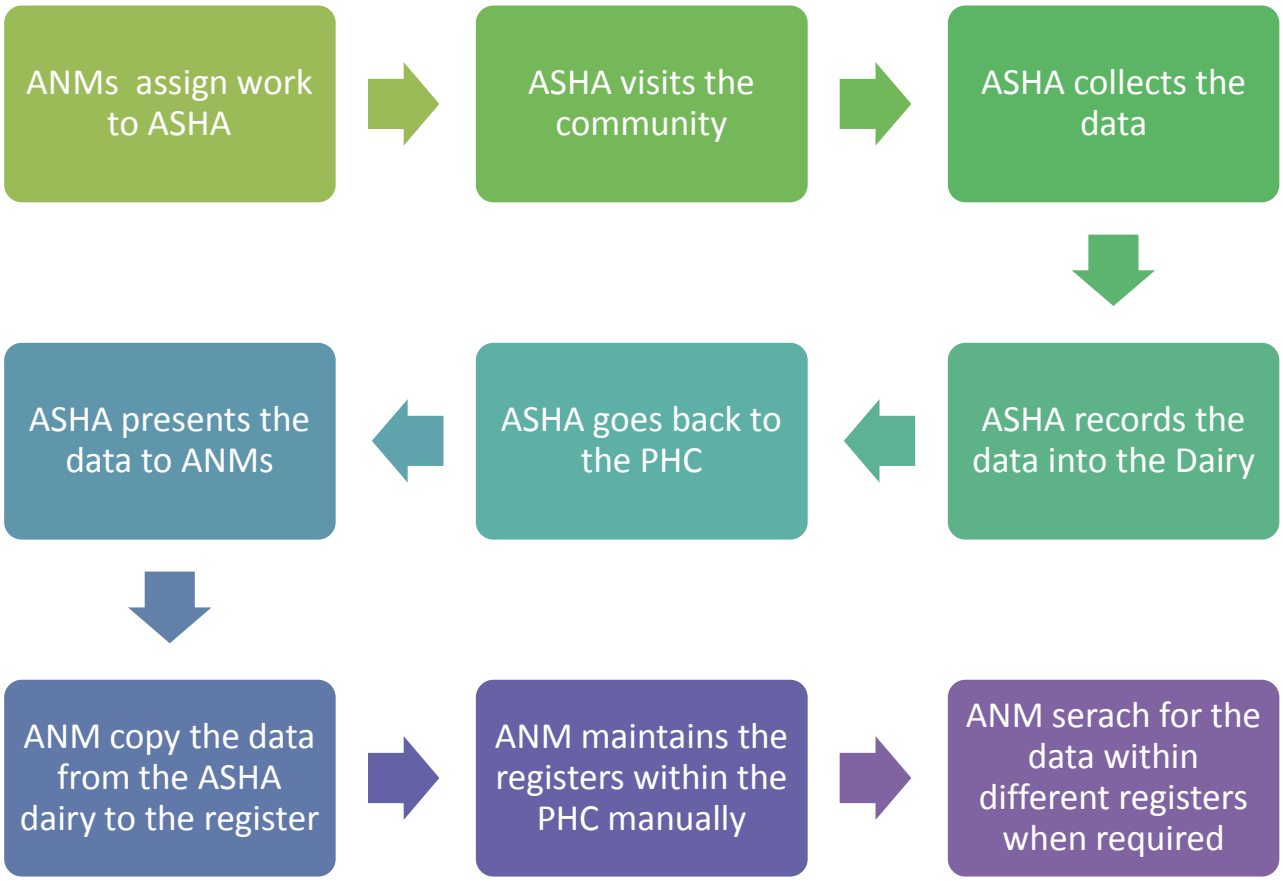
Presently there are about 20 registers which are required to be maintained at PHCs and most of these registers have duplicity of records especially of the demographic details. In the suggested system there will be stages, like in the first stage all the fields of demographic details will be entered then specific details will be entered using stage wise performa. Once all the details have

been entered all the required reports can be easily generated. In the system as the patient arrives in the PHC we will be able to search the patient if he is there in our database and then we fill out his current information, if his details are not there in our database then we can register the individual and a database of the same will be formed in the system.

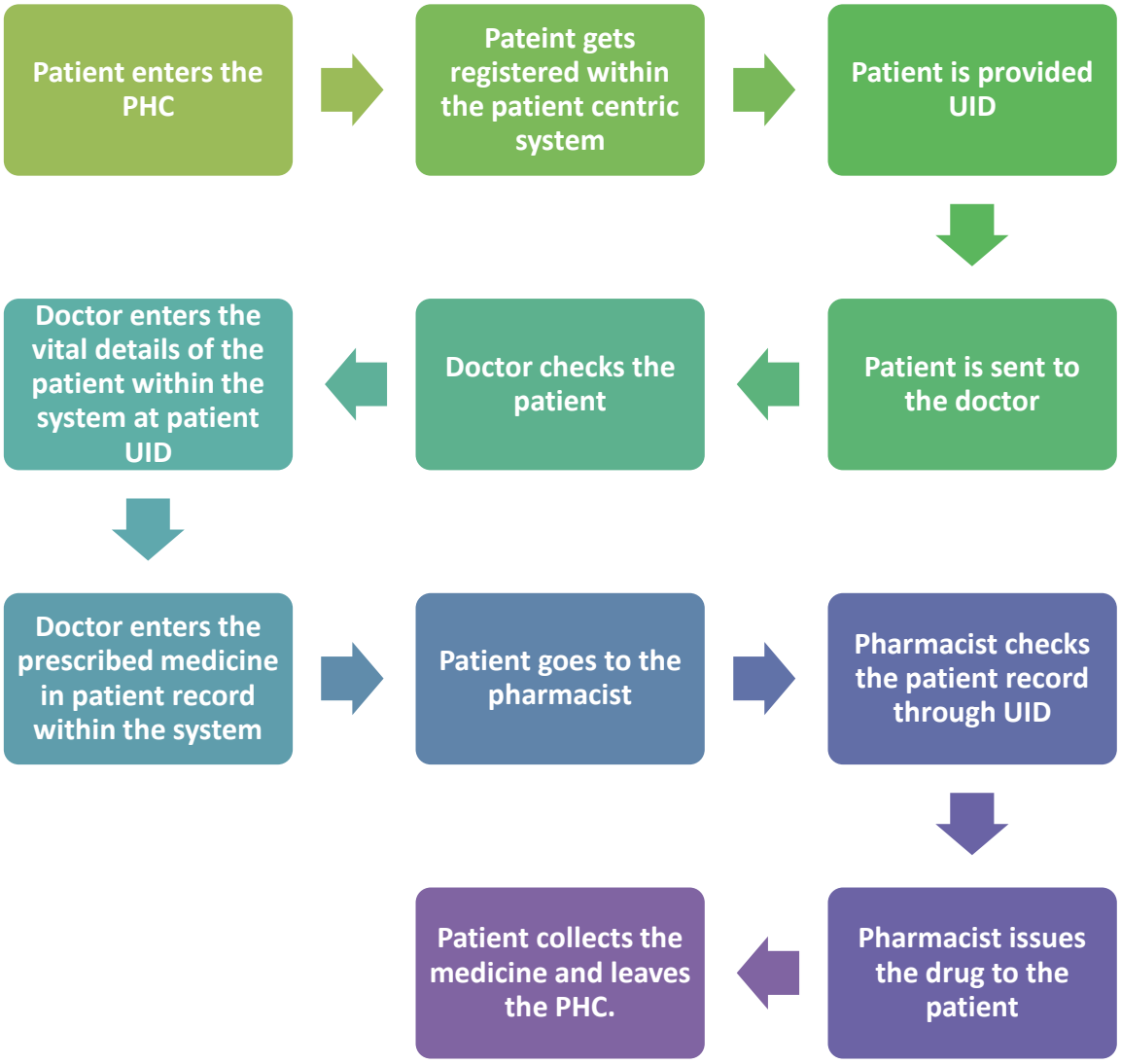
Existing workflow of the PHC



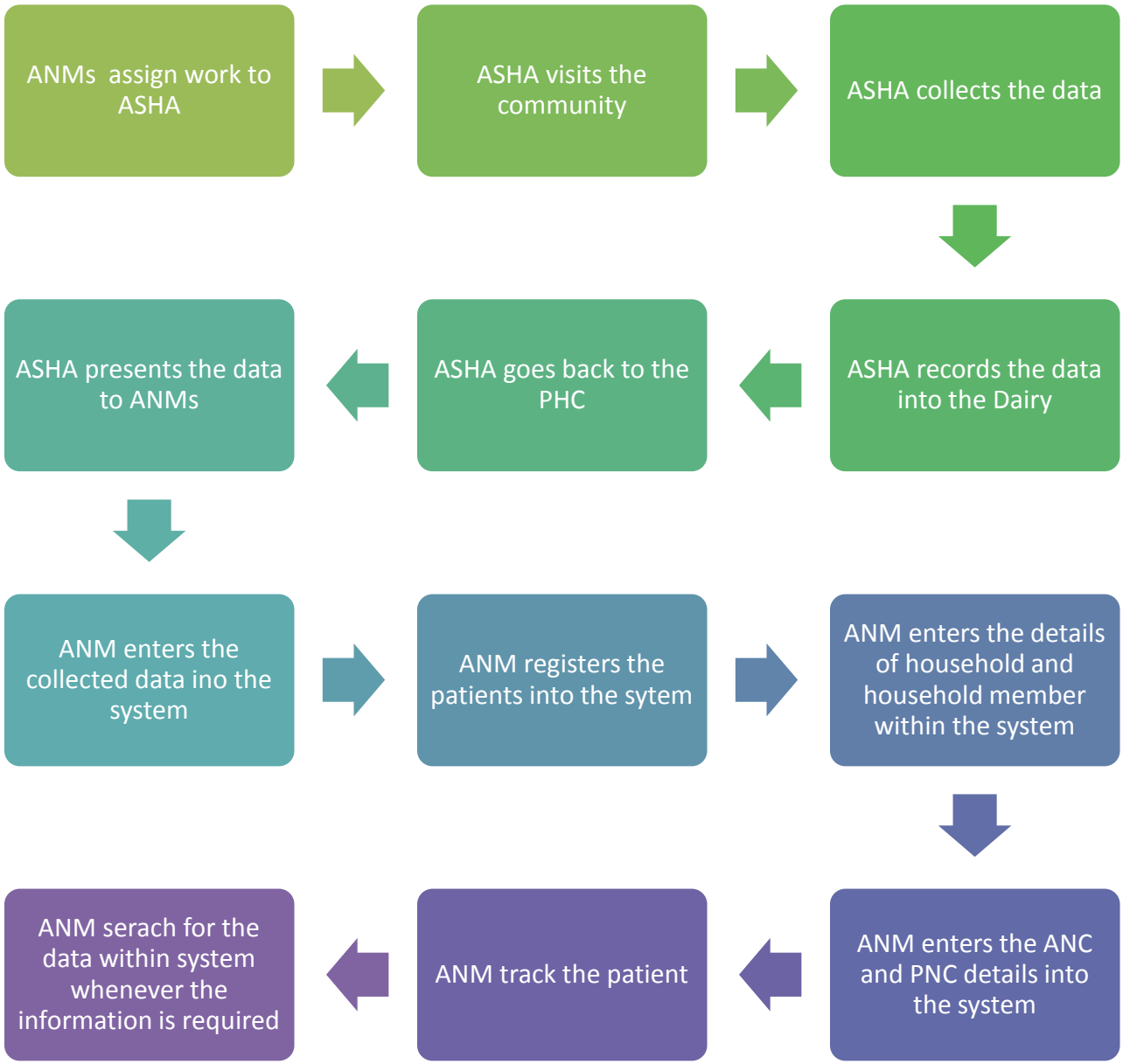
Existing workflow of ANM and ASHA



Proposed workflow of the PHC



Proposed workflow of ANM and ASHA



REQUIREMENTS GATHERED THROUGH WORKSHOP

Requirement for the patient centric system was gathering during the two day workshop conducted at PGIMER. During the workshop the current flow of the PHC was discussed.

Through the discussion about the workflow and challenges faced by the health workers at the PHC, the following requirements were gathered:

- The PHC should have an Integrated system Database.
- The PHC should have a community health information system, i.e. DHIS2.
- The DHIS2 should cover all the registers present at the PHC, which includes Maternal child health, Child immunization, Eligible couple, NPCDCS, Household members and overall Household register which collectively includes all the members of the family.
- There has to be defined elements present with option sets where required.
- The ANMs should be able to understand the system.
- Also a need of a Hospital information system for clinical services covering 3 modules Pharmacy, Registration and OPD, openMRS customization and installation.

DESIGN AND DEVELOPMENT

System architecture

Community health information system

For this process DHIS2 tracker is being used at the facility. This consists of ANM record maintaining and tracking of patient using population baseline. This system allows recording and tracking of the patient enrolled in various programs. Various programs have been customized as modules in DHIS2

Some of the key functionalities offered by DHIS Tracker include:

- Developed as a module inside DHIS2 to enable the tracking by names of patients or beneficiaries enrolled in program requiring longitudinal care.
- Allows for name based data to be tracked longitudinally, aggregated, and exported to DHIS2, where it can take advantage of all data validation, reporting and GIS mapping functionalities provided by DHIS2. From aggregated facility data can drill down to individual names. “From top to down, and down to top”.
- Supports three different models of name based data: one time events (eg birth and deaths), program based events (ANC care or immunization), and encounter based events (tracking TB or ARV care for HIV patients)
- Easily customizable for : Patient registration forms to specific requirements, including managing multiple identification schemes, enrolling in multiple programs; Adding new programs; and Program stages to add or change stages and what parameter needed to be managed where.
- Patients can be easily searched using different parameters, and in also enabling the tracking of migration cases in a district or a state.

- Provides monitoring tools to field staff, such as the Activity Report to help track care of individual patients and the Scheduler to help the health worker plan her activities.
- Integrated with DHIS Mobile for interfacing the receiving of services data from the mobile client and to send activity plans and beneficiary alerts to the mobile. SMS alerts can be sent from the server to the mobile client.

A system in DHIS2 is designed for INTPART project.

DHIS2 Tracker enables states to develop an "electronic health record" for the community. Typically, a particular person in a village may be registered for multiple health program of the health system, such as ANC and Eligible couple, immunization and school health. Currently, the system deals with these program independently, each having their own primary registers, reporting formats and recording forms. The Tracker allows you to have all these program defined in one database, so when a person is being registered for a program, he or she can be searched across the program to see if already registered. And if yes, all the stored information, for example, demographic information and medical history can be reused in the new enrollment. While reducing redundancies of data, this system can also help providing more integrated care.

Login page of DHIS2 for INTPART project

Metadata Creation

The first step for designing a system is to create the metadata within the sheet of the required data. The data is entered within the sheet and accordingly imported to the system.

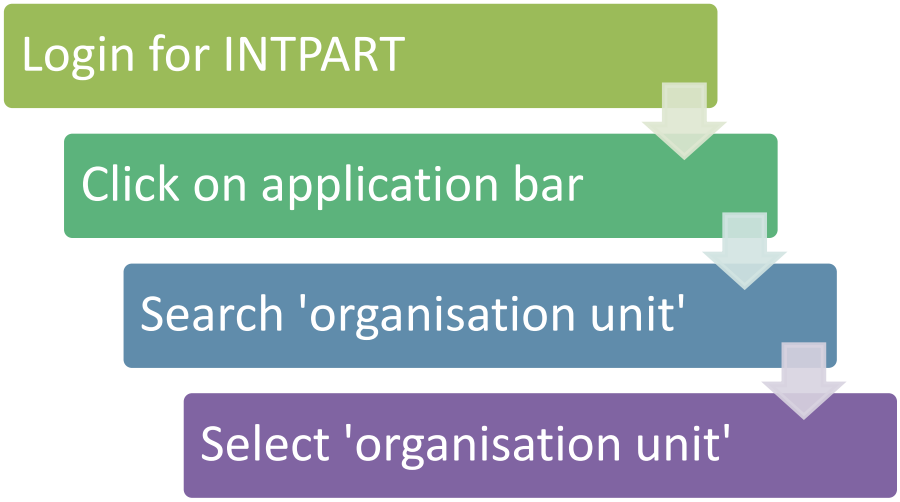
Different registers present at the PHC

- **Family folder(community records)**
- Household information
- House members information
- **RCH Program**
- Eligible couple
- Maternal health
- Child health
- **NPCDCS Program**

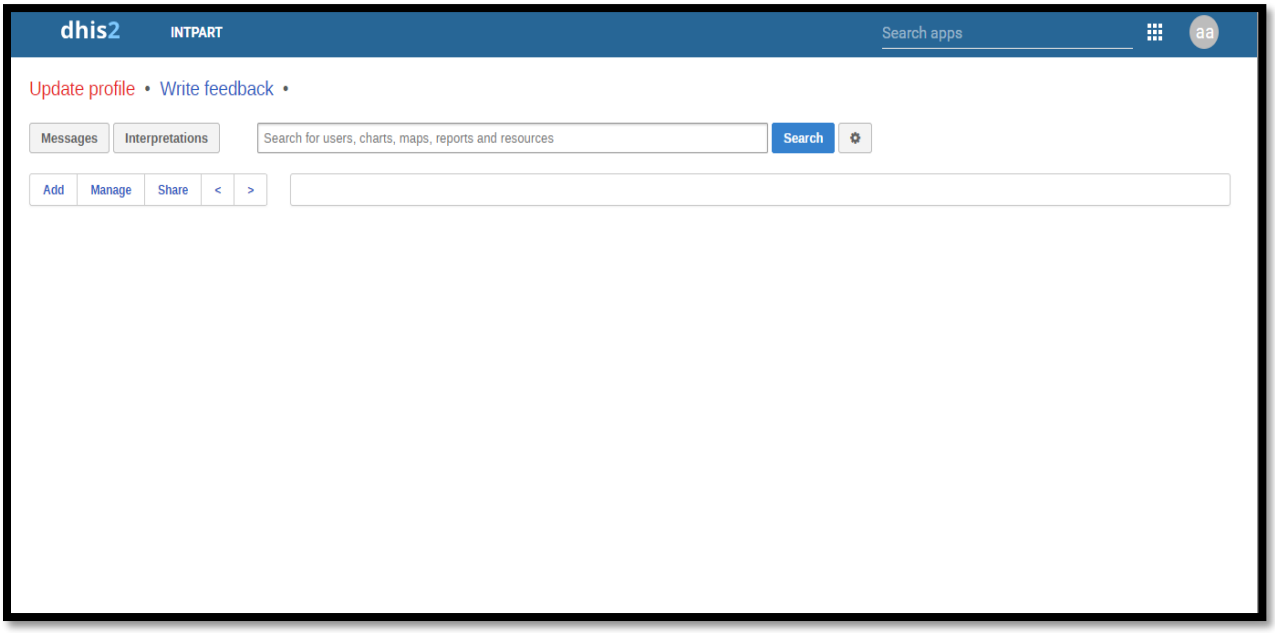
The metadata is being presented to the Project Head. The process of Quality Assurance of the metadata is carried out by the Project Head before importing the data within the system.

Defining Organization Unit

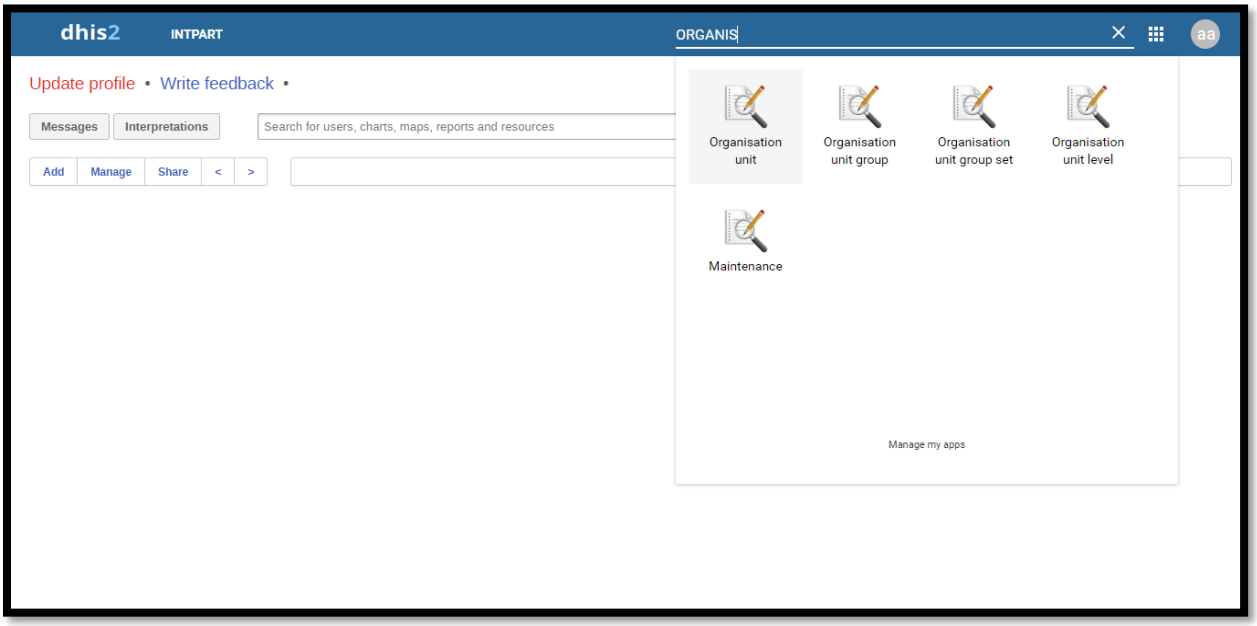
The organization unit consist of the area where the system is being implemented. To start with the process, the unit has to be defined.



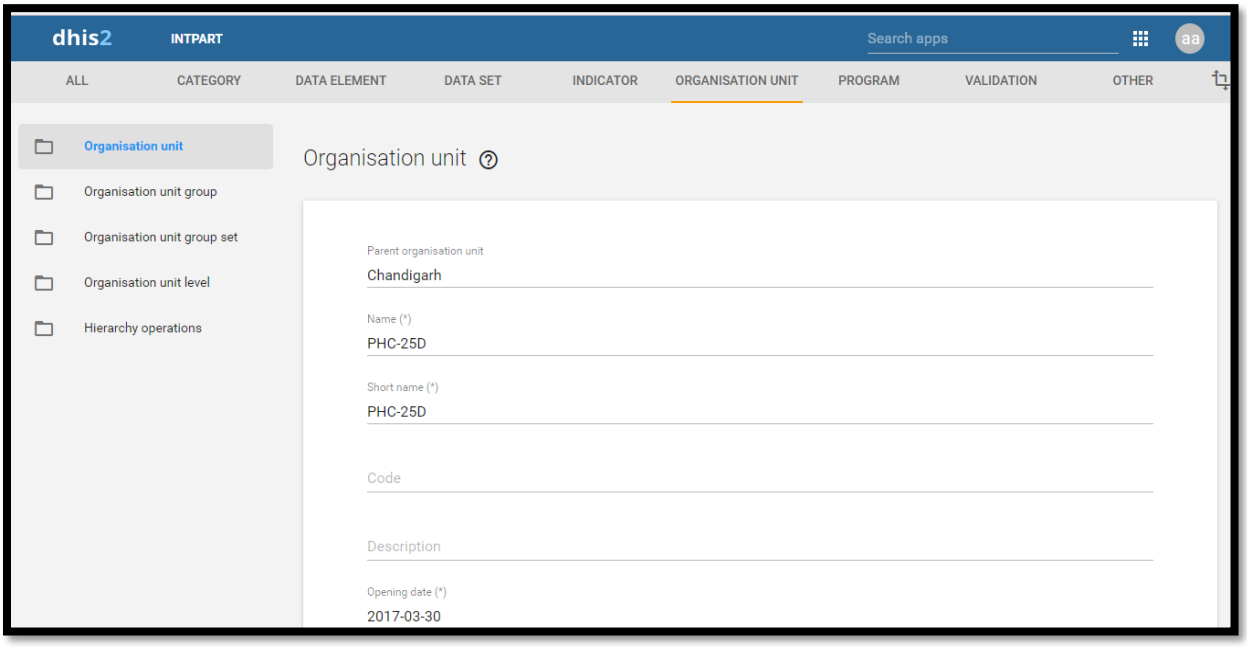
- Home screen for INTPART within the application



➢ Organisation unit option selection in the application bar

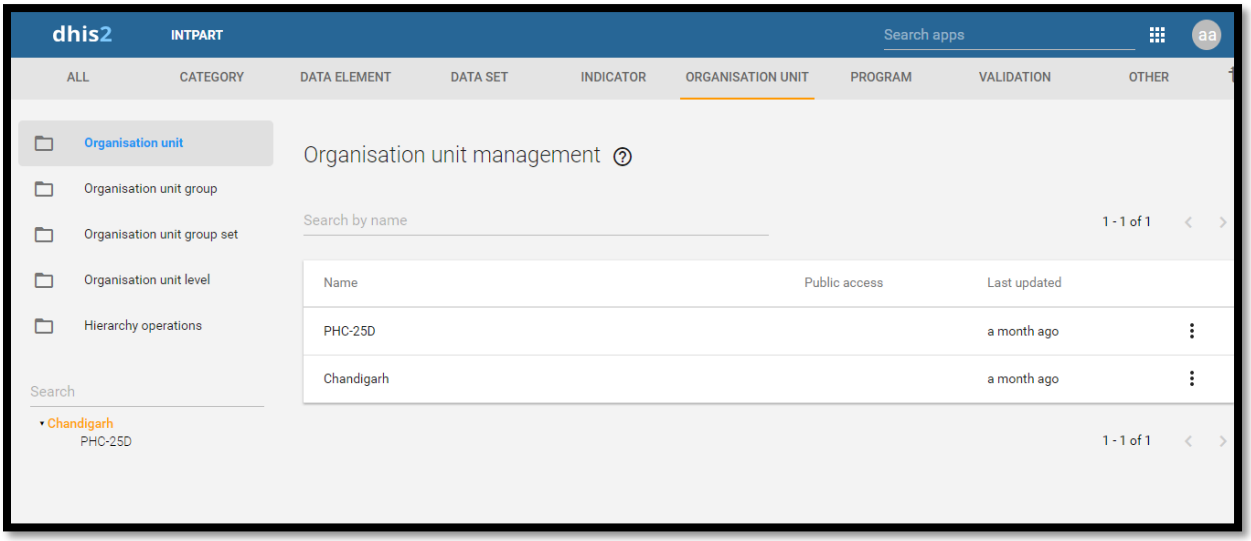


➢ Creation of organization unit



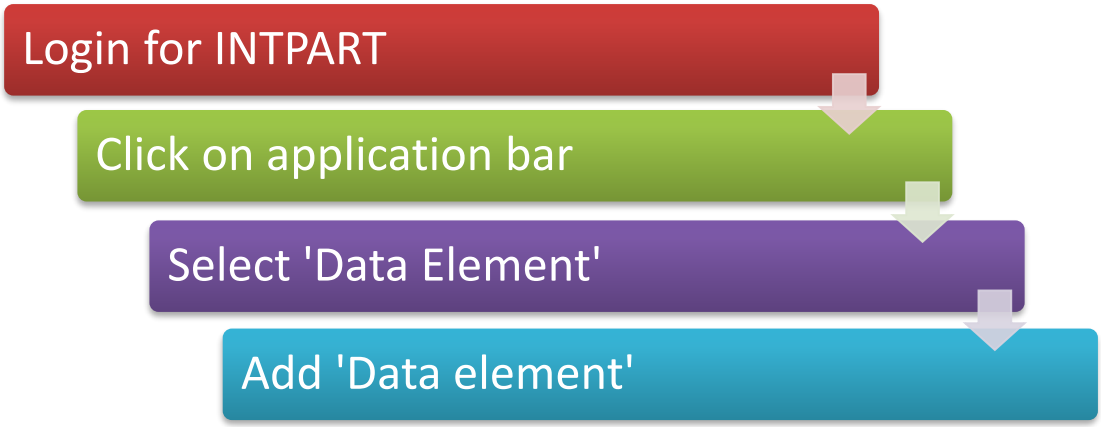
Two organization units were created:

- Chandigarh
- PHC 25

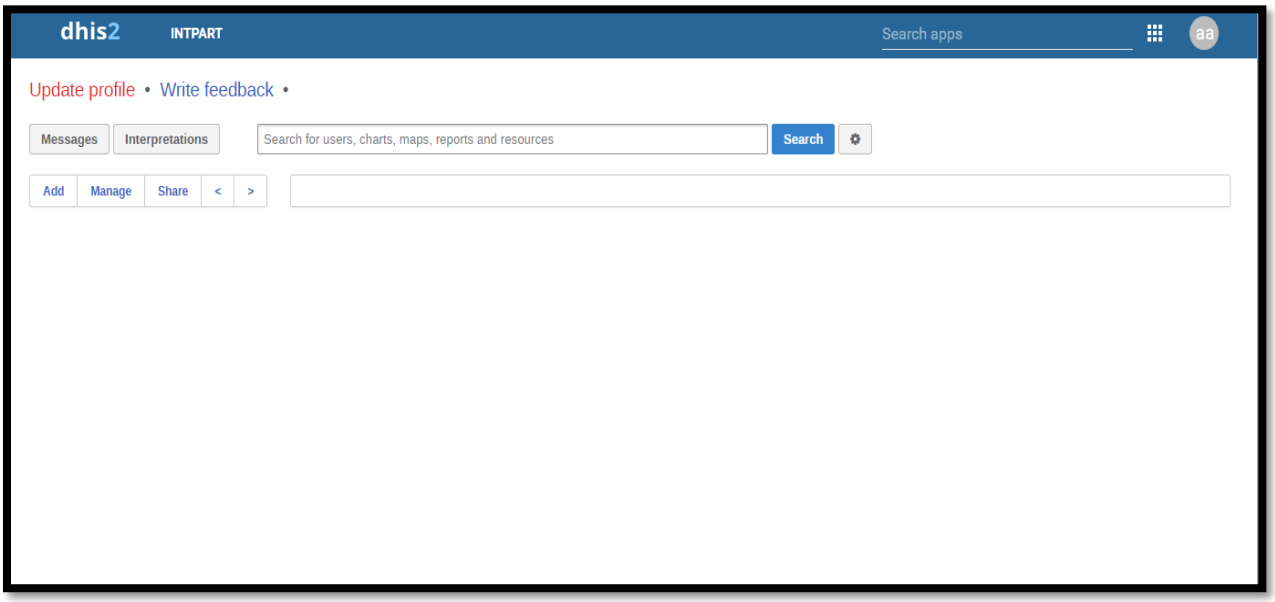


Creation of Data Elements

Next step is to create the Data elements within the system. Data elements are defined as what is actually recorded within the system.

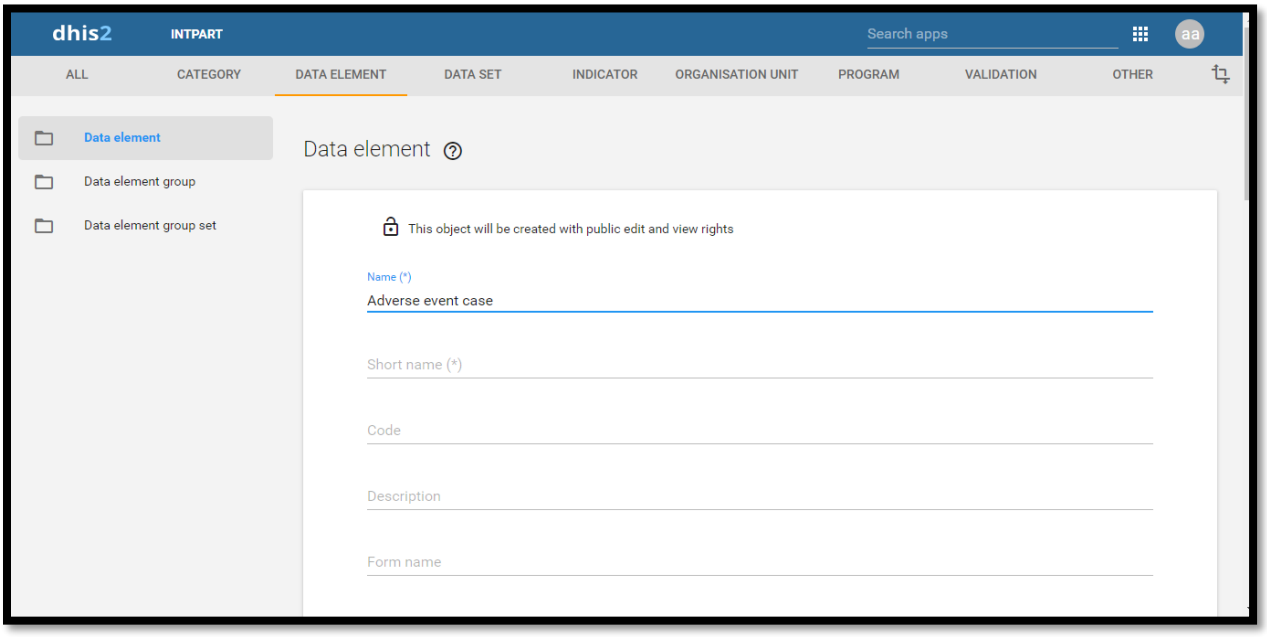


- Home screen for INTPART within the application

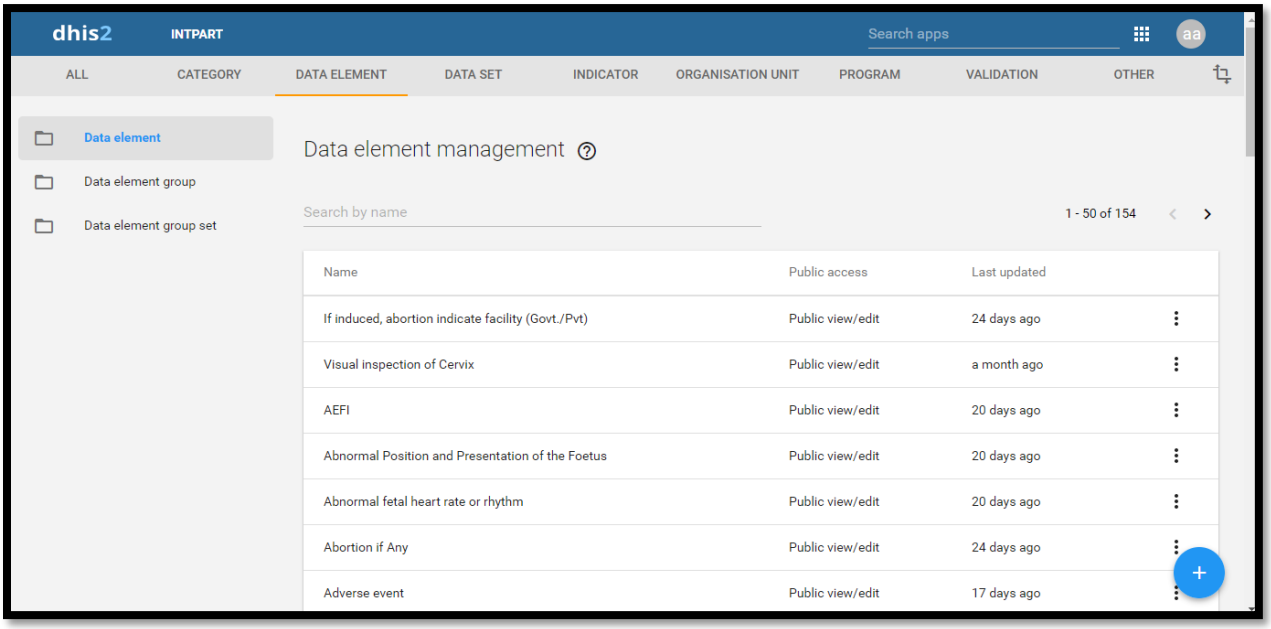


- Data element within the application bar

➢ Data element creation within the application



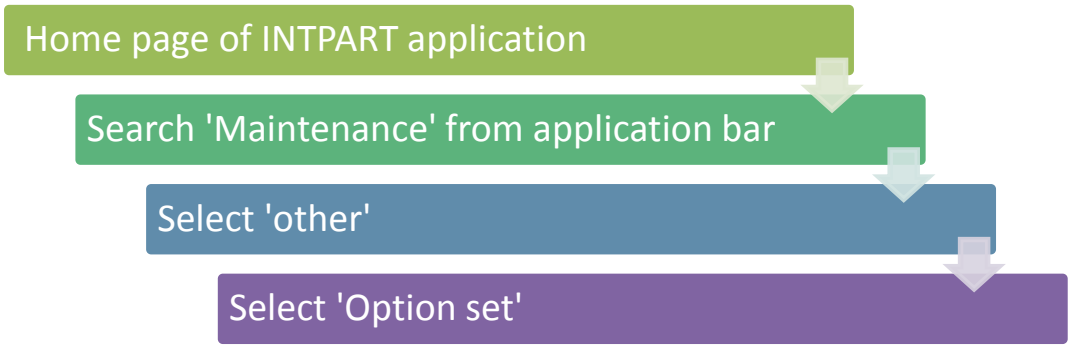
➢ Created data element list within the application



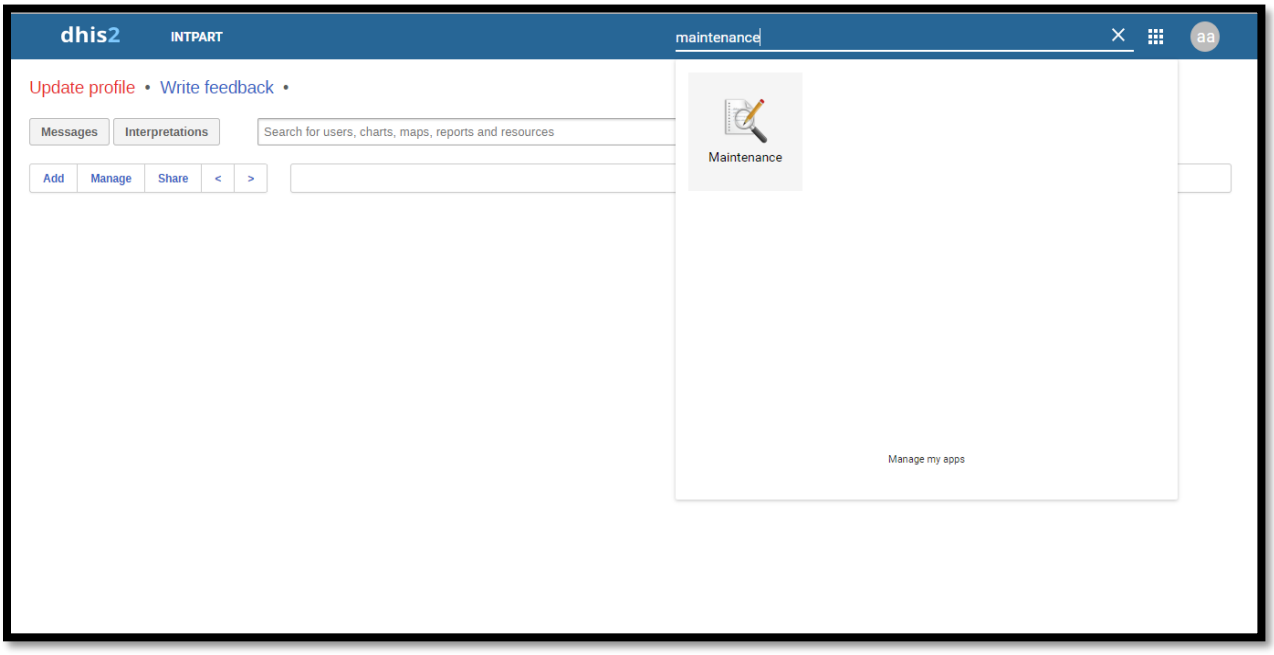
Data elements were created according to the metadata. Data elements consisted of different sets of information required within the application. Different register present at the PHC consist various information sections. For those sections the data elements were created.

For data elements different options were required. For example, the element for abortion present ‘Abortion, if any’ the options required this element created were ‘Yes/no’. The option sets were created along with the options for data elements were created within the application.

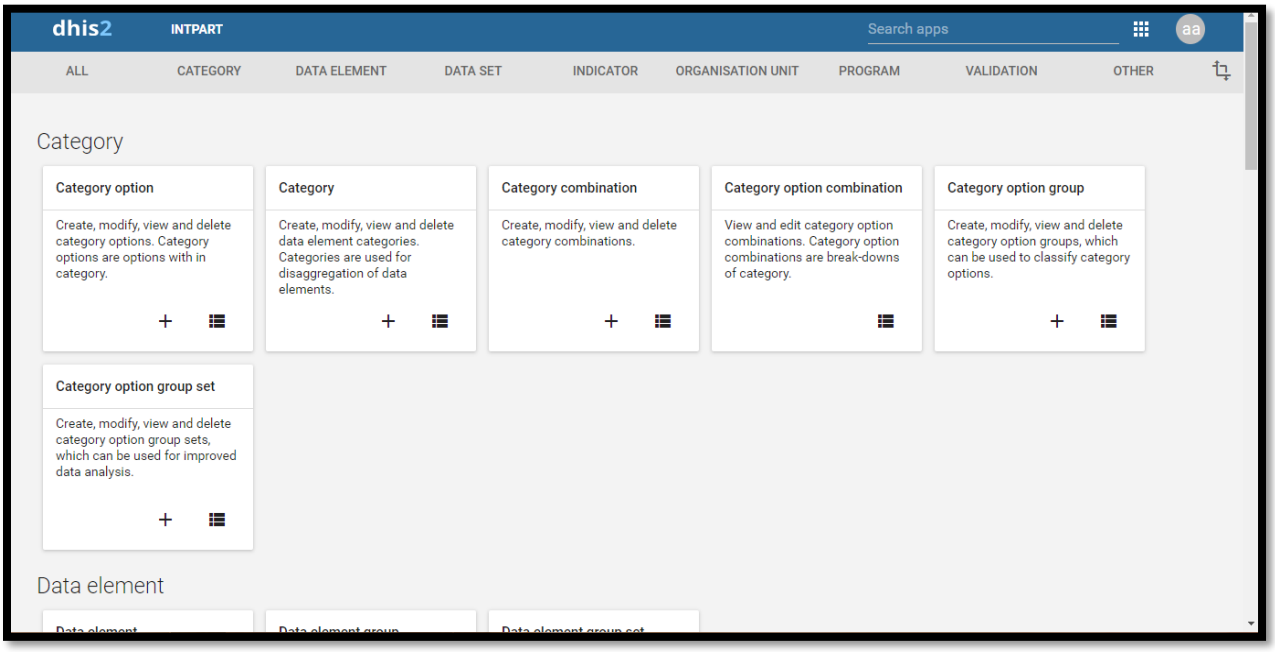
Creation of option set



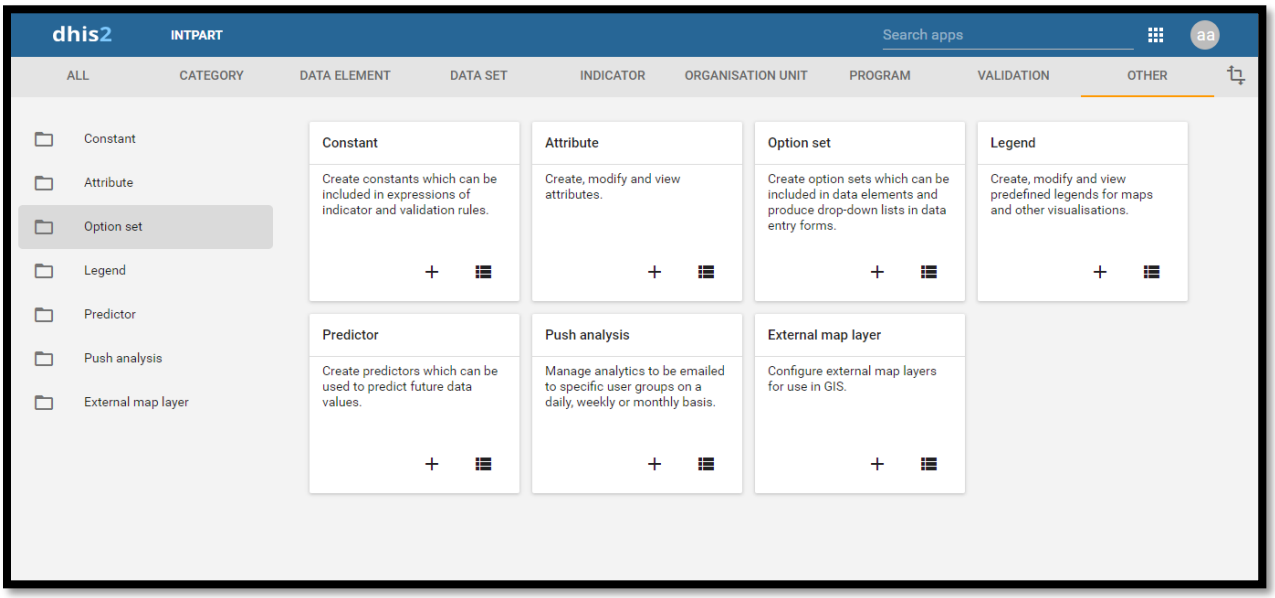
➢ Maintenance search



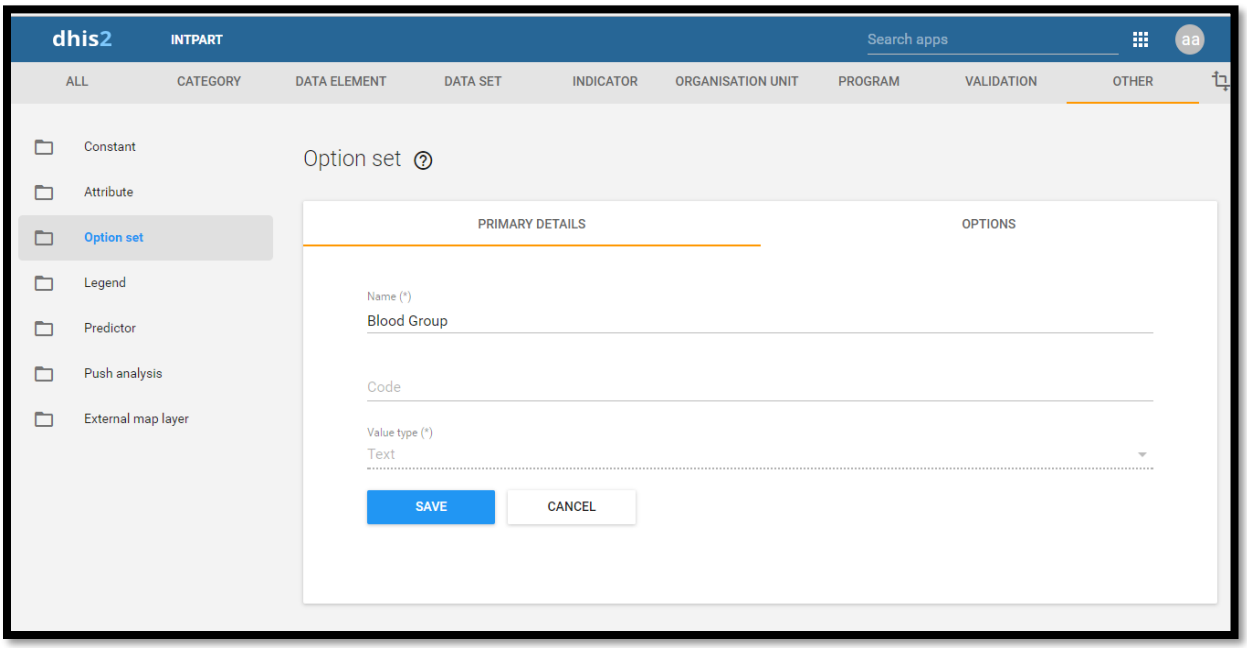
➢ Option for other was selected



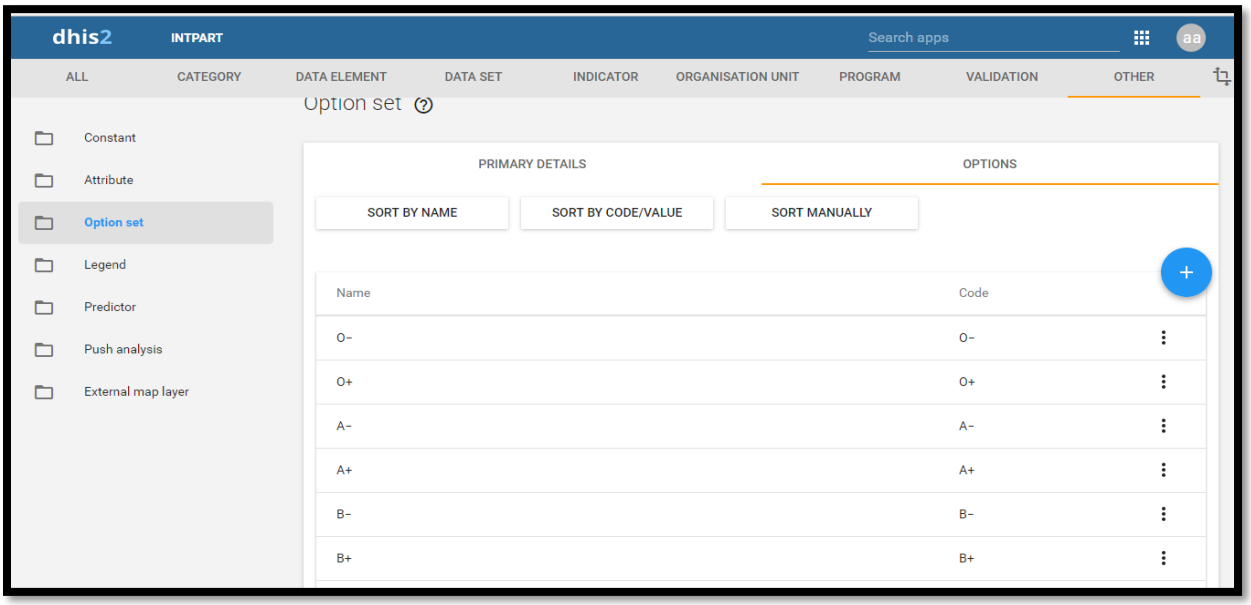
➢ ‘Option set’ was selected



➢ Option set created

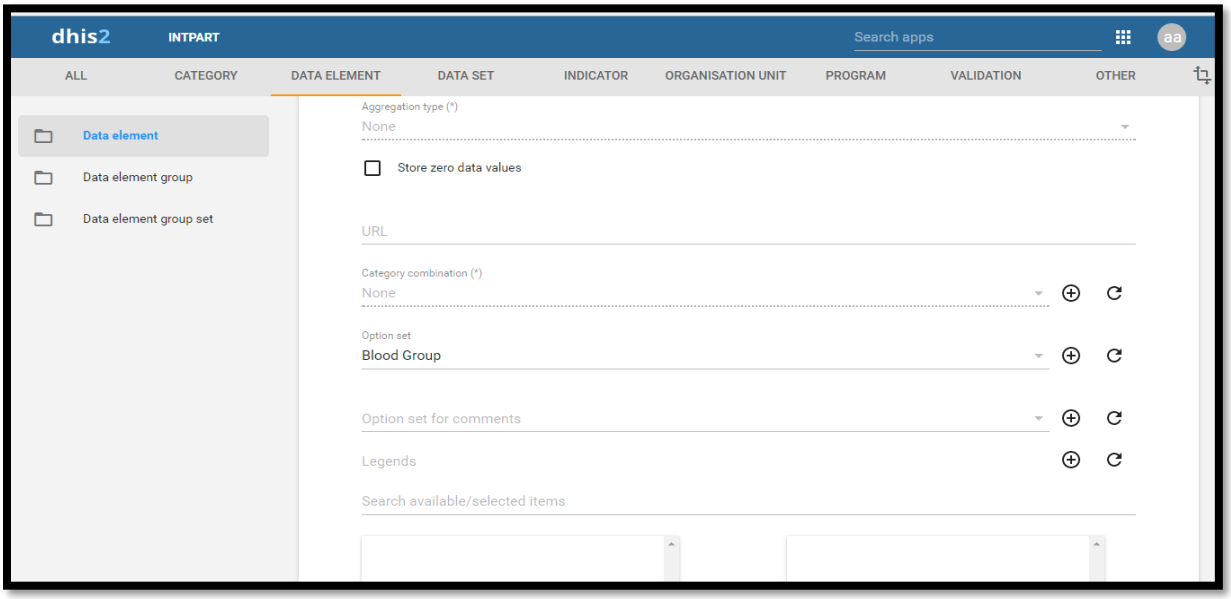


➢ Options for option set created



Option set is required to present options within data element. After the option sets were created they were assigned to the data elements.

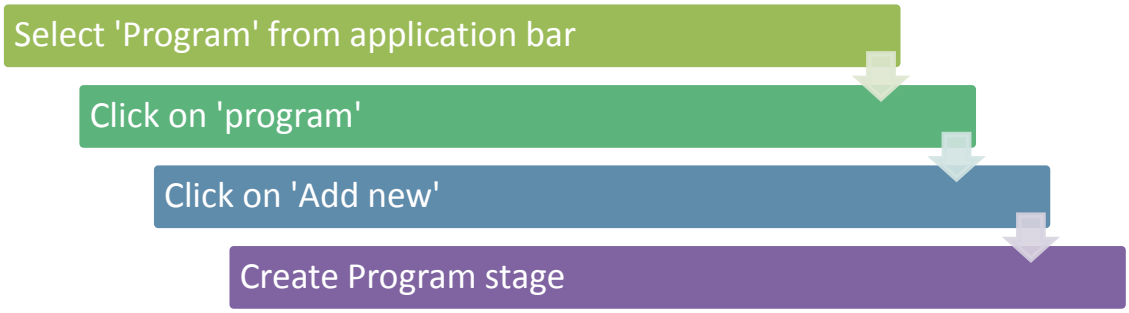
➢ Option set assigned to data element



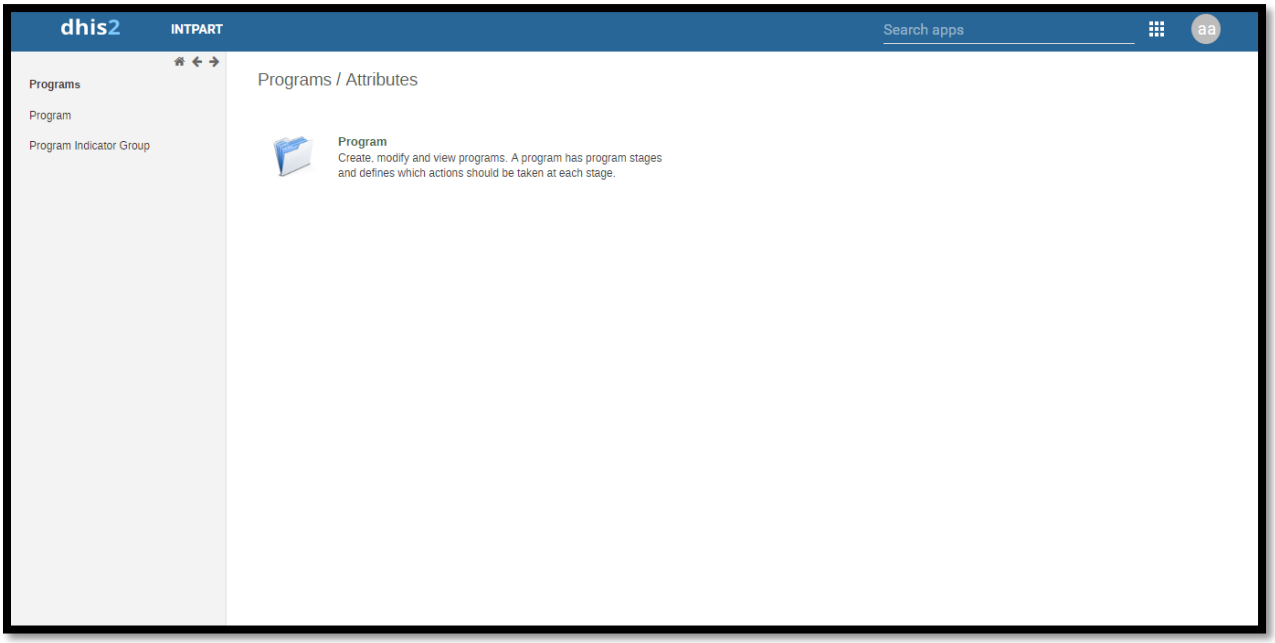
There were different option sets created and assigned to the data elements accordingly.

After the creation of the data elements and option sets different program stages were created and elements were assigned. Multiple events are present within a single stage.

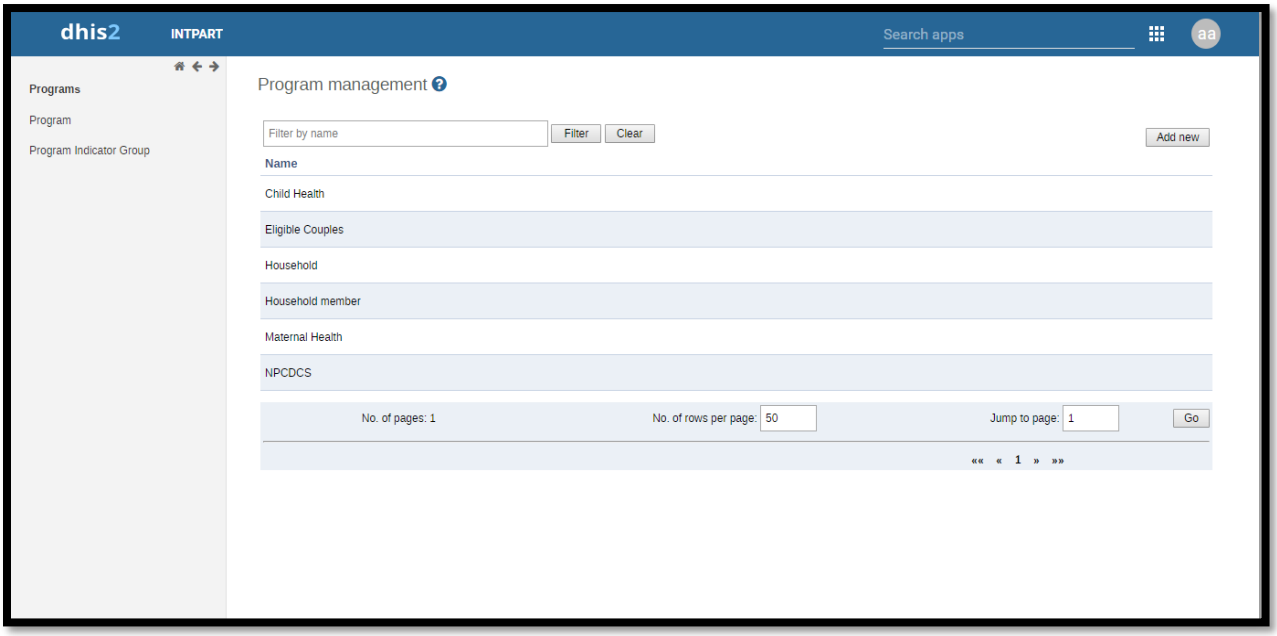
Creation of Program stage



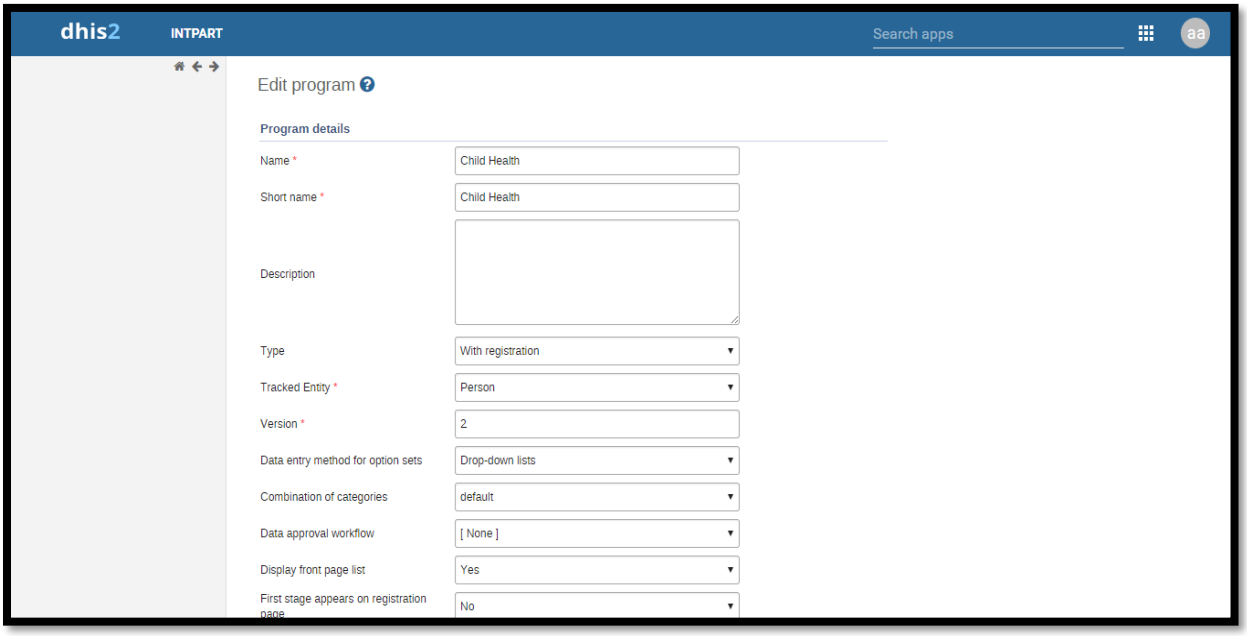
- 'Program' selected



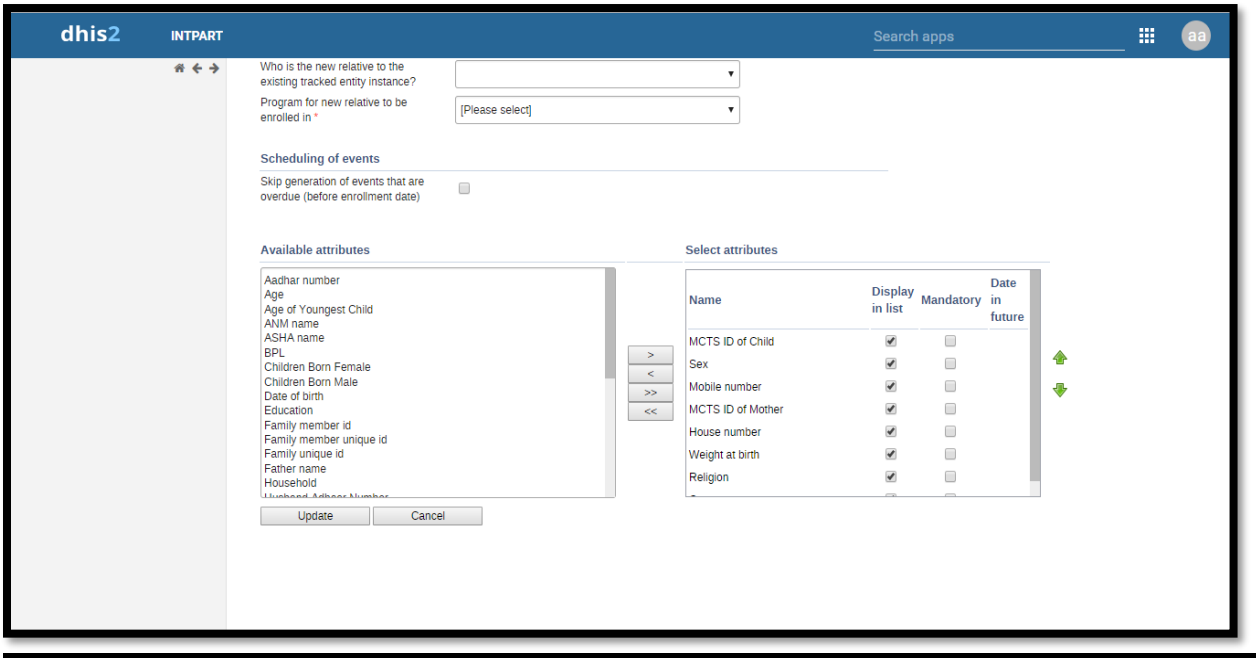
➢ Selected ‘Add new’



➢ Details Added for new program



- Elements were assigned and new program was created



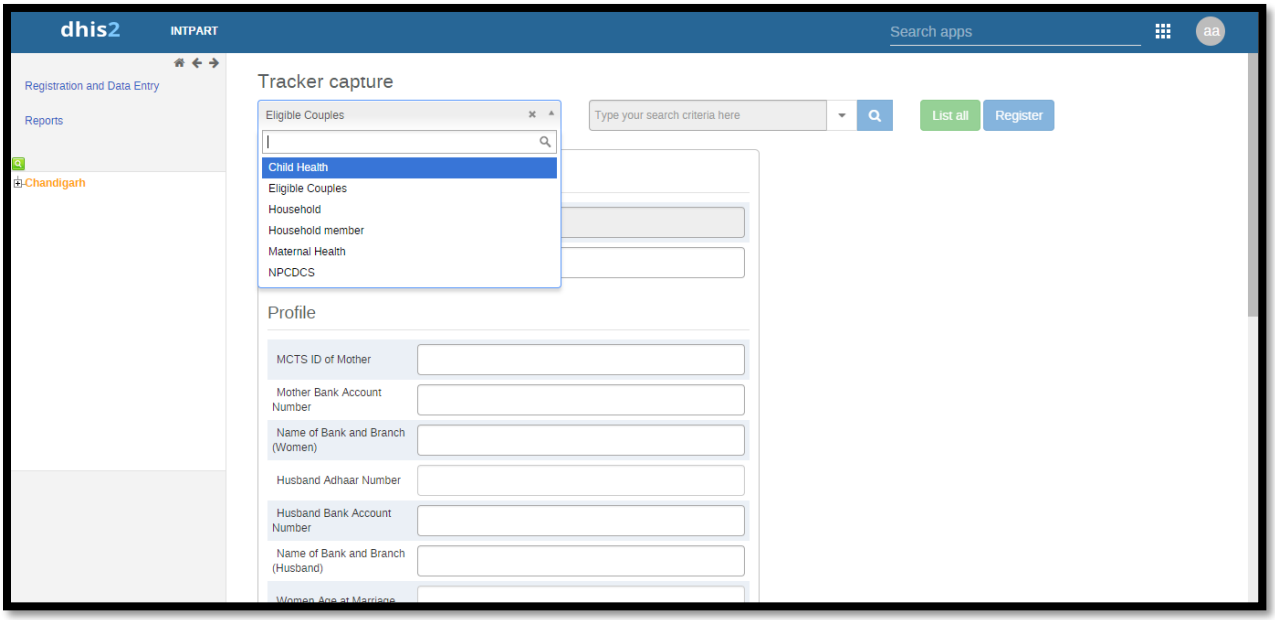
After the program stage create, the sections were managed accordingly. The created programs were assigned organization unit. This made a window available at the Tracker system of DHIS2. The tracker system consists of different program. Patient can be registered within the system through tracker system and can be tracked according to the stages and events.

Different registers were maintained within the tracker system:

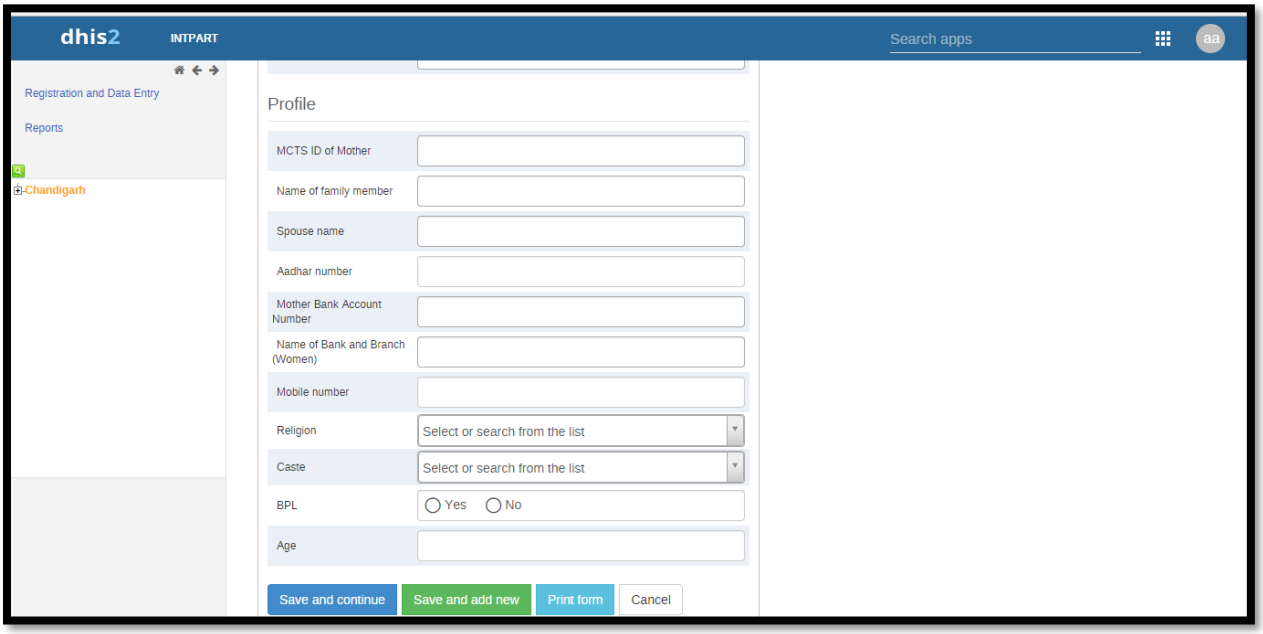
- **Family folder (community records)**
- Household information
- House members information
- **RCH Program**
- Eligible couple
- Maternal health
- Child health

- **NPCDCS Program**

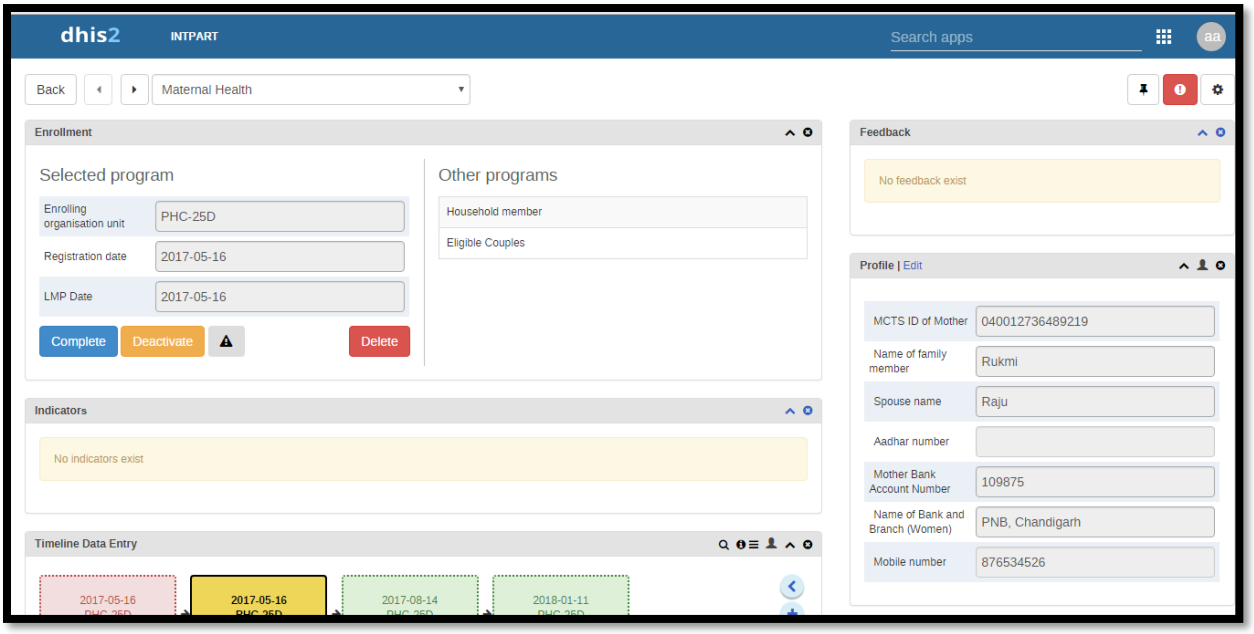
➢ **Tracker Capture window consisting of different registers**



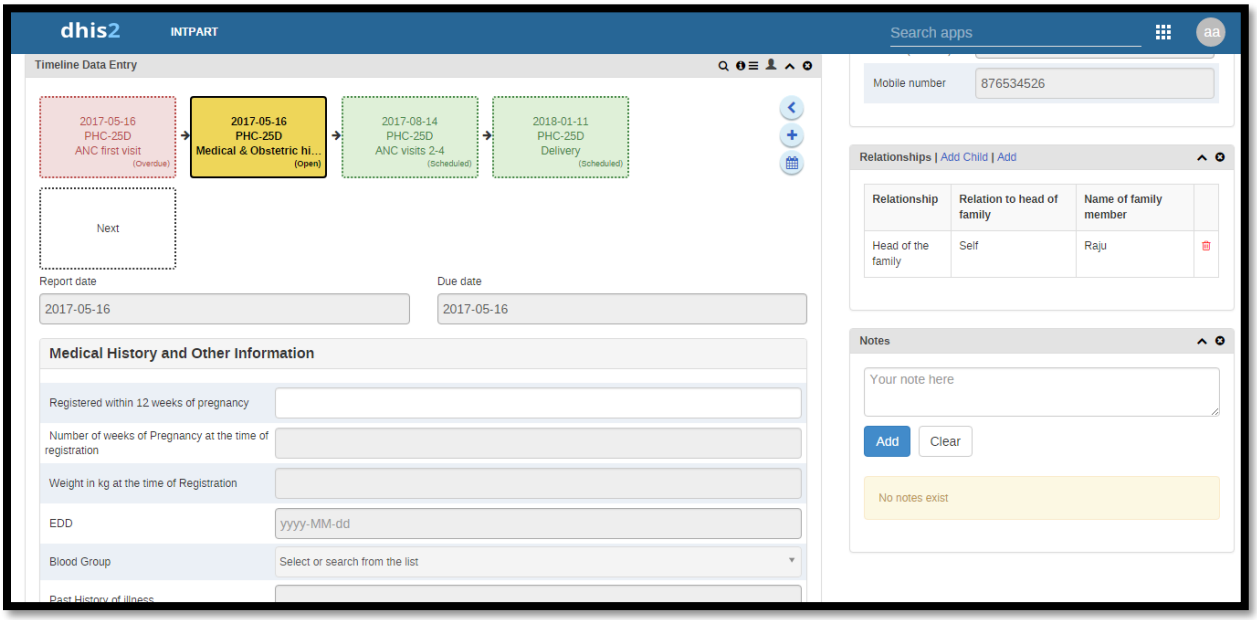
➢ **Registration window for patient**



- **Final window overview of Tracker system**

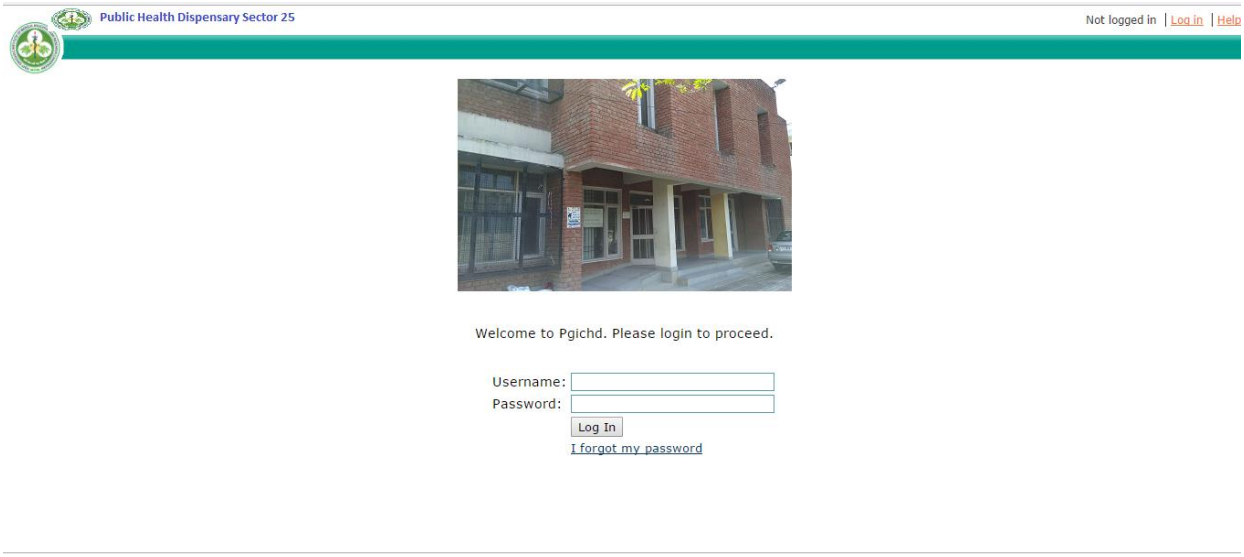


- **Tracker system with a single program stage consisting of multiple events**



Clinical Services

For the clinical services within the PHC, **OpenMRS (Open Medical Record system)** is being used. OpenMRS has been customized as per the PHC requirement. Enables patient registration and other records at the facility.



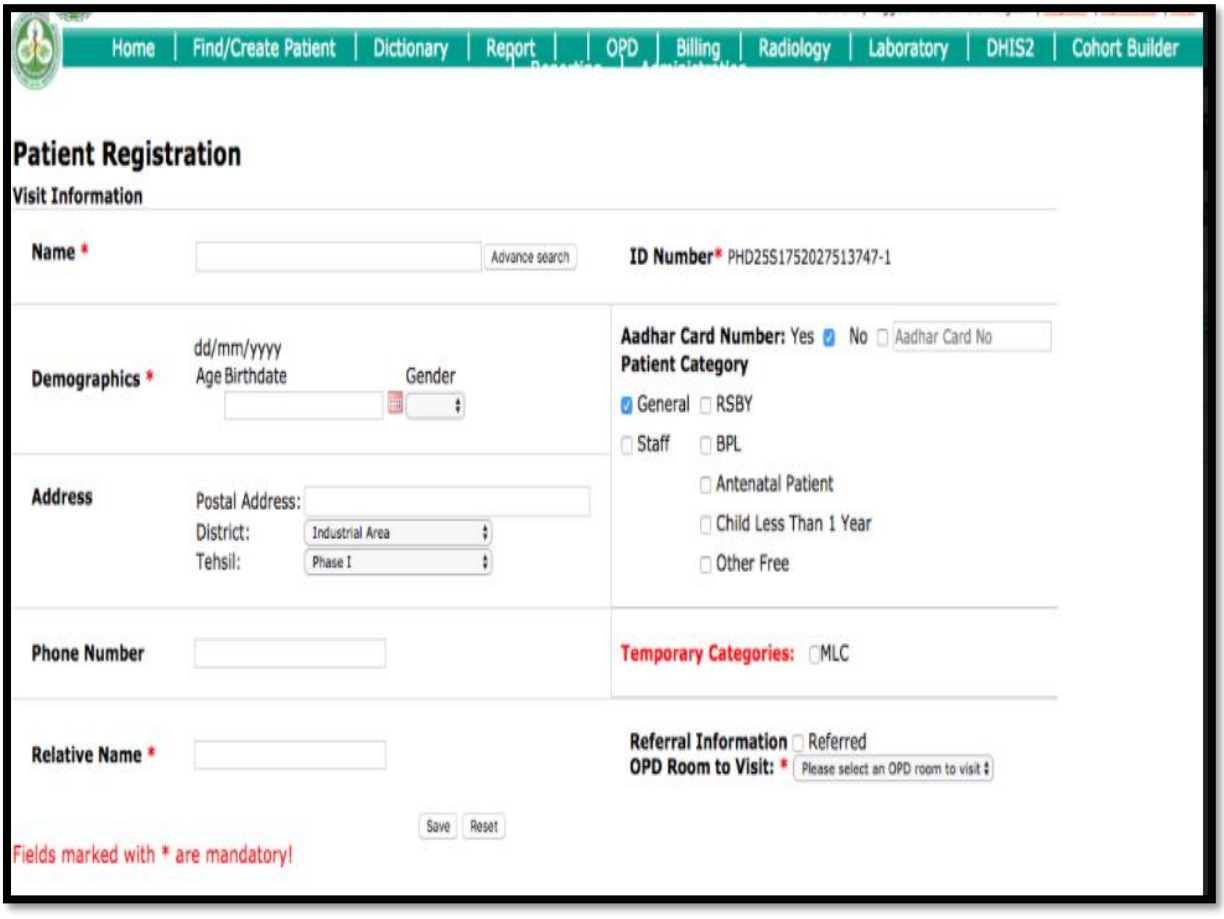
Login page for OpenMRS

OpenMRS at the PHC have different modules, consisting Pharmacy, Registration and OPD. OpenMRS is a medical record system of the PHC. The patient gets registered and the information is stored within the oprnMRS. The patient is provided a Unique Identification Number. The record of the patient is maintained using the UID provided. Patient drug record and doctor consultation is maintained properly which enhances the quality of care within the healthcare system.

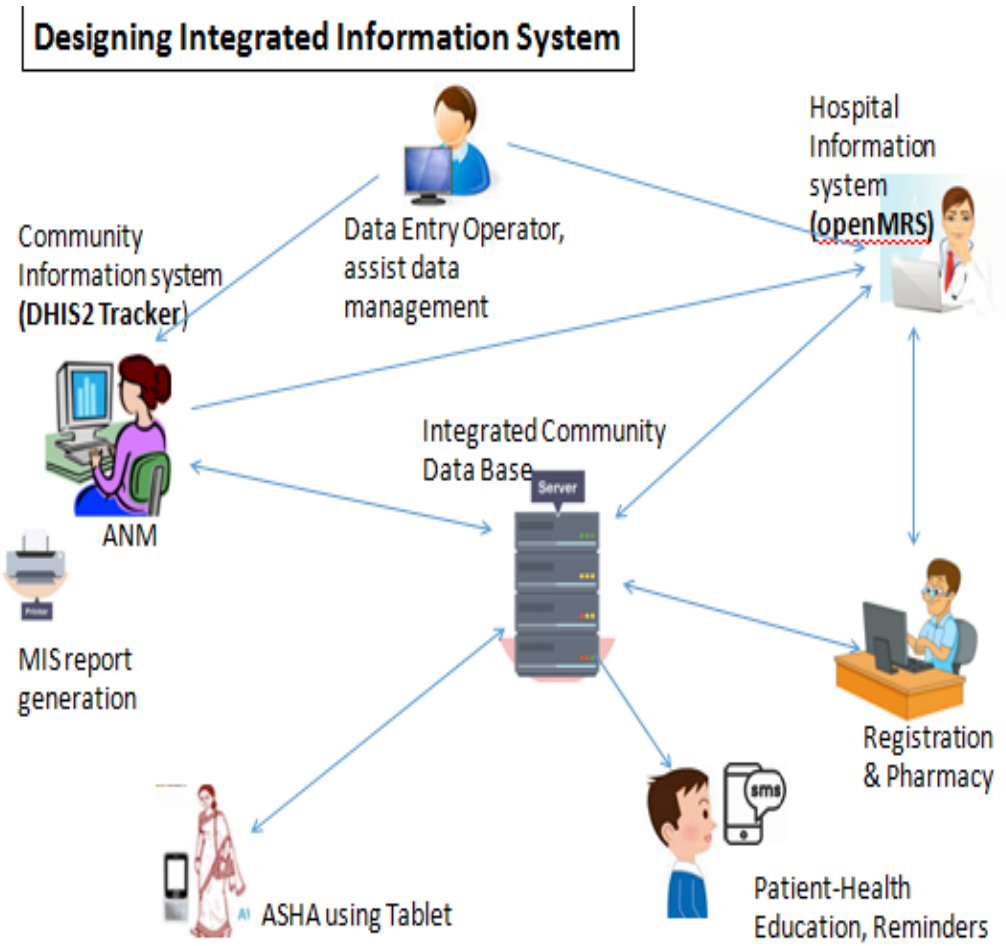
OpenMRS is a software platform and a reference application which enables design of a customized medical records system with no programming knowledge. The system is based on a conceptual database structure which is not dependent on the actual types of medical information

required to be collected or on particular data collection forms and so can be customized for different uses.

- **Patient registration window in openMRS**



ARCHITECTURE DIAGRAM



In the architecture diagram, it is being depicted a system consisting a Integrated community Database, Community information system, Data entry operator, ASHA using the tablet, Hospital Information system, Registration and pharmacy.

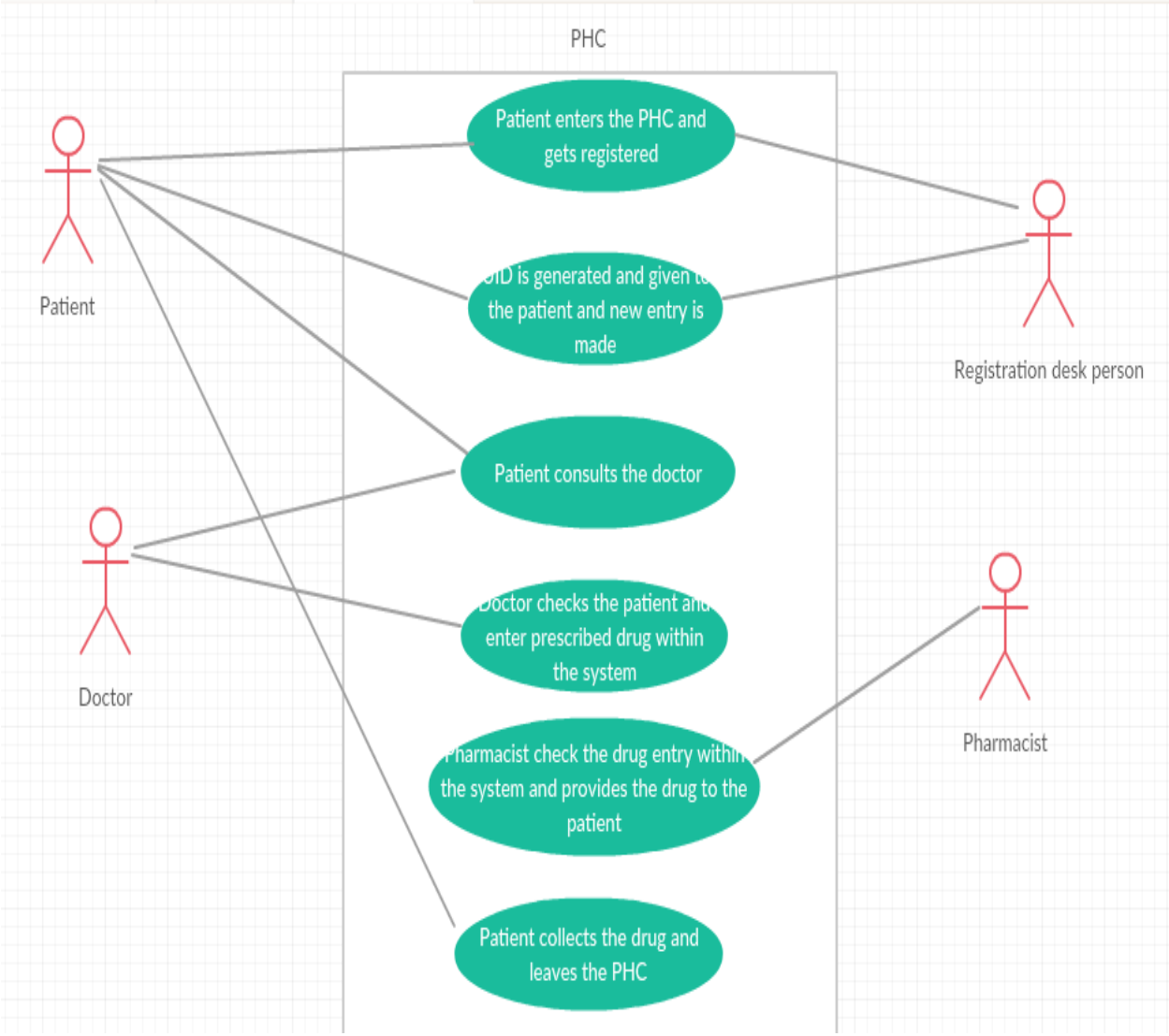
The system present is linked with different actors. The Database is connected to DHIS2 Tracker which is a community information system. The Information from Hospital Information system i.e. openMRS is stored within the Database. The openMRS is installed in the PHC for different modules covering Pharmacy, Registration and OPD. All the information and health records are stored within the Integrated Community Database. The system is operated by different actors consisting of ANMs, ASHAs, Doctors, Registration desk and Pharmacy.

CONCLUSION

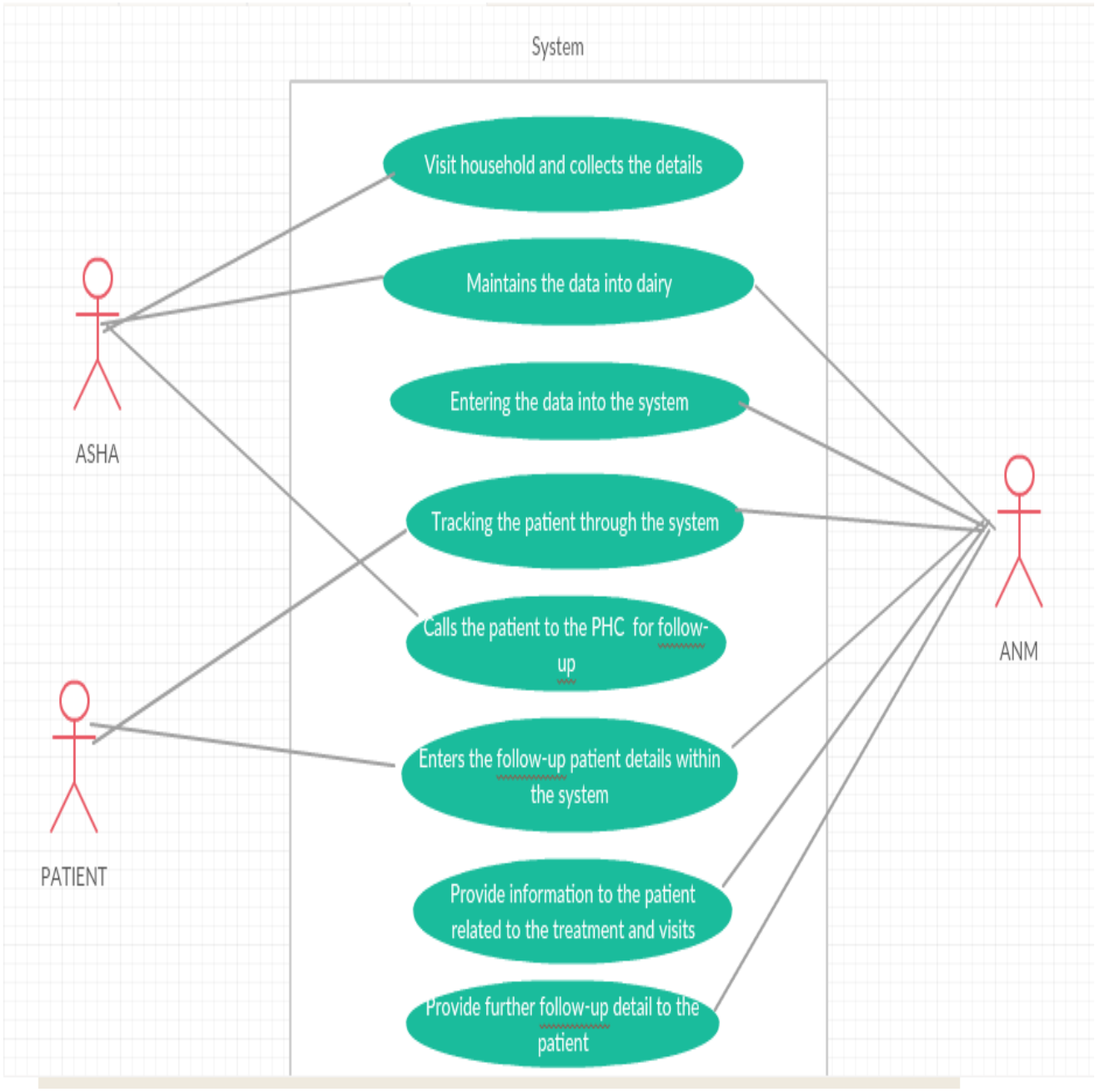
After the study conducted for the current workflow which is being carried out manually, the designing of the system took place. The designing of an electronically based patient centric system at the primary health center was based on the requirements gathered. According to the requirement the patient centric system was designed. The system consist of electronic patient health record. The process starts from the registration till the patient leaves the PHC. The record under the ANM is also converted into electronic record. There is no need for maintain the registers manually.

USE CASE OF THE DEVELOPED SYSTEM

For clinical services



For community services



DISCUSSION

The process of designing a patient centric system consisted different levels. First level was basically to gather the requirement, which was being gathered through the work shop. Presently there are about many registers which are required to be maintained at PHCs and most of these registers have duplicity of records especially of the demographic details. In the suggested system there will be stages like in the first stage all the fields of demographic details will be entered then specific details will be entered using stage wise performa. Once all the details have been entered all the required reports can be easily generated. In the system as the patient arrives in the PHC we will be able to search the patient if he is there in our database and then we fill out his current information, if his details are not there in our database then we can register the individual and a database of the same will be formed in the system. Proper testing will be done after the implementation at the PHC. Testing of the base functionalities would be done to make the application free of errors.

The new system should not become an additional system but it should rationalize the existing system through an integrated system. The patient centric system is developed to decrease the burden and increase the quality of care to be provided. Through patient centric system the doctor can go through the patient record which helps in providing better treatment to the patient. Patient can access to the record whenever in need.

LIMITATION

- No proper internet connection at the PHC
- No server room set up
- Technical support team is not present at the PHC

RECOMMENDATION

- Unnecessary data elimination
- There should be more option provided under the data element
- Element duplicacy should be removed within multiple stages
- Proper description should be provided for elements and programs
- Information should only be captured which can define the indicator properly

REFERENCES

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