

Assessment of the ability of the Health Management Information System in India to use information for action.

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Acronyms Used

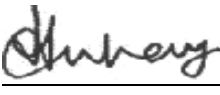
ANM: Auxiliary Nurse Midwife
ANT: Actor Network Theory
BEMOC: Basic Emergency Obstetric Care
CHC: Community Health Centre
CRM: Common Review Mission
DH: District Hospital
DHIS 2: District Health Information Software – Version 2
DLHS: District Level Household Survey|
GoI: Government of India
HIS: Health Information Systems
HISP: Health Information Systems Programme
HIV: Human Immunodeficiency Virus
HMIS: Health Management Information Systems
ICD: International Classification of Diseases
ICT: Information Communication Technologies
IDSP: Integrated Disease Surveillance Programme
IT: Information Technology
MDG: Millennium Development Goals
MoH: Ministry of Health
M&E: Monitoring and Evaluation
NFHS: National Family Health Survey
NHSRC: National Health Systems Resource Centre
NLEP: National Leprosy Eradication Programme
NRHM: National Rural Health Mission
NVBDCP: National Vector Disease Control Programme
PHC: Primary Health Centre
RCH: Reproductive Child Health
RIMS: Routine Immunization Monitoring System
RNTCP: Routine TB Control Programme
SC: Sub Centre
SC/ST: Schedule Caste/Schedule Tribe
SRS: Sample Registration Survey
TB: Tuberculosis
UIP: Universal Immunization Programme

WHO: World Health Organization

DECLARATION

I declare that the thesis "*Assessment of the ability of the management information system in India to use information for action*" is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Full name: Sundeep Sahay Date: 03 – August – 2011

Signed 

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Abstract

This thesis explores the interconnected problems of “why health information is not used in practice?” and “what can be done to address this problem?” The primary aim of the thesis was to make an assessment of the existing Health Management Information System (HMIS) in India with respect to its ability to support the use of information for action in priority areas identified by the national and state governments. The problem of lack of effective information use in health management has been fairly well documented in the literature, but much less has been said about what can be done about it, other than the rather superficial advice of increasing the levels of training. The empirical setting for the examination of these research questions was within the public sector in India, where the research took place within an action research framework. The author was actively engaged as a participant with national and state authorities in the process of redesigning of the HMIS, building and deploying to the states various HMIS reform systems including the software, capacity building and making systems sustainable and scalable. A key focus area of the action research was aimed at enabling systems that would promote the utilization of the routine data being collected through the HMIS, and integrating the same with action areas such as related to planning, monitoring and evaluation. Data collection was carried out through various methods including interviews with key stakeholders, observations, formal and informal discussions carried out face to face and through emails or telephone communication, and the writing of various reports which were then commented on by various people including the state and national level user departments. Both quantitative and qualitative data was collected and analyzed. Quantitative data collected through the “Readiness Matrix for Information for Action” across the three dimensions of human resources, technical infrastructure and institutional conditions helped to see how states performed individually and how they ranked compared to each other on information generation and use. The matrix also helped to diagnose the dimensions for strengthening in order to improve the overall readiness to use information for action in the states. This diagnosis was supplemented through qualitative analysis to further probe into “the why” of the performance of the states at various rankings and what could be done to improve matters. The readiness matrix,

arguably, could be used by researchers in other settings to help diagnose key areas that need to be strengthened in order to improve information use, and also evaluate where a state is in terms of its maturity towards the same. While progress was noted in areas of data coverage in that some sporadic examples of information use were present and enhancements in capacity and infrastructure were accumulating, challenges still remained. Key ones included poor data quality, the unfulfilled promise of integration and a continuing weak culture of information use. Some key strategies identified to address these challenges included the promotion of decentralization of information to support decentralized action, the adoption of a data warehouse approach and strengthening collaborative networks. Achieving this however, requires some structural interventions such as the broad basing of education in public health informatics, institutionalization of a cadre of public health informatics staff within the Ministry of Health, and promoting the use of software which is open source and based on open standards such that widespread local use is supported.

Chapter 1 : Introduction

1.1 The problem setting

This thesis explores the interconnected problems of “why health information is not used in practice?” and “what can be done to address this problem?” These questions are explored within the context of health information systems in developing countries with a primary empirical focus on India. The primary aim of the thesis is to make an assessment of the existing Health Management Information System (HMIS) in India with respect to its ability to support the use of information for action in priority areas identified by the national and state governments of India. The problem of lack of effective information use in health management has been fairly well documented in the literature, (Lippeveld 2001, Braa et al 2004, Sahay and Lewis 2010) but much less has been said about what can be done about it, other than the rather superficial advice of increasing the levels of training.

The key problem this thesis seeks to address concerns how the national level of the Ministry of Health, Government of India (MOH, GOI), can improve the utilization of routine health information so as to inform decision making with respect to supporting the objectives of the National Rural Health Mission (NRHM), to bring about health systems based reforms in the country. The NRHM is an agency created in 2005 by the Prime Minister of India, and is charged with the responsibility of bringing about various “architectural corrections¹” by using a health systems approach, rather than one that is disease or programme specific. These corrections need to support the NRHM’s broad goals of making the Indian public health system more equitable, affordable and effective. Amongst the 14 priority areas identified by the NRHM for bringing about such architectural corrections, the Health Management Information System (HMIS) is a key one.

¹ These corrections are aimed at making structural or design changes in the system thus representing an effort towards a fundamental reconfiguration.

To support the broad agenda of bringing about architectural corrections using a health systems approach, the NRHM has established the National Health Systems Resource Centre (NHSRC) as the nodal national agency responsible for providing technical assistance to the NRHM in 6 broad areas: HMIS; Community Participation; Legal Framework; Quality Improvement; Health Financing; and Decentralized Planning. As part of the effort to identify the key existing challenges, to track the progress made by the states under the NRHM since its inception in 2005, and to target areas for future technical assistance, the NHSRC participated in the development of the Common Review Mission (CRM) report (NHSRC 2008). As a part of this Mission, a team of experts visited 12 states and studied the various systems. A few extracts from the CRM report related to the HMIS are presented below to emphasize the nature of the existing challenges:

Multiple reporting is still in vogue, earlier forms are not yet abolished and there are many other constraints in data collection and flow

Need much better HMIS to identify trends in changes in institutional deliveries

The reports required are bulky and the periodicity of data flow is irregular.

There is a need to publish/disseminate facility reports, and to make them available for scrutiny by the general public

The efforts in monitoring the progress of disease surveillance have been very slow.

The overall recommendation of the CRM was that the HMIS in the country was far from adequate in supporting the ambitious goals of the NRHM and therefore is in need of urgent reform. The NHSRC was thus engaged to take urgent steps to provide relevant and effective technical assistance to the NRHM. It is within this broad context and ongoing efforts to improve the HMIS that this thesis is positioned.

Empirically, the primary focus will be at the national level while additionally the work taking place at the state level will also be drawn upon to make sense of progress made in implementing the reforms. The reason for this focus is that design decisions around the HMIS, for example related to

what data should be collected, by whom, when, and what kinds of reports are required within the Indian context are made by the national level, specifically the Monitoring and Evaluation division of the national Ministry of Health. Without this national mandate, despite health being a state responsibility, the states and districts² are reluctant to make any changes to their existing systems. Within the national level focus, the research is situated within the HMIS Technical Support Group of the NHSRC, as they have been given the mandate by the Ministry of Health to provide technical assistance towards improving the HMIS. Situating the research efforts within this political framework and boundary arguably increases the probability of the research yielding results that are relevant, politically acceptable and practically actionable. The constraints of working in this politically centralized and top-down technically and managerially controlled environment namely, the excessive time taken for decision making and the significant distance between decisions and action were experienced and accepted, as this was and is the status quo within which the HMIS has to operate.

1.2 The theoretical problem

Information is a key resource for supporting public health management. The restructuring of HMIS has become an important trend in the entire developing world since the adoption of primary health care as a global strategy for achieving the ‘health for all’ goals (Campbell 1997). For example, the management of maternal mortality could be better supported by a mapping of existing basic obstetric care services in a district, coupled with information on the geographic spread of pregnant women. This information can help managers to better plan their outreach activities to try and ensure basic obstetric care services are made available to all pregnant women. Similarly, strengthening of child immunization programmes can be supported by information on where the maximum dropouts are taking place in the life cycle of vaccination (between different vaccinations in the life cycle of

² In India, the information flow is organized from the sub district facility level (of Sub Centres and Primary Health Centres to the Block which represents the first level of aggregation. From there, reports flow to the district, then state and finally to the national level, and at each stage an aggregation is carried out.

immunization of a child) for example between BCG 1 and TT1 or between TT2 and Measles. This information can then help planners' to focus on understanding the reasons for the dropouts and what could be done about it.

While the above examples provide instances of the value of routine health information, in practice it is found that while health care services in many developing countries typically are involved in collecting huge volumes of data, there is not commensurate evidence of that data being used for planning and action. Public Health management by definition is data intensive, implying that the routine health information systems typically collect tons of data on a regular basis. For example, it has been reported the Indian public health system till recently was collecting more than 3000 data elements on a monthly basis (Sahay & Lewis 2009). When you multiply this with nearly 200000 facilities in the country reporting this data, there is potentially 600000000 data items being compiled in the national database on a monthly basis. Similarly, in Tajikistan we have seen approximately 30000 data items being reported on a monthly or annual basis (Sahay et al. 2009). With about 70 districts sending consolidated reports we estimate potentially 2100000 data items being reported into the national database. While there is such a huge volume of data being collected, potentially a goldmine for analysis and evidence based action, we see that such analysis is not taking place. Why this is the case, despite the crying need by researchers and practitioners for "using information for action" and despite the fact that we have software tools available to carry out such analysis, is unclear. This thesis explores this question in the context of India.

Conceptually, it is important to distinguish between data, information and knowledge, as there is the tendency both within research and practice to use these terms interchangeably. These words are not synonyms. Raw data are numbers, characters, images or other outputs. Such data are typically further processed by a human, or entered into a computer, stored and processed there, and/or transmitted to another human or computer. Another way to describe the difference is that information has meaning or can inform, while data do not. How processed data (information) is used by humans for guiding different kinds of action, concerns the domain of "information use."

In the context of health, data can be seen as values without context, while its transformation to information requires putting that data in context (either in relation to other facilities or periods). When information is acted upon, for example to devise health programme interventions, this information can become practical knowledge. The business logic in public health management is typically embedded in a variety of complex issues relating to disease burdens, disease determinants, geographical and temporal trends and many other factors. Typically, these analytical dimensions are formulated and labeled as “indicators” which can then be used to compare different catchment areas, facilities, periods and the like.

To reiterate, public health systems in developing countries are routinely collecting large amounts of data on a routine basis through its network of facilities spread nationwide and also administratively across vertical levels of national, state, district and sub district. This data being collected are called “data elements” for example, “no of children given BCG vaccination in a particular period in a facility.” But taken in this “raw form” this data is of little use to the immunization program health manager for a district or state who needs to know “what percentage of children born in the catchment area of a particular facility are given BCG vaccination.” This implies creating “indicators” from the raw data which will divide the data element (number of children given BCG vaccination) with a denominator (expected births in the area for the period) and multiply it by a factor (in this case it is a percentage). Raw data, through the use of analytical tools such as Excel pivot tables, need to be converted to generate useful and relevant indicators, and then presented in an easy to use manner (for example, graphs, tables, charts, maps etc) for the typically non-computer savvy health manager (in the developing country context). This translation process fundamentally depends on a coherent understanding of the business logic which helps to convert raw data (without context) into information (putting data into relevant context) that can be acted upon (knowledge).

Many practical and contextual conditions also impede this process of transformation of data into information and knowledge. For example, gathering data in multilevel organizations comprising of different sub units and spread across geographical locations is a challenge, as each unit may have specific needs for information, and has its set of primary data collection and storage procedures. The diversity of data formats and data elements can potentially adversely contribute to data quality implying “garbage in and garbage out”. Poor data quality, namely of it being erroneous, overloaded and irrelevant, has been identified as a major factor also contributing to the lack of optimal effectiveness in the use of information (Huang et al., 1999, Kerr et al., 2007, Laudon, 1986; Wang, and Strong 1996, Xingsen Li et al., 2009)

Poor quality data adversely affects the quality of decision making, and even may lead to inappropriate decisions being taken if the data incorrectly assumed to be adequate quality. Kerr et al., (2007) have argued that “defining data quality and realising the need for information that is free of defects and that possesses the right qualities for the task at hand remains a difficult issue. This is particularly so in the healthcare sector where the need for effective decision making is high. In the context of public health management, problems of irrelevance, erroneous data, and overload are indeed relevant, but there are many others that relate to the particularities of the sector. For example, a common problem is that the health sector often has different estimates of catchment area population depending on who the collecting agency is. In such a case, the indicator calculation varies between agencies, and is thus difficult to act on. Another particularity of the sector is that there are targets given to field health workers on what they should achieve for services being delivered. As a result, data often tends to get manipulated to show performance is line with the targets set.

This lack of translation from “data” to “information” and “information based action”, is a significant problem for the health services because of various reasons including:

1. The field level health staff spends a significant proportion of their time collecting routine data, and it is important to find commensurate value for this time and effort utilization.

2. The data gathered, if of appropriate quality, can become a very vital resource for strengthening both monitoring and evaluation activities. Lack of use of it implies decision making based on lack of evidence and systematic analysis of the current situation. The poor quality decision making which likely results from this would be detrimental to health systems improvements.
3. Key decisions being made by the NRHM involving large financial outlays, which if made without an appropriate information base, could lead to serious inefficiencies.
4. The morale of staff collecting the data is likely to decrease as their efforts in collecting the data is negated if the data is not translated into information and used productively.

The contemporary HMIS in India could be commented on based on its efficacy in supporting the NRHM's objectives of achieving equity, affordability and effectiveness in the Indian Public Health system. With respect to equity, the HMIS should support the analysis of whether marginalized populations (in the Indian context being the various Scheduled Castes and Scheduled Tribes - SC/STs) are being adequately taken care of by the health system. However, given the poor quality data which is being captured for this it is likely that the HMIS cannot effectively support the monitoring of the equity parameter. Without relevant financial data being reported through the routine system, the HMIS is not equipped to support the monitoring of the affordability criteria either. Finally, with respect to effectiveness, if the primary focus of the HMIS is on data and not its conversion to information, the value of HMIS for monitoring of the effectiveness of the health system is limited.

1.3 The research problem

This research is thus urgently required to understand the nature of issues impeding this process of translation of data to information and knowledge, and what may be done to address them. The existing HMIS in India is identified by the NRHM as needing strengthening especially with relation to its ability to support action. The thesis investigates this and makes an assessment of the ability of

the existing HMIS in India to support the processes of information use in identified priority areas of the government, such as planning, monitoring and evaluation.

The research thus undertakes the following aims:

1. Through an assessment of the Indian HMIS, understand what the issues limiting the use of information for action are.
2. Through an action research empirical approach, understand how improvements can be made in this regard.

Objectives

1. To understand the nature of flows of information from the state to the national level. This will involve understanding what data flows occur, in what formats, periodicities, and who the people involved are.
2. To understand what are the key indicators that need to be monitored by the NRHM decision makers, specifically relating to the criteria of improving equity, affordability and effectiveness, within the Indian Public Health system.
3. To discuss with the different stakeholders regarding what information they receive, what are the perceived gaps with respect to the identified indicators, and what they think can be done to improve the situation.
4. To assess the capacity of the programme managers to understand concepts relating to indicators and use of information.
5. To assess the value, ability and functionality of the existing HMIS to meet the reporting and analysis needs of the various user groups at the national level.

Chapter 2 : Literature Review

Although the term “use of information” has been extensively used in the health care context, there has never been a clear definition of what “information use” means. But in general terms, it refers to the use of information for planning and monitoring health services (Cibulskis and Hiawalyer 2002). In developing countries, various studies have established that the use of information for such purposes in general is low (Williamson and Stoops, 2001), and is something that needs to be cultivated over time. Contributing to this state of poor or non-use of information are various factors including the existing fragmentation of health services delivery, poor and uneven infrastructure, centralised style of decision making, appropriate information not being available, poor quality of information provided, insufficient information provided, distrust of information provided and the required information arriving too late (Lippeveld and Sauerborn, 2000).

Impediments to information use for local action are analyzed in this chapter across three dimensions. The first is at a micro level of the health system where various impediments exist. The second relates to the state strategies where health information systems are seen more as tools to strengthen control and surveillance rather than promote local action. The third issue concerns design where systems are inherently limited in their capacity to capture the dynamics and multiplicities typically associated with a health system. These are now discussed.

2.1 Micro analysis of information use impediments

The RHINO 2003 conference (RHINO 2003) identified the following 5 normative practices to be established in the public health care sector for an information use culture to evolve:

1. Individual client/community interface and continuity of care: client cards and registers should be used as “continuity/quality of care checklists.”

2. Data collection: minimum/essential data should be collected through standardised reporting formats.
3. Self-assessment and peer review: individual or facility performance should be measured by aggregated data which flows from the lower to the upper levels.
4. Health Information Systems (HIS) informed decision making: by developing self-assessment tools and encouraging presentation, self-assessment, and peer review of information during routine team meetings, it is believed that the number of HIS *informed* decisions will increase.
5. Feedback and reporting: feedback of relevant information and decisions taken based on that information is required.

Heywood and Rohde (2001) support the above discussion arguing that:

Information use is made easier when it is ritualized and routines are set up as part of the information culture. In other words, everything done at a facility must be on the basis of information. Every decision made, every action taken, and every change made should be guided by information coming from within the facility and influenced by outside policies, norms and regulations (pp.84).

The information tools which can facilitate the collection and processing of data into information are contained in an HMIS which is basically a database system in which “raw data” are stored and transformed into information (Lippeveld and Sauerborn, 2000). The HMIS can be conceptualized as a “system,” with a set of interrelating components which can be grouped under two entities. One, relates to data collection to ensure that the collection of good quality data from lower levels flows to the central level. Two, at the conceptual level, which relates to the tools for analysis, which facilitates the transformation of data into information for informed decision making, and the provision of feedback mechanisms. There can be various kinds of HMIS or modules in it, including

for epidemiological surveillance, routine services reporting, specific programme reporting (such as Malaria and TB), administrative systems, and systems for vital registration (births and deaths).

While the provision of various tools through an HMIS is an essential component of cultivating information use (Cibulskis and Hiawalyer 2002), on its own it is inadequate to facilitate change processes. From their experience based in Papua New Guinea, Cibulskis and Hiawalyer (2002) argue that *“An important way of developing the periphery in this respect is setting up good examples at the top. If senior management seeks information and uses it openly then the importance of information is reinforced throughout the health system”* (pp, 256). Moyo et al. (2005), based on research in Malawi, have described various kinds of ways in which a HMIS can support information use including the preparation of district implementation plans, the allocation of financial resources and the strengthening of priority supervision.

Information use is not a binary variable of “yes” (i.e. using) or “no” (i.e. not using) but represents a continuum of different degrees of use. Three levels of information "use" can be discerned in a health system, namely:

Level 1: The use of information is limited, and the primary focus of the HIS is on the provision of data based on essential datasets.

Level 2: The use of information is more developed, and information analysis is taking place based on the use of indicators.

Level 3: Indicators (i.e. information) are being used to inform action plans.

The TALI tool³ helps to measure the stage (1, 2, or 3) which the health system of a country is at (Health Metrics Network, 2005). This tool was tested in 9 countries, and based on the analysis, South Africa and Thailand were identified as being outstanding in their use of health information.

³ This represents a tool for evaluation of the health information system of a country. It contains various dimensions (such as technical, legal etc), each of them with various sub-dimensions that have to be rated on a scale of 0 to 4.

While in Thailand, the use of information was catalysed because of it being based on the link of the health information to the universal coverage insurance scheme, including associated payments, in South Africa, information use evolved over a long term process involving the development of national datasets and indicators, data standards, district based health information systems, and ongoing and continuous processes of capacity development. Moving to higher levels of information use necessarily involves first getting up to Level 1 of a functioning HIS, developing indicators/targets as the driver for synthesizing and analysing data (like in South Africa), and then finally moving to Level 3, which seeks to link resource allocation to data and establish institutional mechanisms for supporting information use (like in Thailand). In Thailand, universal health care coverage reinforces the need for timely and standard health information, as it links information with resource allocation.

Several conditions have been identified that contribute to the weak use of health information in developing countries including institutional capacity, centralised styles of decision making, weak and uneven infrastructure, and a weak culture relating to information use (Braa et. al. 2006). While information use can relate to various types such as for reporting, monitoring, evaluation, planning, and surveillance, practically what is seen in many developing countries that it is primarily used for reporting upwards within the administrative hierarchy and not for supporting local use of information (Sahay and Lewis 2010). Further, it can be noted that information use is not a binary condition of “yes” or “no”, but represents a continuum from Level 1 (setting up basic systems of the HMIS) to Level 2 (converting data into information), and Level 3 (relating to the use of information for action). Most developing countries with some exceptions like South Africa can be classified to be at Level 1 or below, because they are geared primarily towards data collection and reporting, and not to information use to any noticeable degree (Braa et al. 2004, Sahay and Lewis 2010). The fact that typically national HMIS are not holistic, but instead rather compartmentalised within vertical programmes, further impedes the use of information for action (Chilundo, and Aanestad 2003, 2004).

In summary, what is found in various contexts, there are micro level conditions that impede the collection of good quality data based on which effective indicators can be generated and used. Further, there are also contexts where despite data and information being available through the HMIS, it is not put to effective action. For example, Sahay and Lewis (2010) describe how in India, despite vast amounts of data being available, because of the dominance of a statistical rather than public health oriented approach to data, the primary focus of use is not towards the generation and utilization of indicators, but rather towards using statistical techniques for data quality analysis through the use of outliers. This issue is discussed further in Chapter 6.

2.2 A political analysis around health information use

Typically, HMIS initiatives are designed and implemented by national ministries, and tend to be centralized and upward looking in focus, with little scope given for promoting and nurturing local use of information for action. Centralization attempts to implement HMIS based on pure statistics are prone to failures, and such substantial legacies exist from across the developing world (Braa et al., 2004). Such centralized attempts of monitoring local events are not a unique phenomenon to the health sector but are endemic to the approach taken by many developing country governments for managing different sectors including forestry, rural development, social welfare, education and others. James C. Scott (1998) describes how state power is exercised in various initiatives aimed at social transformation, for example involving the creation of permanent last names, the standardization of weights and measures, the establishment of cadastral surveys and population registers, the design of cities, and the organization of language. Scott argues such initiatives often end up in large scale failures as they seek to make society legible by trying to transpose complex, illegible, and local social practices onto a standard grid, a place where, in their simplified form, the practices could be centrally recorded and monitored. He gives an example from cadastral mapping where there is a process of simplification where the realities of the complex underlying social processes are abridged. He writes:

These state simplifications, the basic givens of modern statecraft were, I began to realize, rather like abridged maps. They did not successfully represent the actual activity of the society they depicted, nor were they intended to; they represented only that slice of it that interested the official observer. They were, moreover, not just maps. Rather, they were maps that, when allied with state power would enable much of the reality they depicted to be remade. Thus a state cadastral map created to designate taxable property-holders does not merely describe a system of land tenure; it creates such a system through its ability to give its categories a force of law. (page.3).

(An expanded form of this argument can be found in: Sahay, S. and Lewis, J. (2010). Strengthening Metis around routine health information systems in developing countries, *Information Technologies and International Development*, 6, 3, 67-87).

This theme of exercise of state power has been emphasized by Foucault's analysis of governmentality where he argues that power is exercised not only through politics using hierarchical and top-down means, but also through various forms of social control in disciplinary institutions, such as schools and hospitals. He describes in a lecture:

The ensemble formed by the institutions, procedures, analyses and reflections, the calculations and tactics that allow the exercise of this very specific albeit complex form of power, which has as its target population, as its principal form of knowledge political economy, and as its essential technical means apparatuses of security. (1991)

Surveillance and control often become the end aims of these state initiatives where the target is the population, "which becomes available as a category through census classifications, epidemiological surveys and regulations and statistics" (Prakash 2000, p. 10). Similarly, mechanisms such as censuses, cadastral maps, identity cards and security apparatuses are often used by the State to simplify society and make it legible. Scott argues such attempts are designed to fail for two main

reasons: “The proponents of these plans regard themselves far smarter and farseeing than they really were and, at the same time, regard their subjects as far more stupid and incompetent than they really were” (1998, p. 343).

The above statement reflects the power–knowledge relationship, where those exercising these plans see themselves as possessing the power of science and technology, and the recipients of the plans are seen to be ignorant or with irrational knowledge (Puri, 2006). In public health, the use of statistics and epidemiological analysis for planning local interventions exemplifies such a relationship between population and diseases. Hacking (1990) describes how statistics is used to “tame chance” and make the world more apprehensible and thus controllable, like epidemics in public health. Prakash writes:

The desire to bring diseases and deaths under the statistical gaze represented an effort to relocate the indigenous population, to bring it under the colonial complex of men and things, where its irregularities in relation to climate, topography, habits and habitation could be observed and acted upon. Government officials searched for agencies that reached down to the village in order to collect vital information on births and deaths, and complained that inaccurate diagnoses and medical treatments provided by indigenous practitioners enabled sickness and mortality to escape the net of statistics. (2000, p. 135)

In contemporary public health management systems, developing country governments continue to harness and use statistics to simplify complex phenomena, such as maternal deaths, into mortality indicators which they believe can be measured and controlled. Complex social and health-related processes and events, such as underage marriage of women, the prevalence of diseases like HIV and malaria, existing conditions of anemia and the absence of effective access to basic emergency obstetric services—all important determinants of maternal deaths—are converted into linear output indicators of “maternal mortality rate,” which may mask other determinants. This issue is of

contemporary importance as most developing nations are pursuing their Millennium Development Goals (MDGs) (United Nations 2007, 2003) for addressing problems of maternal and child deaths. While the state needs at the national level to monitor macro indicators (such as of maternal mortality and infant mortality rates), these macro figures represent aggregates from sub districts, states and districts. Unless then the local level is empowered with systems and capacities to monitor these indicators at the field level, the national level will never be able to generate reliable indicators at their macro level.

In the domain of health information systems, there are various examples of high-modernist attempts to create social order. Raghvendra and Sahay (2006) report the efforts of one state government in India to generate a unique, multi-purpose household number to help trace by homes the demographic details of its citizens, including their caste, income levels, and various disease-related health profiles. A centralized software system was an essential component of this design, as the state instructed health programs to collect their health services data using these identity (ID) numbers which transformed an existing practice of collecting aggregate statistics to individual name based. The state tried to enforce these directives by stating that reports not based on these ID numbers would not be accepted.

This attempt by the state to reduce the individual households and the complex social processes intrinsic to them to a 17-digit number so that they could be better managed represents a classic attempt to simplify through standardization. Raghvendra and Sahay (2006) elaborate on many social-technical-cultural conditions that contributed to this effort becoming a large-scale failure. These were problems in the concept of the ID number itself, which was based on the household, rather than on the individual. This static number was insufficient to capture the dynamism of the family, where in the joint-family structure there were constant movements due to births, deaths, marriages, etc. Since no support system had been designed to deal with the complex process of updating the database, the rhythms of change in the reality (of the household) were incompatible

with those in its representation (the 17-digit number). Further, since this ID number was created through household surveys based on revenue boundaries which did not directly apply to health boundaries, its relevance for public health was limited. The centralized software designed to support this system coupled with a strong contractual system with the vendor, made the process of bringing in design changes, inherent in the health system, extremely rigid and prone to delays. For example, the political decision to create new district boundaries required the software to change the organization unit hierarchy. Bringing in such changes was problematic for two reasons: the rigid design of the software and the contractual limitations with the vendor, who needed to be paid for services outside the scope of the original contract. Such problems contributed to the erosion of use of the software which faded away within a year.

2.3 Design challenges to information use

Heeks (2002) has described the reason why health information systems and information systems more broadly fail to deliver the goods in developing countries as being because of “design-reality” gaps where the system design does not reflect user realities. Suchman (2001) uses the metaphor of “design from nowhere” to describe the phenomenon of systems being designed in the West for developing country contexts, which come with inscribed assumptions that are incompatible with use realities. As a result, systems are not able to support local use of information and be fully accepted by the user community. Bowker and Star’s classic 1999 study on representations is based on an empirical study of ICD 10 (International Classification of Diseases and Related Health Problems, Version 10). Classification systems are assumed to be consistent, unique, complete and the categories mutually exclusive. However, in practice, no design is ever “complete,” and different groups continue to be in disagreement. A classification system, by design, tends to keep some aspect of the human interaction invisible, valorizing a certain point of view and keeping others silent. As such, giving advantage or suffering to different groups of people are not neutral choices and underlie moral and ethical decisions. As such, classification systems, including the information

systems used to implement them, tend to be sites for disagreement and lack consensus, which over time contributes to their failure.

Health information systems, manual or paper based, in general help to represent the reality of a health situation. For example, an indicator is an informational construct that represents the reality of HIV/AIDS prevalence in terms of indicating the percentage of the population which carries the virus or exhibits the disease in a particular time period (Chilundo and Sahay 2005). The information system then helps to create and circulate the representation by the functions it provides to record, process, analyze, and present the data. Chilundo and Sahay argue that there are design biases that go into the health information system because of the dominance of medical doctors and epidemiologists, who tend to work within a positivist framework involving the use of advanced statistical techniques to model diseases. Such a statistical focus tends to take the attention away from the local and social processes that surround the construction of data and the indicator. Berg (1997) describes the limits of computers to represent intricate medical work (Berg, 1997) which are often shaped by political considerations that make certain forms of work invisible (Suchman, 1995). Latour (1999), using the concept of circulating reference, draws our attention to how aspects of the phenomenon are either lost or magnified in the process of constructing a design representation—which then can never construct a mirror-image of “reality.”

One of the design challenges in health information systems concerns integration and an example is provided from Mozambique (Chilundo and Aanestad 2004). They discuss design with respect to the multiple rationalities or logics inscribed in public health systems. The authors identify three forms of rationalities. The first concerns the rationalities on the ground, which refer to the conditions at the point of service delivery, including high patient loads; the capacities of the field staff, who are the users of the systems; and the nature of their interaction with the different constituencies, including the community. In contrast to this, there is the rationality at the “top,” which includes the agendas and interests of the donors who, for example, seek to support disease specific programs, or

of the Ministry of Health officials who may need to appease the donors in order to ensure that funding does not dry up. Then, there is the rationality of the diseases themselves, which have their own specific implications on the supporting information systems. For example, the HIV information system would need to have specific functionalities for securing the names of patients, which is not an issue with malaria patients. When these different rationalities need to come together and be reconciled within particular empirical sites, disagreements and lack of consensus will abound, with direct implications on how the health information systems are locally used.

Relations between the different actors in the health system are, by definition, asymmetrical (ibid.). So, the entities at the top (namely the donors and central ministry officials) have more power than users at the peripheral level, due to status and resources. Similarly, some disease programs (such as HIV/AIDS) are better funded than others (Malaria, for example, in Mozambique), which means they will have more resources for staff, training budgets and other infrastructure required for the running of systems. With these inherent asymmetries, which are beyond the scope of an information systems designer to modify, the entities with power then have the capacity to direct the health information systems to suit their specific interests and agendas. As often those controlling the system are the national statisticians, the tendency of system design is to support more data collection than less, with a focus on fulfilling national and central reporting requirements than local action. The situation is compounded by donor agendas which promote centralized and disease specific data collection (Haga, 2001) and where the peripheral level is only seen as a source of passive data provision, and not as active consumers of data for their everyday local action. Data collection instruments and reporting formats are usually designed by centrally-located epidemiologists, statisticians, and administrators (Lippeveld, 2001), which again reinforces the design bias of upward reporting. Various researchers (Kimaro & Nhampossa, 2005; Monteiro, 2003; Chilundo & Aanestad, 2003; Braa et al., 2001) have criticized the donor-driven efforts aimed at creating parallel systems, as they contribute to overlaps and gaps in data collection, to a lack of standard definitions of data, and to a huge work burden on the peripheral worker, who ultimately

becomes the target for most data collection. This fragmented landscape of health information systems yields only an abridged version of the reality—representing the state of health of a district catchment population—to the district manager responsible for managing integrated public health interventions in the area.

The other pertinent characteristic of a routine health information system design is that it needs to be flexible, as the demands of the health system are inherently extremely dynamic (Braa et al. 2007). For example, a new disease may become relevant. Such was the case with the recent swine flu epidemic, which required new data elements to be collected and fresh indicators and reports to be generated. Or, there could be a situation where there is a reorganization of political boundaries which requires a revision of the organization unit hierarchy. Such changes in requirements are the norm, rather than the exception. As such, health information systems by design need to be customizable and adaptable; and it cannot be expected that requirements will be frozen and the health system will adapt to the rigidity of the information system. In addition to being dynamic, the changes are of an uncertain nature. It is never known when a new disease may come, or when there could be a political decision to reorganize the health system in a particular way. As such, public health information systems, by the nature of the contexts within which they operate; the existing structures of power relations; and the technologies of knowledge production used, primarily related to statistics, are inherently challenging, by design about disagreements, and biased towards upward reporting rather than local use of information.

2.4 Conclusion

In this chapter, three sets of interconnected challenges related to local use of information have been discussed. The first is at the health system level where various impediments exist including relating to infrastructure, human resources, overload of workers, and in general a limited culture and incentive to use information locally to support action. A second set of challenges are identified through a political analysis of the State strategies where attempts at standardization inherently

involve a gross simplification of complex and local social processes. The systems so designed to support such centralist agendas are by design limited in supporting local information use. Finally, a third set of challenges discusses concern issues of design, where by the fact of who designs the system, the multiplicities of rationalities involved, and the need of the health system to have a supporting system that is dynamic and flexible which is often not the case, make systems inappropriate to support local information use.

After having described with a rather large brush the situation of health information systems in developing countries, in the following chapters the focus is on the particular case of India where an empirical assessment of the health information system is made with supporting events aimed at reform.

Chapter 3 : Methodology

3.1 Study Design

The study design concerns the broad parameters within which a particular research is situated and carried out. In the context of this research, the study design can be adequately described along the following dimensions: a. interpretive approach; b. case study approach; c. applied research framework; d. Multi-level design; and, e. Longitudinal research.

Interpretive approach

The research design involves an interpretive case study within an applied research framework. The interpretive approach (Walsham 1993) to information systems/health information systems research has been widely used by researchers in recent times. An interpretive approach focuses on the subjective understanding of the respondents around the particular phenomenon under study, and the inter-subjective processes through which these interpretations are constructed. In this case, the phenomenon under study concerns the national HMIS in India, the subjective views of the concerned respondents on the current status of information use, the impediments being experienced, and the respondents' opinions on how these impediments can be addressed.

As Walsham (1995) describes, interpretive research is based on certain founding principles, which set them in contrast to a positivist research approach. Firstly, data is always considered to be value laden implying that it is seen to be actively shaped by the perspective and intentions of the researchers. As such, an interpretive approach assumes that subjective interpretations to be context dependent with the researcher playing an active role in shaping them. By the very nature of the questions asked by the researchers, responses are shaped, and as such different researchers and questions may elicit varying responses. This is in contrast to a positivist approach where data is

considered to be value free and independent of the researcher who asks them and the setting within which they are asked. The second assumption concerns the truth claims that are expected to emerge from interpretive studies. The aim here is to understand a particular phenomenon in situ, and develop “rich insights” and coherent stories of the phenomenon under study. Rich insights concerns in-depth understandings of why particular phenomenon unfold in certain ways and the underlying social process and contextual conditions that shape it. In contrast, the truth claims emerging from positivist studies are in the form of statistical generalizations, where from the sample population under study using statistical techniques the aim is to make generalizations for the populations within defined statistical confidence limits. The third assumption is related to the understanding of causal relationships. While interpretive research does not aim to develop cause and effect relations, positivist research seeks to develop hypotheses specifying relationships between independent and dependent variables that can be statistically tested in universal settings.

The question then asked of interpretive research is that if the aim is to develop in-situ understandings of a phenomenon, then what kind of generalizations can be made from them, and how can researchers use these findings in other settings? In a seminar in the United States in 1992, Walsham drew upon a personal example of raising more than one child. He described each child to represent a longitudinal case study, where while each child was unique and particular, there were aspects of child raising gained from one child which could be applied to the other, for example the necessity of immunization. More formally in a journal setting, Walsham (1995) addresses this question of generalization very effectively arguing that researchers are always developing understandings from a particular interpretive study which are useful and which are carried explicitly or implicitly in understanding similar phenomenon in other settings. These understandings are not in terms of causal relationships or “statistical truths” as is the case in positivist research, but in the following three distinct forms:

- a. ***Rich insights***: This represents a deep understanding of the how and why of a certain phenomenon represented through “thick descriptions.” Typically, anthropologists are

known to provide rich and detailed descriptions of the phenomenon they study based on everyday and micro-level observations.

- b. **Concepts:** Walsham takes the example of Zuboff's (1988) concept of "informate" which was derived from a rich interpretive study. This concept was articulated to help distinguish between automation which involves replicating existing manual processes, to when the users can get additional value by the combination of different pieces of information which computerization enables. For example, if a salesman is logging in his/her hours on a system, then it may be seen as a mere automation. However, if this information is combined with sales figures by products, geographical areas and periods, the manager can start making interpretations on the effectiveness of the different salespersons. While this concept was derived from a specific set of case studies, it can help to understand the benefits from computerization in other settings too.
- c. **Theories:** Some interpretive studies can lead to the development of theories which represent a network of inter-related concepts. For example, the Actor Network Theory (ANT) has been constructed based on various studies within the domain of sociology of technology. This theory provides a toolkit of interconnected concepts such as translation, actor, network, inscription etc. This theory is something which can be and has extensively been used in various application domains also outside technology.

So, from interpretive studies it is not that generalizations cannot be made, but qualitatively different kind of truth claims are required to be made.

Case study

Case studies can be constructed around a phenomenon which a researcher wants to study, and this typically takes place within a particular context and time frame. In the field of information systems research, case studies are an established method of carrying out research, especially those within the interpretive research approach and involving the use of qualitative methods. As the tradition of

interpretive research has taken stronger roots in the information systems domain, the use of case studies have heightened as contrasted to earlier applications of controlled and field experiments. While case studies naturally lend itself to the use of qualitative methods that does not necessarily need to be so. Quantitative methods can very well be used if justified by the particular questions being researched.

In this research, the case under study was to develop an understanding in the form of an assessment of the national HMIS in India with a particular focus on its capacity to support the use of information for local or decentralized action. This phenomenon is assumed to be context dependent and shaped by various contextual influences such as bureaucratic structures, donor influences and agendas, the nature and adequacy of infrastructure, the human resources capacity available, the political will of government, and the resources available for HMIS reform. Since such contextual conditions are locally specific they have shaped the HMIS growth in quite particular ways. For example, the colonial legacy of British rule has helped to shape a strong and centralized legacy which has contributed to a national HMIS that tends to be primarily “upward looking.” This stands in quite a sharp contrast to the South African HMIS which evolved in the context of post-apartheid health reform in South Africa which had an explicit agenda of decentralization and unification (Braa and Hedberg 2002).

The interpretive case study approach thus helps to identify contextual conditions such as bureaucracies and governance that shape the HMIS trajectories in particular ways. These contextual conditions, the social constructivists (e.g., Bijker, Hughes and Pinch 1988) argue, shape subjective interpretations and understandings of individuals in the context, which in turn influence the nature of their agency and actions in their everyday life. As such, for example health information officers in India and South Africa or across different districts in a country will have different motivations for action. So, an interpretive research seeks to understand the underlying nature of the context in which a phenomenon is situated, and how this shapes and is shaped by the interpretations and

actions of human actors. Further, context is never static, and human action is continually molding the context in different ways. For example, while the Indian bureaucracy has been historically centralized and controlled, the actions of entrepreneurs in the eighties helped to give the software industry a global visibility and significance. This contribution could not be ignored by the government and provided a much needed impetus for economic liberalization (Nilikeni 2009). This example highlights the need to analyze the mutually interacting relationship between the context and social action – how the existing historical, institutional and political context shapes the content and process of the HMIS, and at the same time how the action of particular individuals (for example, administrators and technical agents like Health Information System Program (HISP) India) helps to either reinforce existing trajectories or may induce change.

Further, a case study design rather than a survey approach or lab experiment helps to arguably develop an in-depth understanding of the phenomenon, the processes that shape information use or non-use, and the respondents' own interpretations of these processes. Since these processes are not “one shot events” that can be captured through surveys but rather evolve over time, and since it is unlikely that their complexity can be simulated in field experiments, a case study design was seen to be more effective in addressing the research questions posed in this thesis.

Applied research framework

This research was conducted within the framework of the HISP initiative which has been ongoing globally since 1994 and operative in India since 1999. I have been actively involved in these efforts since 1999, and have jointly contributed to the articulation of the “networks of action” applied research approach for the study and strengthening of HMIS in developing countries (Braa et al. 2004). This approach, very briefly argues that change is best facilitated in a framework of networks (of people, ideas, shared software and the like) rather than in single and isolated instances of change. The networks of action approach then seek to facilitate processes of networking and collaborative learning both across and within countries. For example, the network linkages between

researchers in South Africa and India helped to understand the manner in which the South African system had defined the relation between indicators and data elements (each data element collected should contribute to the generation of more than one indicator). This was then articulated as one of the design principles in the national HMIS redesign process in India in which I was involved with since 2008. Similarly, as a part of the implementation strategy of the reforms in the various states in India (34 in India), a networking strategy was used. Training material developed for one context was shared with others including required modifications. Further, at the heart of the implementation was the use of the DHIS2 – District Health Information Software – version 2 – which is free and open source thus allowing it to be freely shared across various sites. As particular kinds of analysis reports were created for a particular state, the same were incorporated into other state applications so as to be able to share the learning and products – contributing to the strengthening of the networks of action.

The applied research framework contributed in addition to understanding the phenomenon of information use, and how to try and make improvements in it. Empirically, this meant that the research effort was carried out in collaboration with various stakeholders such as the national government administrators, state and district level users. This collaboration with these stakeholders helped to define the problems related to weak information use, identify the alternative scenarios and solutions, and discuss and identify appropriate approaches to implementation. The network of action approach particularly helped to focus the attention of the development and strengthening of collaborative networks to try to both identify and address problems related to information use.

Multilevel design

The multilevel design required that the case study involve field work and data gathering at various levels. The research aim of understanding the working of the national HMIS in India required firstly defining the boundaries of the “system” that would be studied. The system – the national HMIS - is comprised of an information flow starting from the delivery and recording of services

(typically in the field diary) by the field health provider (called the Auxiliary Nurse Midwife – ANM) to the members of the community in the village, and then posting this data in the primary registers at the lowest health facility of the Sub Center (SC). Typically, a SC is managed by one or two ANMs and the government norm is that there must be one such facility for a 5000 population (usually spread over 4-5 villages). From the primary registers, the ANM compiles a monthly report which is then sent to the Primary Health Center (PHC). Normally, a PHC has 5-8 SCs under its jurisdiction, and it also has medical staff like a Doctor, Pharmacist, and Lab Technician. The norm for the PHC is that it should cater to about a population of 40,000 population. The PHC also has 5-7 beds where they can provide delivery services. The PHC receives the reports from the ANMs of the different SCs under its jurisdiction, and aggregates it together with the services that were provided in the PHC and the ensuing consolidated report is then sent up to the next level of the sub district, called either Block or Community Health Centre (CHC). The CHC has more doctors (3-5), has typically 100 beds, provides more specialized services than a PHC (for example, C-sections and blood transfusions) and caters to a population of about 150,000 to 200,000. A similar process of aggregation and consolidation of reports as those which took place at the PHC level occurs at the CHC, and the monthly consolidated report is sent to the District office. Here, this office consolidates figures coming from the District Hospital (typically, 300 bedded hospitals), and enters other specific district level data such as “Stocks” and the overall report is sent to the state level which consolidates the various district reports and sends the consolidated report up to the national database.

The national HMIS thus comprises this multilevel and rather complex flow of information from the community through these various administrative hierarchical levels each involving particular services, facilities, staff and their respective work practices. Understanding and assessing the national HMIS thus necessarily requires a multilevel analysis of the flow. I have initially worked for 5 years (2000-2005) at the PHC to the district level (in Chittoor, Andhra Pradesh), followed by 3 years (2005 to 2008) at the State level in Kerala and also other states, and post 2008 at the

National level in Delhi. While the primary focus of this thesis is the work carried out at Delhi, this has drawn heavily upon the experiences of the earlier years at the various sub levels. For example, one of the first tasks at the national level was a situation analysis of the national HMIS. This involved an empirical analysis of the state HMIS (of 3 states – Kerala, Gujarat and Jharkhand) including their district and sub district databases to understand issues of data quality, information use and the levels of standardization that exists within and across states.

At another level, the research has also involved a global perspective, as I have also been involved in research into the analysis and design of HMIS in other countries such as Mozambique, Ethiopia, Tajikistan, Bangladesh and Vietnam. Also, having the opportunity to be a research supervisor for students at the doctoral and masters levels from various countries in Africa and Asia, there has been the possibility to learn about other systems – both good and bad practices. These learning have helped to provide a framework to study the Indian HMIS, and where possible apply them in suggesting improvements. As mentioned earlier, an example from South Africa about the relation between data elements and indicators was a crucial benchmark in the analysis and redesign of the national HMIS in India.

This multilevel research design was crucial in providing a more holistic and comprehensive design of the national HMIS in India.

Longitudinal design

A longitudinal design helps to trace a particular phenomenon over time, including observing events that unfold in different ways. An interpretive analysis by definition concerns understanding processes rather than one shot events (Walsham 1993). In this case, the processes under study were related primarily to information use, and how it changes over time with HMIS based interventions such as the redesign of the datasets or the introduction of software applications. Since the focus of an interpretive analysis is to develop in-situ understandings of a particular phenomenon including

how and why that takes place, it becomes imperative to observe it over time. This research is primarily based on observations carried out from 2008 to 2010, while these have also been shaped by my experiences in the field from 2000. As discussed earlier, an interpretive research approach assumes that data collection is never independent of the researcher's own experiences and agendas. In this case, experiences of more than a decade in the field have shaped my particular research perspectives. Further, experiences during this research (post 2008) have even helped to revisit my earlier experiences and revise them. For example, my learning of the national level perspective post 2008 helped to better understand my earlier experiences at the state levels.

3.2 Study Population

The study population in line with the aims of the research and the multilevel design have included respondents from different levels of the administrative hierarchy with a primary focus at the national level. At this level, the key respondents were the Mission Director of the NRHM, and the key functionaries in the Monitoring and Evaluation Division including the Chief Director, Director and the IT consultants. Further, the focus was also on understanding from the national level health programme managers, particularly for Child Health, Maternal Health and Family Planning, their requirements of monitoring indicators and the formats and periodicities in which these were required. As many of the national health programmes are funded or technically supported by international donors, such as the WHO for the Child Health programme, the World Bank for the Integrated Disease Surveillance Programme, I was also involved in multiple discussions with their representatives on the rationalization and integration of their formats and programme specific information systems into the proposed integrated HMIS. At another level of the state, the study populations included the Health Secretaries of the State Health Department (the senior most ranking bureaucrat in the state), the Mission Director of the State NRHM, the State Data Officers, and the State Health Programme Managers. Since the research efforts have involved multiple training efforts at the state for which I have been a trainer and facilitator, I have interacted also

extensively with the District Statisticians, the District Monitoring and Evaluation Officer, and other district level functionaries dealing with data who have been part of the training programmes.

In this way, the study population has included health staff functionaries from different levels including the national, state and district, and also across various functional areas including policy makers, donors, programme managers, statisticians, IT consultants, and others responsible for the HMIS functioning.

Sample studied

The sampling design was purposive in that it was broadly judgmental as to who should be included and evolved based on suggestions made by the initially identified key respondents, as to who else should be included. This process of sampling can be termed as snowballing, in which interviews with particular respondents led to suggestions on who next should be met, and subsequent meetings were carried out accordingly. This process was continued till a state of “theoretical saturation” was achieved when it was felt that no real new insights were being obtained from further interviews.

The details of the sample studied are given below:

1. The Mission Director NRHM, Ministry of Health, Government of India was interviewed more than once to understand the aims of equity, affordability and effectiveness that the NRHM is striving for and his perception of the role of the HMIS in supporting actions towards reaching these aims. In addition, I attended many of the meetings chaired by the Mission Director and attended by various national level functionaries on HMIS reform.
2. Interviews were conducted with the national level programme managers of the 7 programmes that the NRHM seeks to integrate (Reproductive and Child Health, Malaria, TB, Blindness Control, Leprosy Eradication, Integrated Disease Surveillance Programme, Child Health). These interviews helped understand their needs for

indicators for programme management, how they related to the broader NRHM criteria of equity, affordability and effectiveness, and what gaps in data and quality and completeness they experienced with the current HMIS.

3. Each of the programme managers was asked to suggest one key person in their programme who was responsible for the operation of the HMIS, and they were then met. Sometimes, the responsible person referred to was the IT consultant or vendor who was responsible for running the computer systems.
4. The Chief Director, Director and Statistician in Charge of the Monitoring and Evaluation Division of the Ministry of Health, Government of India at the national level were interviewed to understand how the current HMIS was organized, the infrastructure and capacity available, their interactions with the programme managers, and what they believed were the key challenges experienced, and their opinions on possible interventions required for the HMIS. Many of the meetings with them involved discussions with their IT vendor as the DHIS2 needed to be integrated with the Ministry of Health web portal.
5. While some states (such as Bihar and Tamil Nadu) had a greater focus because of their technical support requests, with a broad brush the HMIS related events of about 25 states were under my radar. State level functionaries including policy makers such as the Health Secretary and Mission Director, the state data officer or the statistician in-charge were interviewed to understand how they responded to the national reporting needs, the tensions and dilemmas between balancing the national and state specific information needs, the drawbacks experienced, and the adequacy of the current HMIS to support action.
6. During the interaction with the states, since I was involved in the capacity building efforts to support HMIS implementation I had the opportunity to interact both formally and informally with many of the district functionaries. While the aim of these trainings were to orient them to the revised HMIS, strategies for implementation, and engage

them in the use of the software and information generated from it, with many of them friendships were forged which helped them to also share at a personal level in the future the challenges which they experienced with HMIS and often they made requests for technical support which HISP India responded to.

7. The donor partners supporting the NRHM programmes (for example the United States Agency for International Development supports the RCH and the WHO supports Child Health) were interviewed to understand their needs for programme specific indicators, the compatibility of their needs with those of the programme managers), and the links between funding and information provision. Since many of these meetings were about the integration of their specific systems and datasets with the routine HMIS, they were the site for politically charged negotiations.
8. Other respondents were met, for example academicians, who were suggested by any of the above as may be relevant to meeting the study objectives.

3.3 Research Context and Data Collection

Before describing the details of the data collection methods, it is important to provide the context within which this research was carried out. Three aspects are important in describing the context. The first concerns my own role and location in the research. The second concerns the implementation framework that was officially defined and it was within this the research took place. The third aspect concerns the scope of support.

With regards my role, I was officially appointed as the National HMIS Advisor on HMIS at the National Health Systems Resource Centre (NHSRC) from January 1, 2008. NHSRC was set up by the Ministry of Health, Delhi, to provide technical assistance to the Ministry and NRHM on six different areas, one of which was HMIS. As Advisor my mandate was to design, organize and implement technical support to the states. My research work was situated within this ongoing work commencing from 2008 till approximately mid 2010.

The second facet of the context concerned the specific scope of support that NHSRC was mandated to provide. One of the first tasks I had as Advisor was to define this scope of support in consultation and guidance with the Executive Director, NHSRC, and also the senior officials at the Ministry of Health. Box 3.1 below outlines this organizational mandate for NHSRC with respect to HMIS support.

1. Supporting processes of system redesign and rationalization.
2. Software customization to meet both national reporting needs and to incorporate state specific requirements for local consumption and use.
3. Meet emerging needs of applications of state, e.g. program specific or new domains like hospitals.
4. Ongoing capacity building and hand holding to support implementation.
5. Public health analysis of data and feedback.
6. Providing support to establish policies and procedures.
7. Distribution of training material and other implementation support guidelines.

Box 3-1: Mandate of NHSRC technical support on HMIS to states

The third facet of the context concerns the actual operationalization of this broad support mandate into concrete tasks. This was done through a definition of an “implementation framework” which detailed the different phases through which state support should be guided. In Box 3.2 below, the details of the different phases of the work and the associated timelines are outlined.

Phase 0: Redesign of the national HMIS (period 12 months)

Objective: Conducting a situation analysis of the existing HMIS in the country, and based on this redesigning the systems.

Phase I - Establishing Routine Systems (period 6 months)

Objective: Establishing systems required for routine information processing, (including data entry, processing, reporting, transmission and uploading into web-portal)

Phase II - Focusing on use of information for action (period 6 months)

Objective: Strengthening and institutionalizing processes for the use of information for action

Phase III - Ensuring sustainability and building advanced skills (period 6 months)

Objective: Ensuring sustainability by building state ‘ownership’ of HMIS process, and building advanced skills in selected technical staff

Box 3-2 The HMIS Implementation framework

Within this defined framework to guide the national HMIS reform process, this research reports on primarily the Phase 0 and Phase 1 components, and to a more limited extent Phase II. During this period, data collection has involved mixed methods, using mainly qualitative data but incorporating some quantitative data as well. I describe below how these data were collected and used.

Qualitative Data Collection

The qualitative methods approach involved three main methods of data collection namely interviews, participation in meetings and in training programmes, and document analysis. In the interviews conducted, questions asked aimed at elucidating the understanding of the information needs of the respondents for supporting action, and how the existing information, supported or not their particular needs for information for action. Further, their opinions on how this link can be strengthened were probed. And by meeting the same respondents over time, I could also try to understand if the introduction of the revised datasets and software systems helped to improve their access to data, timeliness of reporting, and in the use of analytical tools for the interpretation and use of indicators for programme management. In some cases, where GIS mapping was being used, an attempt was made to understand whether it has helped the users to better visualize the problems and in the design of more effective health interventions.

Participation in meetings, both as a member or as a presenter, was another significant source of data. There were different kinds of meetings in which I participated. Initially, in the national

ministry, in capacity of the HMIS Advisor at NHSRC, I was asked to present the NHSRC perspective on HMIS, the efforts being undertaken by NHSRC towards supporting national HMIS reform initiatives, and also the status of activities carried out or planned with associated budgets and timelines. Meetings in which I presented would involve PowerPoint slides which I stored away as a part of my research data. Further, I participated in meetings chaired by the Mission Director NRHM with other stakeholders during the process of redesign of the HMIS datasets, definition of indicators and datasets. These meetings were often quite formal with clearly defined agendas. As a part of this formal process, minutes of the meetings were created by the note takers which then became a part of my research data archive. In addition, I would jot down in my own diary comments which I felt were key to the discussions, and later intersperse it with my own opinions. Many of these meetings details were exchanged over email, and I kept them away in a separate mailbox which I would peruse later when needed. In addition to these formal meetings, there were scores of informal meetings taking place at the Ministry, NHSRC office, or in the HISP India facilities. The topics of these meetings could range from small clarification of issues, to showing demos of systems or the exchange of documents.

As discussed earlier, participation in training programmes on HMIS for state and district HMIS teams and health programme managers was indeed interesting and insightful. While one purpose of these sessions were about orienting the participants on the government agenda and vision of HMIS reform, the broad implementation framework being followed, specific information on health indicators, data elements, reporting formats etc, providing skills on software use, and last but most importantly, on the principles and techniques to strengthen practices around use of information for local action. However, it must be said the focus in training tended to be more technical and orientation on reforms rather than on the public health dimensions of using information for action. The reason for this was in the initial stages, the focus was very much on getting the data processing systems working, providing the necessary skills to users on software use, and on issues of data

quality. We were waiting for the data to be on flow before focusing on information use which was estimated to be a process of at least 12 months from initiation.

Document analysis was carried out on the existing policy pronouncements on the HMIS and what they said about the use of indicators. Specifically, policy implications related to equity, affordability and effectiveness (the key NRHM goals) were examined and their implications for the design and operation of the HMIS were teased out. The NRHM website and various reports published by different programme divisions were studied to understand their programme specific priorities. For example, the Maternal Health Division had a specific programme in place for payment to mothers who delivered in institutions (called JSY – Janani Suraksha Yojna – meaning scheme for the protection of women). As this programme involved large budget outlays, the programme manager here was interested to get specific indicators which helped the analysis of the percentage of pregnant women registered for ANC who actually received payments, and how this was broken up by public and private institutions, by different geographical areas and over time. The Statistics Division of the Ministry of Health published an annual report on HMIS which helped to understand what the key indicators they were interested to monitor, and also their styles of publishing and the levels of analysis. Programme specific reports were studied to see whether there existed effective mechanisms for feedback and supervision support at the local levels.

Quantitative Data

Various forms of quantitative data were collected and analyzed.

1. The existing routine health data transmitted from the state to the national level was accessed and analysed. This involved obtaining from the national level the data they had received from the different states for the last six months. This data was then taken into Excel to analyze the following:
 - a. What was the proportion of missing data by organization units (states or district), by datasets (for example, immunization or maternal health)? If data was systematically

not being reported then the question was raised to the decision makers “what is the relevance of this data element if it is not being systematically (across facilities and periods) reported on?”

- b. Data was analyzed to make interpretations on whether there were abnormalities in the patterns of reporting. For example, if immunization was reported at around 50% every month, and in one month it showed 95% that could be seen as a large variation which required an explanation. Similarly, various other kinds of abnormalities were identified and discussed regarding the underlying reasons for their presence.
- c. Two kinds of abnormalities were identified in the data: data related and programme related. This was identified through the application of validation rules pre-defined in the software application. For example, if there was a validation rule saying that BCG vaccinations given were less than or equal to the total deliveries. Suppose in one month, this rule was violated and it was found that the BCG vaccinations exceeded the deliveries. Then an analysis needed to be made if this was due to a data or programme artifact. A data artifact would be one where due to for example a typing error a wrong figure was entered (such as 3000 instead of 300). However, this violation could also take place due to a programme artifact when children from outside catchment areas have come to a particular area for vaccinations because the vaccines were not available in their facility. This migration resulted in the validation rule being violated, but that was not due to a “data quality error.” Often, I found the tendency amongst the authorities to attribute such violations as data errors, while in fact the data was “correct,” and reflecting the reality on the ground in the form of a programme artifact.
- d. Data quality audit was done through various means such as running the data through validation rules (expert and absolute), and identifying violations⁴, which could

⁴ Absolute validation rules are those that necessarily cannot be violated (for example: Male Births + Female Births = Total Births. While expert rules are those that should hold in most conditions but

further be drilled down by facility and data elements to identify the source of the violations.

- e. The data element-indicator match or mismatch⁵ was another focus of analysis. This involved understanding the number of data elements being collected, how many indicators were being calculated, and what the ratio between the two was. Further, I analyzed whether all the data elements required for the calculation of key indicators were available in the dataset. This analysis enabled me to assess the suitability of the existing HMIS with respect to the generation of relevant indicators.
2. The Readiness Matrix was used to quantitatively assess how different states fared on the dimensions related to readiness for information use. This matrix (see Appendix 1) was developed through a collaborative effort of the University of Cambridge, UK and NHSRC. The aim of this tool was to help analyze what the capacity of states to be able to undertake systematic information analysis and use for action was. This matrix was developed over three dimensions of technology readiness, human capacity readiness, and institutional readiness. Each dimension has various sub dimensions, as described in the table below. Each sub dimension has a scale of scoring from levels of 0 to 3 with 0 indicating least ready to 3 being most ready.

Development of the readiness matrix involved a process wherein first a senior researcher from the University of Cambridge, UK (Prof Walsham) after spending a month in Delhi and visiting 3 states to assess the HMIS there, designed a first draft of this tool. This tool was then presented and discussed with myself first and then to a larger audience consisting of members from the HMIS

are not obligatory. For example: Ante Natal Care check ups in First Trimester should be less than or equal to Total of Ante Natal Cases given Monetary benefits. While this rule is expected to hold in most cases, they sometimes may not because of backlog cases from previous months who were not provided with benefits and are being now paid in the current month.

⁵ This represents the relation between the data being collected and whether or not it is used to generate an indicator.

division of the NHSRC and staff from HISP India. Based on comments received during the seminar, the tool was revised, and then piloted with 2 researchers and subsequently detailed guidelines were presented.

In an official presentation made by me to the Governing Board of NHSRC, the details of the capacity building and support carried out were summarized, which is outlined in Box 3.3 below.

1. Orientation of State and District teams on revised formats carried out in 30 States.
2. 100 % of these teams have been found to be competent in data entry, report generation & report uploading in web-portal.
3. Over 1987 persons trained on HMIS application (state & national), including 30-40% person attended training more than once.
4. 250 Master Trainers have been identified in the States.
5. 310 training person-days conducted in the States.
6. State and district HMIS teams have been notified in 18 States.
7. In 19 states revised formats have been printed and disseminated up to the facility level.
8. 12 states have started block level data entry in online DHIS2 state application – Punjab, Tripura, Kerala etc.
9. 6 states have started PHC level data entry.
10. Gujarat has started data entry from Sub-centre.

Box 3-3: Capacity building details

Also, described below in Box 3.4 below is the list of resource material that was distributed to different states. This dissemination took place during the training programmes. In addition, all these materials were made available on the NHSRC website, and the states were also given the URL to enable them free downloads.

1. Guidelines:

Data guidelines

Indicator dictionary

Implementation framework

Operational & support guidelines

Guidelines of manpower requirements

2. Formats

In English and Hindi

Guidelines for use

3. Manuals

DHIS-2

Use for information

Use of computers

Box 3-4: Resource/reference material support dissemination

3.4 Data Analysis

The mix of quantitative and qualitative data provided the possibility of make a rich analysis which would not have been possible if only one or the other had been used. For example, while carrying out the situation analysis, first a quantitative analysis was conducted to determine the percentage of zero and blank reporting. This then helped to understand there were for example on average 40 to 50% of data that were not reported on or had a zero value, which enabled me to raise the question of “is this data element actually contributing to data analysis?” The qualitative methods which followed then helped to get at the “why” of this phenomenon, and what were the underlying reasons. With the above example, I could identify various reasons ranging from that particular data elements were currently redundant as they were from a historical legacy of programmes which were no longer operational, or there were data elements for which no primary records existed and thus could not be reported upon or the field nurses did not understand those elements. In summary, the quantitative data in this research helped to identify the symptoms of a problem while the

qualitative data enabled the drilling down of the same to reach a diagnosis by understanding the perspectives of those involved.

Generally, data analysis was carried out based on the principles and spirit of interpretive analysis (Walsham 1993). This implied that data analysis took place primarily within an inductive framework where the data was “allowed to speak” to the analyst. Broadly, the process and steps involved in the qualitative data analysis was as follows:

1. All the interviews and summaries of the document analysis were typed out, and helped provide the basic raw material for the analysis.
2. These typed notes were intensively studied, and themes were identified such as that data quality problems were contributed to by “weak supervision mechanisms.”
3. These themes were discussed with other colleagues at both NHSRC and HISP India to get their perspectives and opinions, and their underlying rationale for them.
4. The different themes were then compared and contrasted to develop more holistic inferences. For example, themes of weak supervision mechanisms and poor human capacity were converged to a more integrated theme of “poor institutional support for HMIS.”
5. At various points in the analytical process, reports were developed and presented to the various stakeholders at the national and state levels to obtain their comments and suggestions. These helped to further revise and enrich the analysis. Playing a similar role was seminar presentations made in the university or in international conferences where such feedback was also elicited, albeit from an academic audience as contrasted to a practice based audience in the first case.

Data analysis also involved the Readiness Matrix which was used to assess the readiness of the states. For this, three people including myself who had been involved in providing capacity building and other support to all the states, and thus had a good idea of the status of the different dimensions in the state, were called upon to assess the states. The three then independently rated

the different states on the various dimensions of the matrix. An average score was then computed, and based on this the different states were ranked on their overall readiness to use information for action. The brief results from this analysis exercise are summarized in Chapter 5.

3.5 Validity/Trustworthiness

The first step towards establishing the validity and trustworthiness of the research has been to explicitly state my position in relation to the research. Being engaged in a formal capacity with NHSRC no doubt shapes my perspective, and is further biased towards an approach to making a change based on a formal governmental agenda. The validity and trustworthiness of the data and its analysis was enhanced by discussing the findings with the respondents and getting their view on my interpretations. Findings were also discussed with other research colleagues working in relevant areas especially those within the HISP network. For all claims made in this thesis, I have tried to back them up with sufficient and credible evidence, and have also related them to research findings from other contexts. The reflexive process of analysis that has been adopted, especially through gaining feedback from other researchers and also the respondents from whom the data was gathered in the first place, has helped to ensure that the interpretations are coherent and to an extent without bias. Further, wherever possible data triangulation was carried out by examining the inferences and interpretations being made about the data with respect to findings of other people expressed in similar reports and documents.

Generalisability

General principles of HMIS design, development and use might be identified which could be expanded into theoretical concepts that can be generalized. The more specific mechanisms of how health information systems and health service provision functions in India are context specific and therefore cannot be generalised.

Ethics

Ethical approval was obtained from the University of the Western Cape research committee. Further, permission to proceed with the research, access to staff, use of documents, guarantee of confidentiality and non-disclosure have been agreed with the NHSRC, Delhi. It has been ensured that complete confidentiality was maintained for all the respondents, and no particular individual or health facility could be traced back to the source. Informed consent (in most cases verbal) to participate in the research was obtained from all those interviewed and they were all informed that they were free to withdraw from the interview at any stage without providing a reason for their withdrawal.

After this chapter in which the empirical approach has been described, the next two chapters focuses on describing the findings. The next chapter focuses on the Phase 0 detailing out the process of situation analysis carried out, and in the subsequent chapter, the outcomes from the interventions are discussed– both what has been gained, and what could not be gained – the underlying reasons and how the constraints can be addressed.

Chapter 4 : Situation Analysis

In India, the National Rural Health Mission - NRHM – was established in 2005 with a vision of making architectural corrections within a health system framework in different technical areas including in health information systems. Some of the guiding principles that the health information system needed to support included that of decentralization, integration, and the promotion of evidence based decision making. With this as the point of departure, a process of redesign of the health information system was first undertaken in early 2008 which was then followed by a process of implementation. This process of redesign is now described.

The redesign phase consisted of the following activities:

- a. Carrying out a detailed situation analysis of existing systems using data for 3-4 states.
- b. Having detailed consultations with national, state, district representatives, and also with academicians, NGOs and international experts.
- c. Inductively deriving principles of redesign of the health information systems.
- d. Applying these principles to develop the revised health information systems.

A brief overview of each of these activities is now presented.

Situation analysis: Using some sample states for which data was available on their health information systems, an analysis was carried out to identify what were key constraints in the existing system. This analysis was then integrated with the empirical knowledge the different participants had of the field situation, and the following constraints were identified:

- a. An excessive number of data was being collected – ranging from about 1500 to 3000 per month per facility. This created a significant work burden on the health worker and also seriously jeopardized data quality.

- b. A large number of data elements were being captured simultaneously in multiple forms (for example Childhood TB was collected in Form 6, Universal Immunization Programme and Integrated Disease Surveillance Programme leading to redundancy of work and also to data quality errors at source and thus contributing to a weak foundation for the overall health information system.
- c. While a lot of data was collected, there was limited evidence of even 5% of the data being used for the generation of indicators in a systematic way. For example, no State Plan was seen to use indicators related to Schedule Caste and Scheduled Tribes – SC and ST - disaggregated data even though they constituted about 33% of the data being collected.
- d. A large percentage of this data being collected (say 45 to 60%) was being systematically reported by facilities and periods as blanks or zeros – raising questions as to why they were then being then collected. (See Table 4.1 below).
- e. More than one third of the data collected represented disaggregated data (breakups by SC/ST/Other or by age or sex) which could arguably be more effectively captured through surveys rather than through the routine reporting system.
- f. Fragmentation and compartmentalization of systems was rampant, which led to both the missing out of important data (e.g. HIV tests of ANC cases as they represented different programs) and repetition of certain data (like the example of Childhood TB above).
- g. Data only flowed upward and not downwards, implying poor use of data for supervision and feedback. Further, this created a weak motivation for data providers towards improving quality of data as they understood nothing would come back.

The Table below presents an analysis of data for 3 states that had been reported for 9 months by the different reporting units. While in Kerala data was obtained from all facilities in 1 district, in Jharkhand data was obtained for 623 PHCs which constituted X% of all the PHC facilities in the state and included data from X of Y districts. In contrast, in the State of Gujarat the data was

obtained for 25 districts. From this data collected, first the number of data values reported per month was computed, and the percentage of those reported as “blank” was determined.

Information on	Kerala	Jharkhand	Gujarat
Data elements	1667	623	1128
Reporting units captured	566	2334	25
Data values per month	5257764	414996	28200
Data values for 9 months	10758240	3734964	253800
Data values reported for 9 months	654131	1494502	169392
Data values reported as “blank”	310100	735914	86381
% of values reported as “blank”	53.61	50.86	50.99

Table 4-1: High proportion of “blank” values

The details of these findings from the situation analysis were presented in a national workshop in February 2008 at the India International Centre, New Delhi, where a number of experts attended and feedback was obtained. In this way, user level inputs were taken into the design process before the system was designed. Further, since a number of user groups and experts were represented in the whole process right from the beginning, at least to a certain degree inputs from users and other stakeholders (for example, officials from the health departments at the national, state and district levels, academics and NGOs) were being elicited.

Consultation process: The process of consultations with different stakeholders including national level program divisions, M&E division of the Ministry of Health, states, the NHSRC, and other experts took place in an intensive period following this workshop, and under the direct leadership and guidance of the then Mission Director of the NRHM. The aim of these consultations was to rationalize the forms and information flow, identify key indicators for different levels, and define the recording and reporting formats. As could be expected, these consultations were politically charged, with each constituency not willing to let go of what existed, even though at a conceptual

level there might have been agreement on the need for rationalization. An important example was the discussions around whether data with breakups of SC/ST/Others should be collected through routine data or should they best be captured through annual surveys. The arguments for taking into the survey dataset were:

- i) It adds on to the burden of data collection (each data element gets multiplied three times).
- ii) On the ground, it is very difficult to actually capture this data.
- iii) On analysis of the SC/ST/Other data for 3-4 states, the data was found to be rather “constructed” reflecting similar percentages of SC/ST populations in the state as reported in the 2001 Census.
- iv) Since proportions of these disaggregated populations remain relatively stable in an area, it could be more effective to capture them through surveys rather than routine data.

Arguments for keeping the status quo were:

- i) The new formats have only recently been introduced, and frequent changes would be disruptive.
- ii) The data was important for reporting to Parliament and the political constituency.
- iii) Data quality is good and reasonably complete.

Finally, a call was taken at the highest level and a decision taken to move it into survey data. Some other efforts towards rationalization were not as successful. For example, on the integration of data from the Integrated Disease Surveillance Programme data into the health information system, despite a number of consultations with the programme division and also the WHO, they did not agree to integrate the two data flows based on the argument that the “logic of a disease surveillance system is different from a health information system.” In other cases such as the Routine Immunization Management System - RIMS - there was mixed success, with an agreement initially being made to integrate but subsequently a resulting ambiguity about what was to be rationalized as

clear instructions did not go from the programme division at the national level to the states to stop using the old forms.

Inductively deriving principles of redesign: These consultative processes were accompanied by a design activity of deriving inductively the principles on which the recording and reporting formats could be redesigned. These principles could be summarized as follows:

- i) No data should be entered in more than one form.
- ii) Data should be only be reported based on the service provided by that facility. This implied the previous practice of area based reporting (which arguably led to duplicate reporting) would be replaced by a system of facility based reporting.
- iii) Disaggregated data which was better captured through surveys should not be included in the routine datasets.
- iv) To establish a hierarchy of information needs and required indicators at each level, and to clearly establish the distinction between a “data element” (raw data) and “indicator” (processed information).
- v) Every report going upwards should have a corresponding report going down to support feedback and supervision.
- vi) Establish clearly the distinction and understanding of a reporting format and recording format. While a recording format was where the primary data was registered (for example, the registers), a reporting format was where the data was compiled to be sent to the next reporting level.

Applying these design principles: Applying these design principles contributed to the following outputs:

- i) Redesigned facility specific datasets for each facility type: Primary Health Centre, Sub Centre, Community Health Centre, and District Hospital - PHC/SC/CHC/DH - and others. Formats were so designed so that they could be adapted to other facility types such as private facilities based on the correspondence of services the facilities offered.

- ii) Redesigned reporting formats with a focus on the district consolidated monthly report which was to be the standard for national reporting. In addition, there were the quarterly and annual formats for service and financial reporting.
- iii) A defined set of indicators representing a hierarchy for different levels – with a set of about 30 indicators for the national level and 100 for the district.

These outputs were operationalized into a “HMIS Tool Kit” including:

- i) A book containing all formats including their Hindi translations.
- ii) A data dictionary which provided details of all data elements, their meanings, and data collection guidelines.
- iii) An indicator manual which provided a description of each indicator including its numerator, denominator and guidelines for use.

Further, NHSRC in collaboration with its technical partner HISP India also customized using District Health Information System 2 (DHIS 2) (a free and open source software which was already being used in some states like Kerala and Gujarat) a “standard application” which was capable of meeting all the functionalities for recording and reporting the above defined formats, in addition to providing various functionalities of data validation, analysis, GIS mapping and presentation. This entire tool kit was made available to all states without cost. Table 4.2 below summarized how certain design principles were inscribed into system requirements.

General Design Principles	Examples of their application
Should allow for local control	Reducing the number of data elements to be collected by 90% would help field nurses to have more local control of data collected
Treating the health information system as an infrastructure rather than a standalone system	Integration was a guiding principle, where based on the NRHM agenda, the aim was to create an infrastructure which would gradually provide information support for health programmes
Hierarchy of information support	Different sets of indicators were created for different levels, with the national level assigned a set of about 20 impact indicators and the district about 100 monitoring indicators
Action, not data led	Attempts were made to see each data element included in the dataset was linked to the generation of at least one indicator.
Should support, not disrupt existing work practices	By trying to reduce the redundancies, for example the same data element to be collected only in one form, not three, an attempt was made to support simplified work practices
Adopt an incremental approach to design and implementation	Integration was approached in an incremental manner, where first the immunization data was attempted to be integrated, and then plans to integrate the other programs in an incremental manner were phased in.

Table 4-2: Design principles in action

The above table illustrates how an attempt was made to develop practical design principles, and apply them in the case of the Indian national HMIS, while keeping in mind the broader architecture or infrastructure required. The redesign phase can be seen to have been a positive step towards developing a HMIS that could be geared towards supporting information use. This was done through the reduction of data elements, systematically introducing indicators into the reporting, and intentionally incorporating feedback reports in relation to every report that was to be sent upwards. In terms of integration of data from the other vertical programmes, not much headway was made because of the general reluctance of the programme managers to forego their systems. Only the immunization data was included in the HMIS; but this was seen as a first step in the larger integration agenda.

The learning from the process of implementation that took place in the states from October 2008 to date helps to further redefine these principles, and create others that are more suited to the practices on the ground. For example, we found even though in the design process, the immunization data was removed from the existing routine immunization management programme and integrated with the health information systems, in practice this integration was at best partial. This was because the child health division at the national level had not bought in completely into this change process and as a result had not issued clear guidelines to their line departments to affect this change. The learning is thus that while technical integration may be relatively easy to carry out, the institutional integration is much harder to realize due to historically existing institutional conditions. Greater amount of negotiations thus need to be carried out at the national level leading to clearer directions to field staff to make integration work on the ground.

Chapter 5 : Implementing the redesigned systems

5.1 Initiating the implementation process

In this chapter, I discuss the process by which the redesigned systems, including the principles, the formats for data entry and reporting, and the supporting software were implemented in the various states.

The process of operationalization of the redesigned system was initiated through a letter by the Mission Director NRHM dated 09 September 2008 marked “MOST IMMEDIATE” and addressed to the Mission Directors of all the states. This letter requested the states to immediately start the implementation of the new data recording and reporting systems. An important message conveyed through this letter was:

“In addition the States are requested to send all the data on the revised forms **ONLY**. All **earlier forms** should be **discontinued, repeat discontinued**, except those being submitted for the RNTCP, NVBDCP, NLEP and IDSP where integration is still in process.” (emphasis in original).

These lines emphasized that all earlier formats in use should be stopped and replaced with the new ones, and further that integration was being treated as a process where in the first phase systems such as for RIMS (Routine Immunization Management Systems) were now merged with the existing formats (and were to be stopped), and other programs like RNTCP (Revised National TB Control Programme) and IDSP (Integrated Disease Control Programme) would be addressed in following phases. The NRHM agenda of integration had thus been taken forward head on. Following this, two issues became critical with respect to organizing the implementation process:

1. Which agency(s) should be made responsible for providing the implementation and capacity building support in which states?

2. What software should be used to support the implementation of these new recording and reporting formats?

Again, a subsequent letter of the Mission Director dated November 10th 2008 provided clear guidelines on this:

About training:

“To facilitate implementation, NHSRC has been entrusted with the task of providing training and support to the states and ensuring their information is posted on time and on the HMIS web portal. States have to organize training with their funds for making the HMIS functional. In these trainings, resource persons from the Ministry and NHSRC will attend at their own cost. The training shall take care of all reporting formats, explain the line listing approach and include training on the national HMIS portal with facilities available through it.”

About software:

“NHSRC has an open source software also capable of handling local level information needs including data entry and analysis. It is amenable to specific customization and can support GIS applications. It is also available to States from NHSRC **for free**. States willing to make use of it for Blocks/Facilities may avail the services of NHSRC for implementing it. The HMIS formats to be used in this are compatible with the Ministry’s format. The software has the provision to electronically post the data from Blocks/Facilities, compiled through it at the district level, directly on the national HMIS portal.”

With these guidelines in mind, the process of implementation was taken to the states through two key mechanisms. Firstly, NHSRC created a MOU with its technical support partner HISP India (a not for profit NGO) to carry out the following tasks:

- a. Provide the District Health Information Software (DHIS2) as the “State Application” configured as per the “standard NRHM requirements” (as described above) without cost to the states.
- b. Integrate this application with the National Web Portal of the Ministry so that all the mandatory reports required were generated through the DHIS2 and then electronically uploaded into the web portal where after a process of confirmation at the district and state levels, the reports were committed to the national database. The DHIS2 integrated with the Web Portal thus represented an “integrated HMIS solution” which could cater to both the district and sub-district information needs of the states and also the mandatory reporting needs of the National Ministry. However, this integration was carried out at the reporting rather than the database level which would have been a more effective and robust technical solution. Requests to enable such integration were made to the Ministry but a positive response was not received.
- c. Help customize the application where required and requested by the states to incorporate local requirements, such as the addition of new data elements, new indicators, local validation rules, reports, and the inclusion of the sub-district hierarchy to facilitate facility wise data entry, data validation and reporting. The guiding principle in this customization was that while states and districts had the flexibility to add on local requirements, they could not delete any element of the standard formats which were required for the national level.
- d. Provide server hosting capacity and support to the states for the DHIS2 on a temporary basis until they were ready to host the application and data on their own servers. With this facility, states could take local ownership of their state data.
- e. Provide capacity building and support to the states on various aspects including:
 - a. Orientation on the background of reforms, its relation with what previously existed and what it would take to implement them.

- b. Proposing and elaborating on an overall framework of implementation which included three phases: *operationalization phase* (estimated at about 6 months) of making the basic systems of (data entry, validation and reporting) functional; *information for action* phase (estimated at 6 months to initiate processes) where the focus shifts from generating data to converting it into information to be used for planning and action; and, finally, the *sustainability phase* where the states and districts start to take more independent ownership of the HMIS systems and processes.
- c. Detailed orientation on the meanings and use of the various data elements, indicators, reporting and recording formats, and the information flows including the feedback loops.
- d. The functional use of the integrated HMIS solution including both the DHIS2 and the Web Portal.
- e. Disseminate and orient the states and districts to the use of the HMIS tool kit including the data dictionary and indicator manuals.

Secondly, the M&E division of the Ministry of Health partnered by IBilt (a private company) whose name was subsequently changed to Vyayam Technologies, the developers of the Web Portal, provided training and capacity building to various states in orienting them on the use of the Web Portal especially relating to the functionalities of data entry, report generation, and the processes related to the uploading, confirmation and forwarding of data at the district and state levels.

In the table below, the relative functionalities of the Web Portal and the DHIS2 are compared to help provide an overview of the technology dimension.

Features	Web Portal	DHIS2
Ownership	Proprietary	Free and Open Source: Code available to the state
Customizability	Recording and reporting formats pre-defined. Vendor's intervention needed to develop new reports and formats	A normal user can add, edit and delete data elements and customize organization unit hierarchy through the interface. A skilled user can develop his/her own customized reports, and also create adhoc reports on data elements and indicators through the dashboard interface.
Validation options	In subsequent version, hard coded validation rules have been defined through programming intervention	Validation rule engine is inbuilt in the software, which allows user to define, add and delete rules through the user interface
Indicator options	In subsequent version, hard coded indicator reports have been defined through programming intervention	Indicator engine is inbuilt in the software, which allows user to define, add and delete indicators through the user interface
Data quality analysis	Through drop down options, user can view data status by periods, facilities, generate outlier reports, and view % status with and without zeros and blanks	Through dashboard, data status (with and without zeros and blanks) can be viewed for organization units and their children; null reports (missing facility) can be generated; also, data element group wise (ANC, delivery etc) data status can be generated
Line listing facility for data entry	Not available	Available for line listing of births, deaths, and maternal deaths.
District and sub-district organization unit hierarchy	Not available in first version of portal.	Can be added through the user interface by user
Data analysis facility	Provided through externally available SAS package requiring web access	Available through dashboard module inbuilt in software. This allows the generation of graphs and charts for data elements and indicators for organization units and their children for selected period. by Organization unit wise (selected/children/group wise) and period wise.
Representation facilities	Available through tabular reports	In addition to tabular reports, graphs and charts can be generated

GIS functionality	Not available	Module integrated into the package, and can be used to represent indicators in maps. States need to make available shape files of district and sub district boundaries
Deployment	In online mode. Facility available to download formats, enter them in offline mode, and then upload them through web access	Entire application can run either in online or offline mode, with available facilities for import and export to facilitate database integration. Synchronization with online application can be done by build-in functionality Import-Export OR Excel Import.
Integration features	Largely a stand alone system, integrated with SAS for statistical analysis. The use of encrypted Excel sheets limits integration efforts.	Since DHIS2 is an open source software and developed on open standards, the software is (can be) integrated with: <ol style="list-style-type: none"> 1. Mobile reporting system (done) 2. Name based tracking system for pregnancy and immunization (in process) 3. Excel reporting (done) 4. OpenMRS for hospital systems (in process)
Development community	Vendor controlled	Community based open source model of development
Deployment spread	Mandatory use of portal at district level in all districts of the country. No visible evidence of sub district use	Used in about 20 states in country for district and sub district data entry and analysis, and in about 20 countries globally. DHIS2 adopted as part of WHO Public Health Information Tool Kit.

Table 5-1: Comparative functionalities in software deployed

5.2 Evaluating the implementation status: State wise details

The implementation status in the states was rather mixed, and in this section a brief description is provided, and a detailed state wise summary is given in Appendix 1. In the initial stage, about 25 states agreed to use DHIS2 as their state applications, after a process of initial system demonstrations and orientation to the state authorities. While some states were satisfied with just

adopting the standard formats prescribed by the national level, other states like Assam, Gujarat, Karnataka and others requested for specific customizations such as adding data elements, adapting the organizational unit hierarchy and including some state specific programmes. This could be done rapidly by the HISP technical team given the flexible architecture of DHIS2. The effectiveness of DHIS 2 as a plastic tool to carry out customizations was even confirmed by a state technical person:

“DHIS2 is a very good tool for facility wise data entry and further it also enables us to analyse data the way we want. Moreover, it is very flexible and can be customized to state specific needs at different levels”

A major challenge in the customization was the setting up of the organizational unit hierarchy in the different states. While states which wanted only to report by districts, we only needed the district names, we took those from the web portal. Here too there were differences, because the states often had a different list. For example, for the state of Madhya Pradesh the web portal showed 48 districts, while the state had a list of 50 districts as two new ones had been recently added. Like that, there were other states too which had similar discrepancies which needed to be understood, discussed and resolved. This problem of reconciliation became far more complex in states which wanted facility wise data entry (by Block, or even by PHCs/SCs). Firstly, there was no agreed upon lists and often the state and district had different lists. Secondly, there was no uniform nomenclature existing, and in Orissa for example, PHCs were called Additional PHCs, New PHCs in addition to PHCs, all of which were providing similar services. Reconciling this was a complex task requiring many rounds of discussions and iterations. With each round, we could compile the list in an Excel sheet, provide the same to the concerned district to verify who would nearly in all cases come back with suggestions for modifications.

Another challenging issue was that of aggregation, given that no clear guidelines existed. For example, in Orissa in some districts the district hospitals were sending their monthly data to the

district office, while others were sending it to the block office. There was thus a need to rationalize and make uniform these flows which required often State policy guidelines. In the absence of this, these issues were very difficult to resolve for the district functionaries who did not have the authority to do so. Problems became further magnified often because of the central control from the national level, the states were reluctant to make decisions which they felt may not be taken well by the national level.

This process was then followed by rounds of training, typically carried out at the state level in which the district level coordinators would attend. The aim of these training programmes was to firstly get systems initiated at the districts so that district level consolidated reports could be entered. The plan was initially to have such rounds of training about once in two or three months and then slowly space the trainings so that the state teams could gradually take ownership of the systems and be able to manage the processes themselves. In some states, training schedules were rather intensive such as in Assam where nearly 5-6 rounds of training were carried out over the space of the first 9-12 months. In states like Karnataka, the process was more proactive with the state taking ownership from early on. It was in November 2009, the state sent 6 member technical team to Delhi, and after being given a training on DHIS2 for 3 days by the HISP India team, the team themselves were involved in customizing their state application which included setting up the database, defining the datasets and even designing their own reports. Through this process of engagement, we found the state to be quite competent in managing the application independently. Some states were rather slow in the whole process, for example Chattisgarh, where there existed a degree of ambiguity at to whether the state wanted to use the DHIS2 as their state application or enter the data directly into the web portal. In the absence of a clear decision on this from the state authorities, the process of implementation remained slow. However, in general we found a need being expressed for more training, especially related to developing better understanding of data elements. As expressed to me by a Block Programme Manager in one district in Bihar:

“At the district itself, understanding about data elements is lacking. Field staff doesn’t know what to report in the data elements and what not to report. E.g., in the hospital report they report all cases of IPD including deliveries. No health official is aware of the definition of ‘in-patient midnight headcount’. Furthermore, the M&E officer was not well versed with data element definitions.”

With regards training, a district manager in the state of Madhya Pradesh lamented on the neglect of the field service providers with regards training. He said in an interview:

“Most staff “make-up” data; they refer to past records and report numbers that are similar and convincing. Only 2 data elements (deliveries & immunization) can be verified since these are recorded in the registers and maintained properly but mostly the major reason is the training as most of the trainings are done for program managers but not for the ANMs and data entry operators.”

There were other states which because of number of parallel existing systems, often each collecting their own (many times overlapping data), found the introduction of the NRHM revised systems to be complex. The programme people were reluctant to leave behind their existing systems and datasets even though there were clear national guidelines on what to collect and what to not collect. We take as a classic example in this regard the State of Tamil Nadu whose progressive condition with IT applications actually turned out to be a hindrance to the introduction of the reform systems. (See Appendix 2: Situation Analysis of HIMS in Tamil Nadu as an illustration). The State HMIS officer interestingly remarked in an interview:

“The problem in Tamil Nadu is that we have too many computers and too many statisticians”

There were challenges arising also due to an extreme variability of infrastructure. For example, in the North Eastern state of Nagaland, the internet connectivity was extremely poor making it problematic to introduce a web based application. Further, there were also severe constraints of electricity which made the use of laptops challenging. To try and address this problem, the state

budgeted for generators in their district facilities and also gave data cards to their district staff. To address similar infrastructure challenges in the State of Uttarakhand, the HISP team created offline installers of DHIS2 for each of the 88 blocks, and these were installed in the local machines to enable offline data entry, and the data files were then exported to flash drives which were carried manually to the districts where they were then imported into the district web based server application. In contrast, there were states like Kerala and Karnataka where the internet infrastructure was even working to the sub district level. In terms of infrastructure, the problems were not only related to the electronic one, but also with the basics of people, transport and similar resources. This situation was described by a district manager from Haryana, in close proximity to Delhi:

Most of the PHCs are run by either ANM or compounder so there is no one to train them, monitor them in filling the form and send the reports. Also doctors don't have vehicle to visit field staff. In all of the districts and blocks HMIS team has not been formed. The urgent need is to form these teams at block, district and state level. These teams should take the responsibility to implement HMIS. State team can deal with bigger issues like recruitment, organize workshops at state level, providing technical support, IT infrastructure etc. District team in each district can focus more on data status and quality checks and focusing on the use of HMIS. Block teams can focus on proper supervision for data entry and reporting. They can also supervise and monitor the process of collecting data. Block is much nearer to the data reporting units they can also help in providing formats, reporting formats and registers etc.

Further, there were constraints on the availability of primary registers in the SCs, and we were told in the state of Bihar it had been some years since the facilities had been given new registers. Another district manager from Madhya Pradesh told during an interview:

"At the sub centre level ANM has data recording registers but in the register itself she don't have monthly consolidation sheet to consolidate data to report on monthly basis. At the

APHC, PHC & Hospital level no such data collection registers are available. There is no record available for In-patient Head Count, IPD age stratified counts, maternal complications, complications attended, childhood diseases, Lab test, operations done, operations (major & minor) etc., as there is no place to record these. When registers were available it was found that it was a plain register and the concerned staff had developed their own formats for recording, leading to multiple recording forms which are not able to feed HMIS requirements.”

In summary, as this brief overview describes, the situation in the states while being mixed, arguably an overall improvement was made in the systems with nearly 100% of districts starting to report data available to them to the national level. About 30-40% of the Blocks also started to report data to the district level, while about 10% facilities were reporting data to the block level by early 2010. Given this foundation, it was important to examine the aspect of information use across the states, which is carried out in the next section.

5.3 Evaluating status with respect to information use: the “Readiness Matrix”

The details of the Readiness Matrix and how it was used for data analysis have been described in the chapter on methodology. In this section, briefly some sample results are presented to assess how the different states were faring with respect to their readiness to use information for section. First, the state wise summary scores are presented out of a maximum possible total of 48.

State	Scores	Ranking
KERALA	42,99	1
Gujarat	41,66	2
Karnataka	34,34	3
MAHARASHTRA	33,66	4
PUNJAB	33,34	5
MADHYA PRADESH	31,01	6
UTTARANCHAL	28,66	7
MANIPUR	28,64	8
MIZORAM	28,34	9
BIHAR	28,33	10
ORISSA	28,01	11
ASSAM	27,99	12
Chandigarh State	24,68	13
ANDHRA PRADESH	24,66	14
MEGHALAYA	22,68	15
WEST BENGAL	22,33	16
JAMMU And KASHMIR	22,32	17
TRIPURA	22	18
Himachal Pradesh	21,34	19
Nagaland	20,33	20
Goa	14,33	21
UTTAR PRADESH	14,32	22
UTTAR PRADESH	14,32	23
DELHI	14,02	24
Haryana	13,65	25
CHHATTISGARH	11,65	26
Jharkhand	10,99	27
RAJASTHAN	10,99	28
Sikkim	10	29
ARUNACHAL PRADESH	8,99	30
Pondicherry	7,67	31
Dadra Nagar and Haveli	4,67	32
Lakshadweep	4,33	33
Andaman and Nicobar	3,99	34
Daman and Diu	2,66	35

Table 5-2: State-wise readiness matrix

To unpack what these scores mean and why, for the top three states, a detailed dimension wise analysis was conducted. A schematic representation of some of this drilling down for the leading states was created and this is provided below. First, an overall schema is presented that defines the overall categorizations of the good, average and poor dimensions.

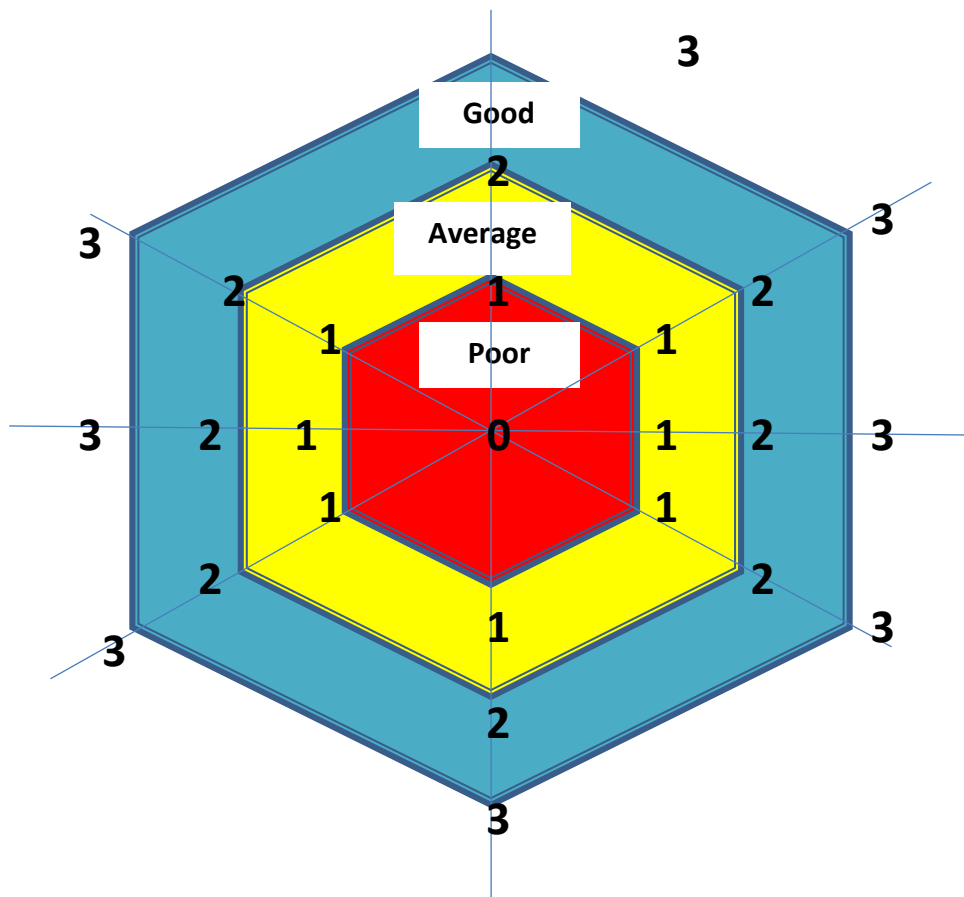


Figure 5-1: Rating of readiness matrix:

Following this, the top three states identified – Kerala, Gujarat and Karnataka – in that order are detailed along the different dimensions.

Kerala

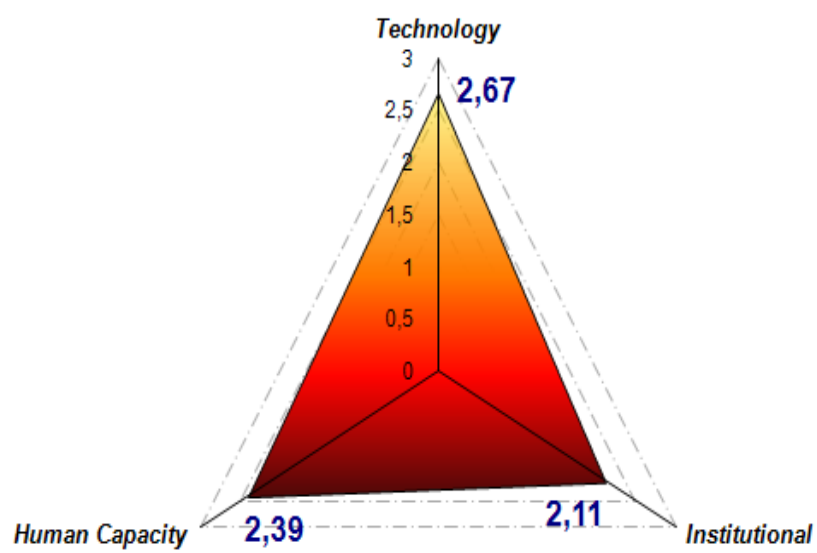


Figure 5-2: Kerala state readiness matrix

Gujarat state

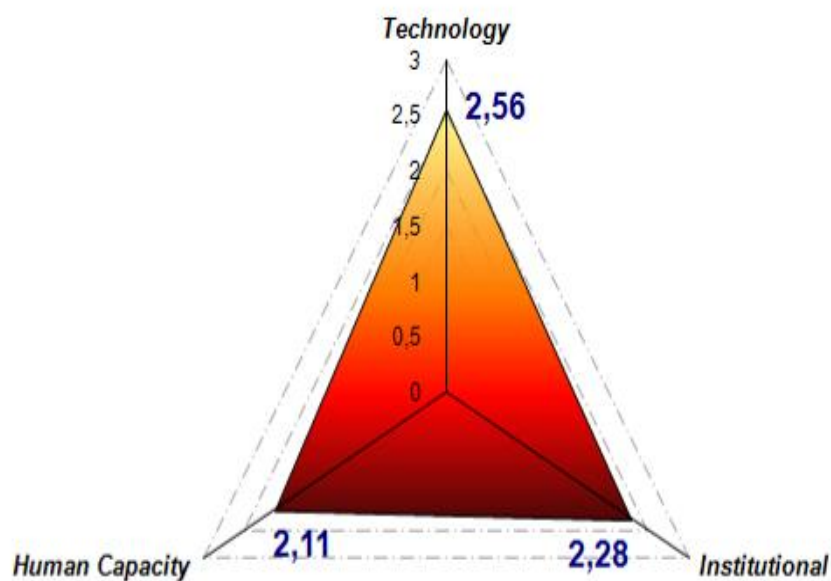


Figure 5-3: Gujarat state readiness matrix

Karnataka

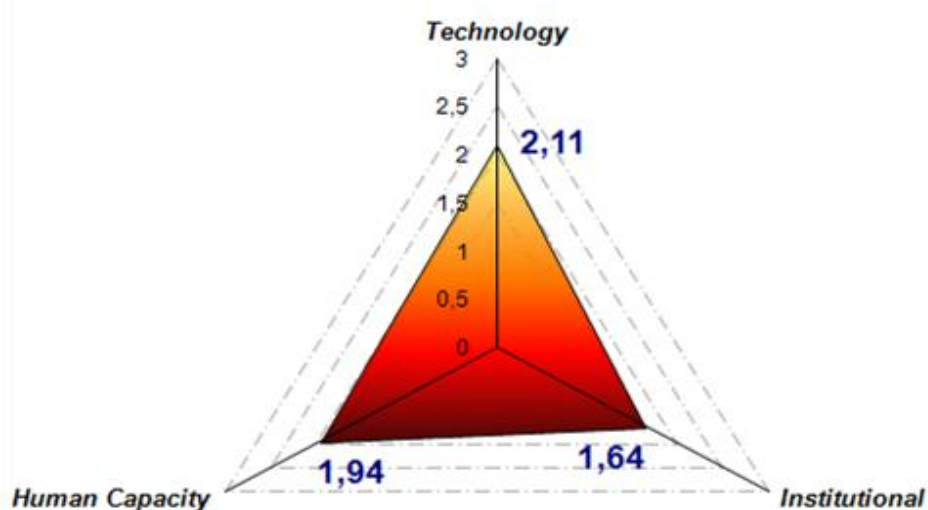


Figure 5-4: Karnataka state readiness matrix

After gaining an overall idea of the variations across the different dimensions for the top ranked states, a further drilling down was conducted across the different dimensions. As an illustration, the analysis carried out for the technology dimension is presented for the three states to understand what the critical contributing factors were.

Technology dimension

Kerala

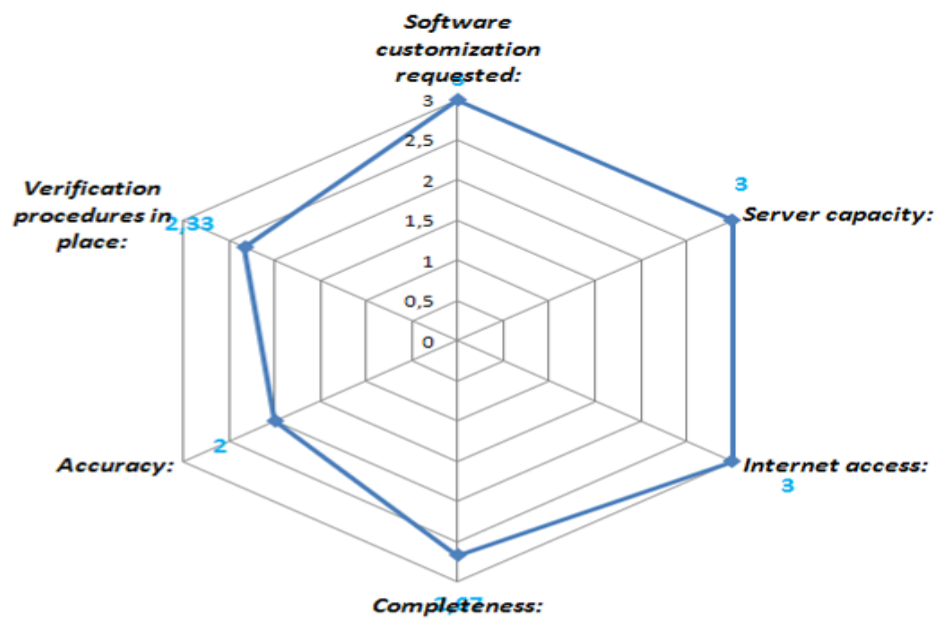


Figure 5-5: Kerala state technology dimension readiness

Gujarat

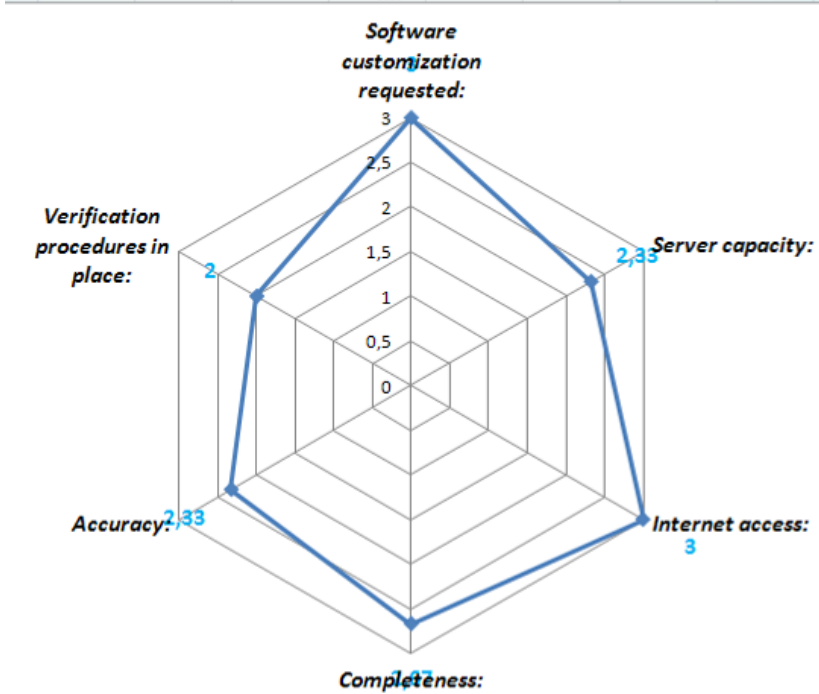


Figure 5-6: Gujarat state technology dimension readiness

Karnataka

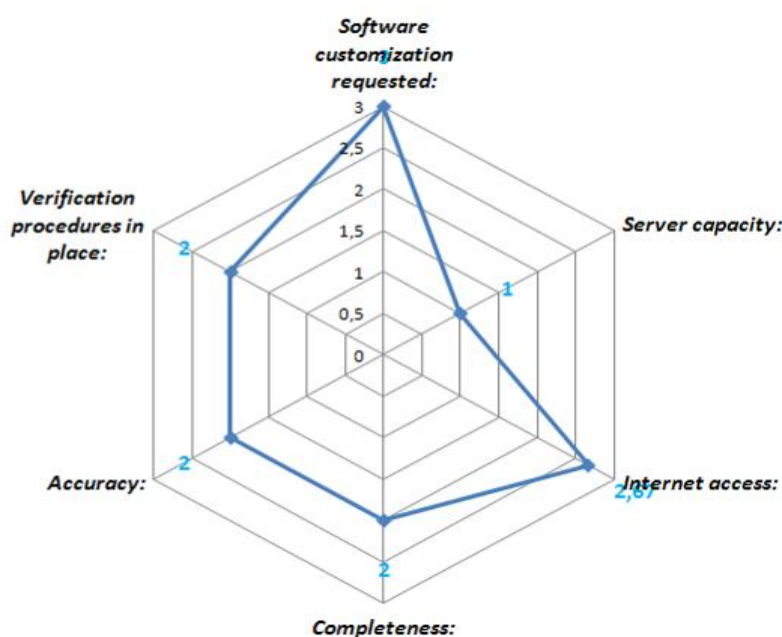


Figure 5-7: Karnataka state technology dimension readiness

An analysis of the above figures helps to understand for example how server capacity and internet access play an important role in determining the state of technology readiness. For example, while Kerala state scored highest points in both these sub dimensions, Gujarat and Karnataka states were progressively lower on them. It would be clear to a policy maker then, that this points to the need for improvements in these areas if the overall state readiness on information for action has to be strengthened. Strengthening server capacity for example, helps to get ownership of their own data as compared to having to access the same from a national database. Improved internet access can help to provide access to data, improve the availability of feedback reports disseminated through the web.

In this way, the readiness matrix described above can serve as a useful diagnostic tool to identify areas of strengthening for a state to improve its overall capacity to use information for action. Similar analysis can also be carried out at the district level to understand inter-district variations and identify areas of improvement to strengthen local information use.

The diagnosis carried out through the readiness matrix was further explored through qualitative data. For example, while probing at the national ministry in Delhi, a senior bureaucrat described institutional conditions as reasons for weak information use. Similarly, a state level officer highlighted the problem of lack of ownership of data of the programme managers in the following way:

“The problem is with the lack of ownership with HMIS data reported. People see data a means of coercion and not as a tool for improving program performance especially program managers. Also the monthly meetings happening in the health facilities are more of get together rather than discussing strategies. This will certainly improve when HMIS data will become the only source for planning and management. From new financial year onwards states have to use HMIS data to make district action plans and by this way the problem will be solved.”

The integration of quantitative and qualitative analysis helped to provide insights into the issues and potential interventions required, which would not have emerged if only one of the approaches had been used.

Chapter 6 : Discussion - Issues and challenges in use of information for local action

Over the approximately two years of empirical engagement, first with the HMIS redesign, followed by the implementation of the HMIS reforms including the new integrated datasets and software in various states, a number of issues and challenges can be identified. This was achieved through the analysis of data – both quantitative and qualitative – as described in the previous chapter. Further, it involved putting this analysis into context of the large overall experience that had been developed through this intensive engagement over the last two plus years. As often is the case in interpretive research, just focusing on the data tends to be rather reductionist and needs to be made more holistic by bringing the experiential and tacit understandings that develop as a result of “indwelling” in the research context over time.

While a fair amount of progress has been made in relation to the implementation framework, various impediments also remain. First the key progress points made are summarized, followed by the challenges.

6.1 Areas of progress identified

Data coverage

Before the reforms were initiated, the Monitoring and Evaluation division of the national level was only receiving consolidated state wise data, that too not for all states. Further, since there was not one uniformly defined information flow, reports were being sent for certain programmes directly to the programme managers in the central Ministry. So, even though data may have been available in different places, it was not known to or accessible to the Monitoring and Evaluation division. In short, it did not lend itself to the planning and implementation of coordinated action. Over the last year and half since October 2008, the situation had changed. A senior bureaucrat in the ministry gave his assessment of the situation since the reform initiation:

“HMIS has been improved significantly over the last year and the Web portal is now able to generate all reports required by ministry for monitoring and evaluation. HMIS is now becoming more and stronger day by day and one of the basic reasons is the analytical tools which we have provided with web portal. SAS has greater analytical capacity to analyse large amount of data. The basic issue is that we wanted them to equipped with high end technical solutions so that they can do further such analysis in future.”

Since the process of implementation of reforms were initiated in October 2008, it was seen by the end of the financial year (March 31, 2009), district wise reports showed nearly a 100% coverage, implying that all districts had uploaded their “district monthly consolidated dataset” for the last 12 months (April 2008 to March 2009) into the national web portal. It was also seen that various states (7-8) had gone beyond district consolidated reports and had initiated processes of decentralized data reporting by sub-districts and were taking various steps to institutionalize these processes, such as notifying HMIS teams at the district and block levels. A case in point was the state of Bihar, where since the last 6 months or so block level reporting had been initiated and nearly 95% of the blocks were reporting data across districts. From initially when many districts were even not reporting data, the State had gone through a systematic process whereby all districts were included in the reporting, and then from the beginning of 2009 financial year, block level data entry was initiated. Again, initially there were only 10-11 districts that were reporting data by blocks, and by early 2010 only one or two districts were not reporting for a limited number of blocks. The reasons for this non reporting was often institutional such as the non availability of personnel.

Information use

The implementation framework had envisaged a process whereby the initial 6 months or so would be spent on getting the basic data systems up and running, and once this was in place the focus would shift on examining data quality issues and also on information use. It was seen that in a limited way, some states had initiated processes providing evidence that they had moved beyond

data to information. For example, in the state of Manipur every district had started to analyze their monthly data using graphs and charts, and were trying to identify specific action points towards making data quality improvements. In Bihar, all districts were being guided and trained in using HMIS analysis in the development of their District Health Action Plans for the 38 districts in the state. So, also states like Jammu Kashmir and in the North East, the use of HMIS data for the planning process was in evidence. Some examples are given below of the kinds of graphs and charts that were being created and discussed in different states.

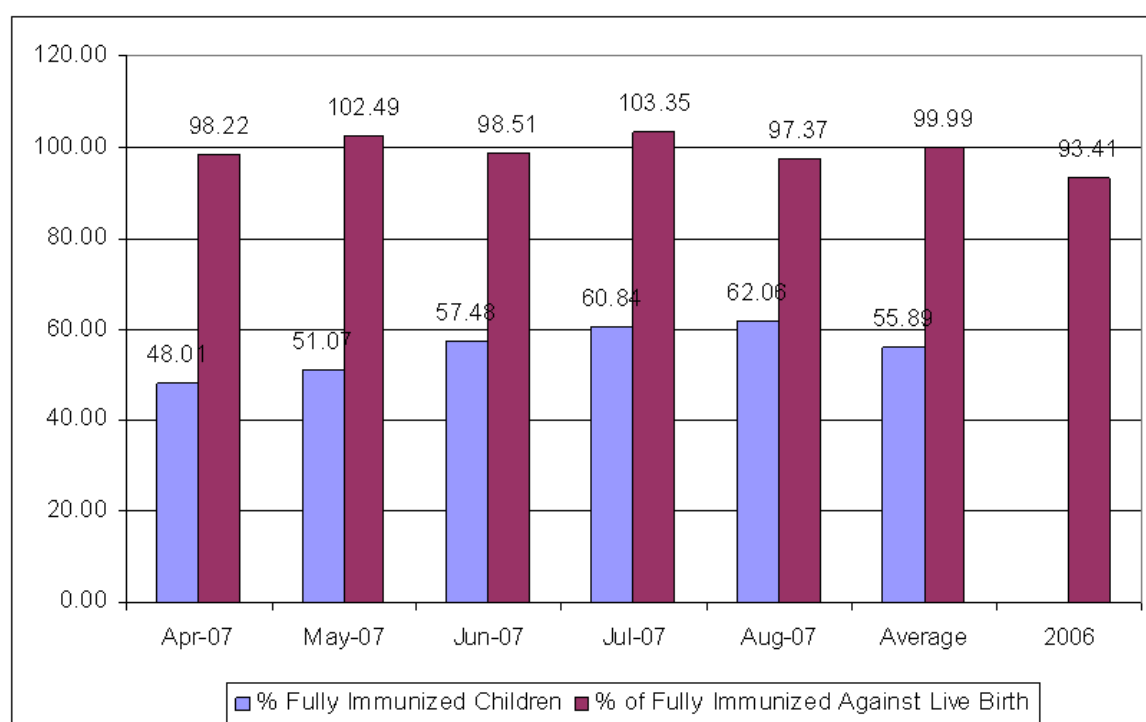


Figure 6-1: Immunization coverage graph from one state

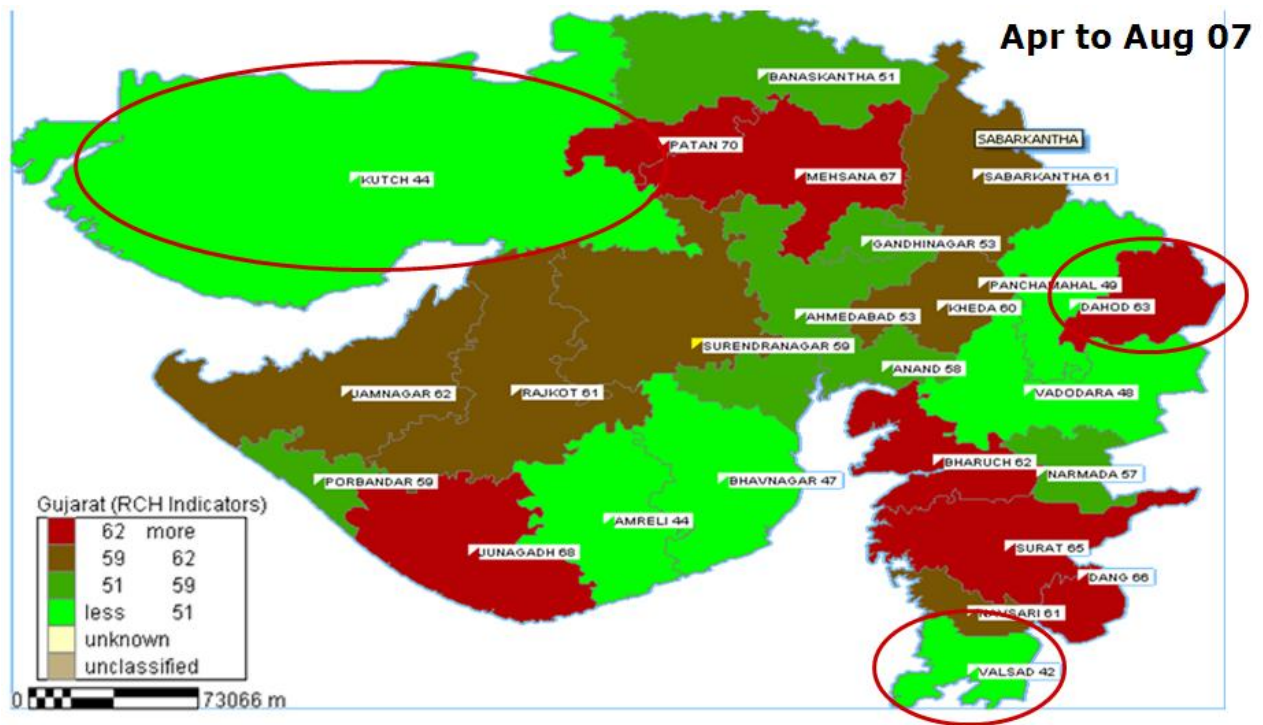


Figure 6-2: % ANC First Trimester Registration

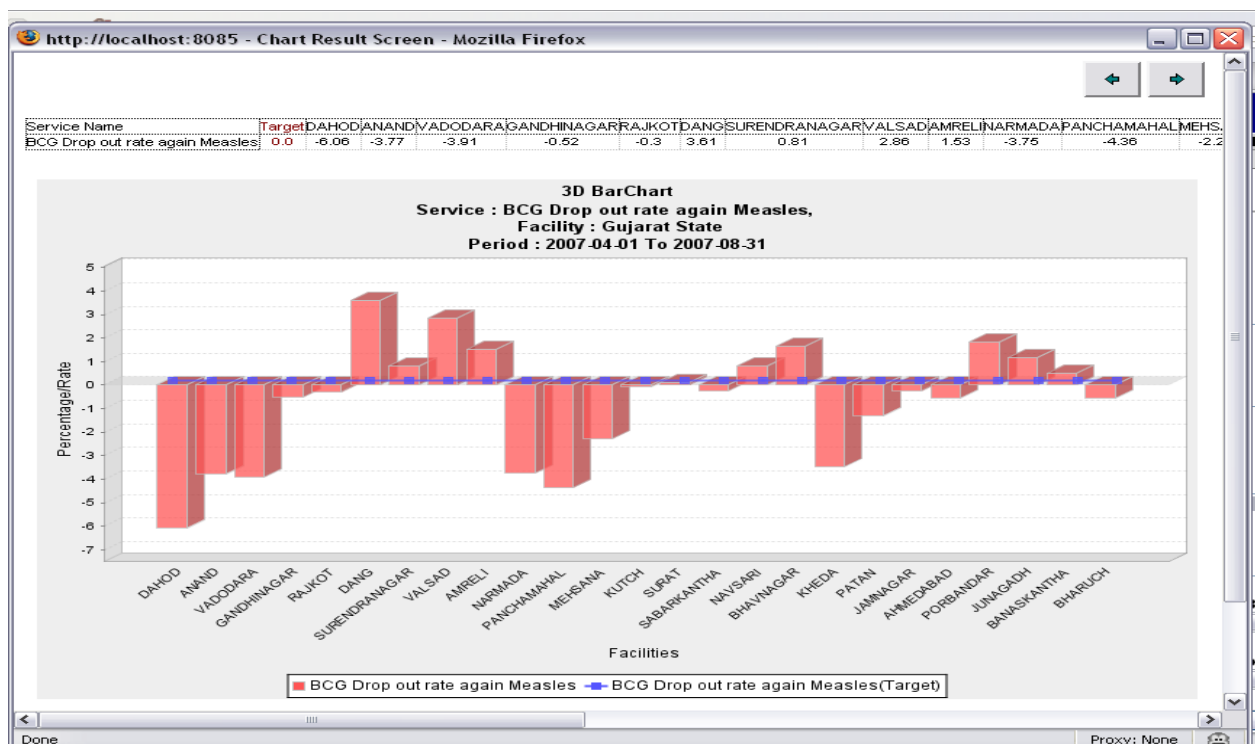


Figure 6-3: BCG to Measles Drop out Rate

While the use of the above maps and graphs indicate that some states were engaged into trying to put data in context by comparing across districts or across stages of the vaccination programme – implying transforming data into information – there was much more limited examples of states

trying to move from information to knowledge, i.e actually trying to take practical action based on the information for specific areas of programme improvement such as developing micro plans for immunization and for identifying poor access facilities. An important point to note was that despite information use was only in limited evidence, at the national ministry the slogan of “information for action” was seen to be circulating more widely than before. While it was only in the form of a slogan and not practice, the fact that it was visible was a sign of progress.

Capacity enhancements

Systematic process of capacity enhancements of HMIS teams in the states, and to a limited extent of the health programme managers was engaged with in the states. Large scale capacity building programmes were completed in nearly all states, including in many states nearly 3 rounds of training were completed at the state level, and in more limited amount, training was also carried out in some states at the district level, where the district and block staff attended. One major limitation of the training programmes conducted was that the field health providers were not included. The major reason for this was the lack of training resources. The training programmes included basic orientation to the nature of HMIS reforms including the revised datasets and formats, the use of software, and basic public health concepts such as data elements, indicators, coverage and population estimates.

Arguably, these capacity building efforts contributed significantly to the development of a cadre of Master Trainers in the state and at the district levels, which in the longer run with continued and focused efforts would help to ensure sustainability of systems and processes in the states. These capacity enhancements were supported by the dissemination of relevant resources. Large scale training materials were prepared, discussed in training programmes and distributed to the state, district and even block level teams. These materials related to software manuals, implementation frameworks, data dictionary and indicator manuals, Service Providers Manual on HMIS; Data Managers Handbook on HMIS; Mobile Based Health Information Systems Manual; and, Name

Based Tracking System Manual. With this, arguably, a comprehensive set of resource material were distributed to the health functionaries.

Infrastructure improvements

Large scale infrastructure improvements were carried out in various states by the health departments, including initiating processes of server up-gradation whereby the state application and data were hosted in the state server, making improvements in providing computers and internet access to Block levels and in some cases even to the PHC levels. Within a year of starting the processes of implementation, rough estimates could be made that nearly 98% of all districts were equipped with computers and internet facilities, the same for about 30% of the blocks and maybe 5% of the PHCs. States like Uttarakhand were innovative and districts established local AMCs with vendors to provide hardware maintenance support, thus reducing their dependency on state support for locally solvable problems.

In summary, while there were signs of progress visible in key areas like coverage, capacity and infrastructure, many challenges remained and these are now discussed.

6.2 Challenges identified

Data quality, completeness and inconsistencies:

While there was more data on flow, as seen in the discussion on coverage, there were variations across states, often contributed to by challenges of infrastructure and a weak leadership. A district programme manager from the North Eastern state of Arunachal Pradesh said in an interview:

I don't think that use of information is lacking, as soon as good quality data will be received use of information will improve simultaneously. There is no problem with use of information the most serious problem is data reporting. Like in our state, the ANMs have to walk for a day to reach the facility and internet connection is so slow that they are not able to upload all facility data in one day time so we are improving the application to accommodate those problems.

In the state of Madhya Pradesh, a Supervisor believed that the quality of data remained poor because figures were being manipulated at the lower levels magnified by the problem of absence of a process for data verification. She said:

“There is no process of data verification at the district and even below district. Medical officer just sign on the report and they never look at the data and due to this reason values for particular data element does not show right value. In the last month’s report out of 16 blocks, 4 have entered data in the ‘discharged under 48 hours’ but no data in the ‘institution deliveries’.”

Despite increased coverage, the content of the data still left much to be desired. However, it can be argued that if data is not on flow, discussions on data quality currently ongoing could not have taken place. Taking a process rather than an output view, data quality can be conceptualized as a multifaceted problem often revealing important information which needs to be analyzed and understood and not normalized and corrected. For example (see Figure 6.4 below), which shows a graph of JSY payments to public and private facilities. JSY payments are made as a form of incentive to mothers who deliver in an institution (public or private) rather than in a home. The graph of the JSY benefits being paid to mothers in Bihar showed abnormal figures on payment for private facility deliveries. This can be a data quality problem, but arising not because of intent to manipulate or misreport but due to a poor understanding of the data element, where instead of reporting the number of women paid benefits, the rupee values were entered.

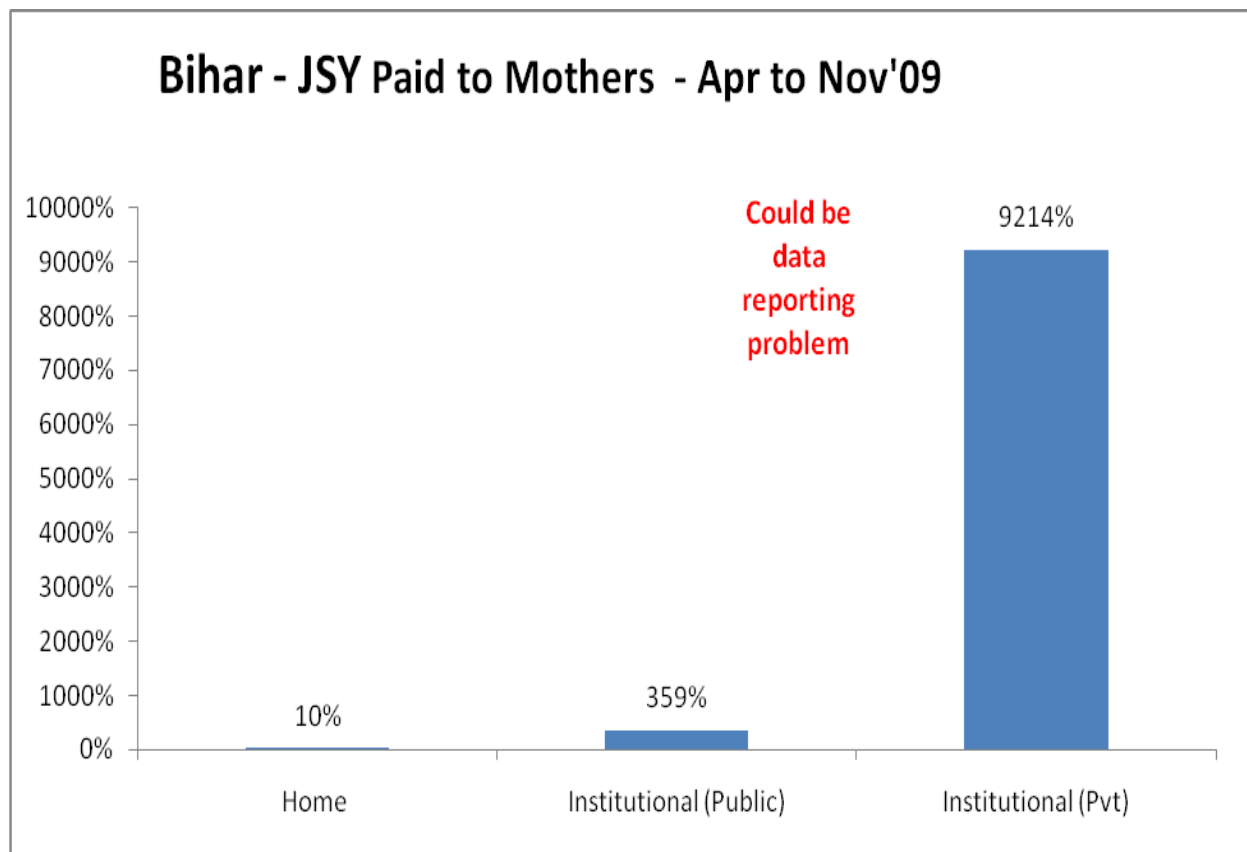


Figure 6-4: Bihar - JSY Paid to Mothers

Similarly, another graph of Polio cases in Bihar show figures of more than 34000. These figures are in contradiction with the statistics reported from the civil surgeon's office. These abnormal figures indicates a number of systemic issues: need to align reporting and creating a single window for the reporting (HMIS and civil surgeon's figures should be the same); the HMIS data should be endorsed and approved by the civil surgeon; the data entry operators should be trained to understand these figures are abnormal and raise a red flag. It may be that AFP cases are being reported as polio cases, and the data entry operator does not understand the difference between AFP and Polio. Further, by quickly seeing the graph, the problem districts can be seen to be few (Bhojpur, Patna and Siwan), and these can be targeted for focused remedial action, such as training on understanding better the data elements and also how they relate or not to each other. The district wise problem can be further drilled down to blocks and months to develop more granular action.

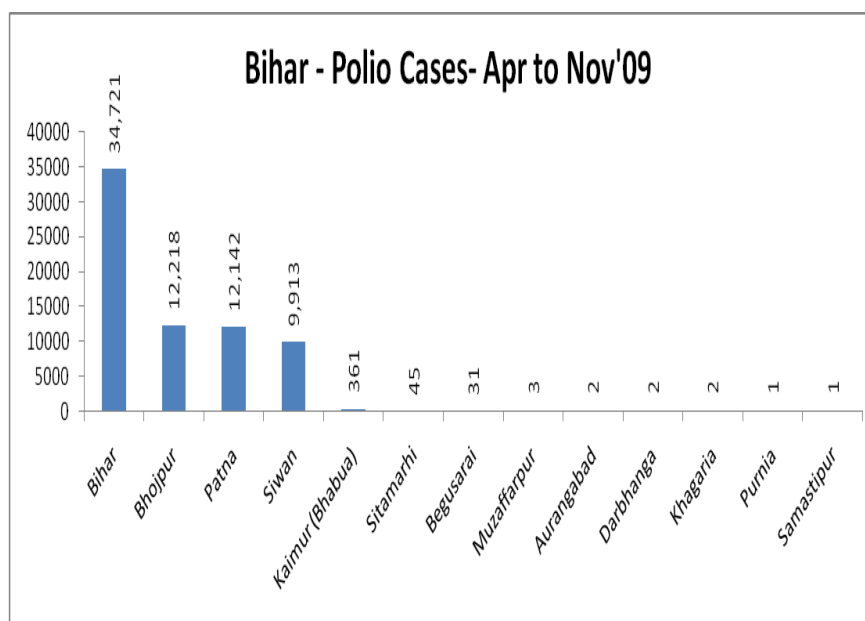


Figure 6-5: Bihar – Polio Cases

While there was an increasing trend in terms of completeness of facility reporting, further improvement needs to take place with respect to completeness of *what* is reported? While on an average states were reporting at a level of 25 to 40% completeness, implying that 25 to 40% of the 227 data elements included in the district consolidated monthly dataset had a value against it. However, on drilling down on these filled values, a more alarming picture emerges. For example, taking again the case of Bihar, the state till about June 2009 had reported 15-20% of the data (from the district consolidated dataset containing about 227 data elements) was being filled. By January 2010 this % had gone up to about 48% which showed a sign of improvement with % figures for November and December showing 38% and 40% respectively. However, taken in a larger national context, this can be said to be average performance with respect to other states in the country, as some states had averaged about 70 to 80% and even some (like Manipur) averaged in the nineties. This completeness of data was computed while including also the “0”s being reported. This was based on the assumption that “0” implies that there actually was zero activity for that data element and hence “0” was correctly recorded. However since the data elements covered common activities it is quite unlikely that there would be zero activity for any data element for a month. Now, if the issue of completeness of data reporting is analyzed by taking out the “0”s, and only including the

non-zero values, there is a dramatic drop in numbers. See the table for certain districts of Bihar below:

District	Nov % (with 0s)	Nov % (without 0s)	Dec % (with 0s)	Dec % (without 0s)	Jan % (with 0s)	Jan % (without 0s)
Araria	99%	20%	75%	16%	11%	2%
Aurangabad	53%	17%	52%	18%	53%	17%
Nalanda	74%	13%	78%	14%	84%	19%
Paschim Champan	15%	10%	11%	6%	91%	12%
Patna	26%	10%	27%	11%	26%	11%
Nawadah	28%	6%	8%	5%	3%	2%

Table 6-1: Reporting comparison with zeros and non-zeros

The above table indicates a serious problem: either the service which should be available in a facility is not available, and is thus being reported zero; or, the data is just being entered as 0 to fill in the numbers. Either case is problematic, and needs to be investigated by field level visits and the examination of primary registers, and through large scale educational programmes where the service provider is made to understand the serious differences between a zero, blank and a non reported figure.

As there are significant patterns of variation in data completeness across states in the country, similar inconsistencies are also found across districts. For example, in Bihar while districts like Begusarai showed figures of 98 to 99% over the Nov-Jan period, Nalanda showed figures of 74, 78 and 84% for the corresponding period, Patna district averaged 25% for the same period and Paschim Champan reported figures of 15%, 11% and 91% in the same period, and Aurangabad district was consistent in the fifties. Further, there were significant variations in data completeness

across data element categories. In the table below, an illustration of this variation is provided again taking the example from Bihar.

Data element category	Data filled % (Nov to January average) including 0s	Data filled % (Nov to January average) excluding 0s
JSY	76%	67%
Delivery	46%	15%
Pregnancy outcomes	60%	29%
PNC	54%	26%
MTP	42%	0%
RTI/STI	45%	6%
Family Planning	52%	19%
Immunization	72%	57%
ANC services	62%	39%

Table 6-2: Variations across data element categories

The above table shows that while there is relatively complete data for immunization, data for delivery and pregnancy outcomes is poor (if excluding 0s data is considered). Furthermore, the MTP data is worrying where 46% of data is showing reported, but all these values are 0s. There are also various other reasons for data quality being poor such as the absence of primary recording forms and the poor quality of them. A field nurse told in an interview in Bihar:

“Most of the time district doesn’t provide us with reporting forms, field staff has to either photocopy it or they make report on blank papers. Repeated photocopy reduces the quality of form and sometimes even data elements are difficult to read. This reduces the quality of data reported. Sometimes one section of data goes to other section.”

Similar problems of availability and quality of recording instruments were nearly a universal complaint across the country. This problem was magnified by the lack of focused training on the

understanding of data elements which created the foundation of the HMIS to be weak. A field nurse told in Punjab:

“Data element definitions were not clear to ANMs. Speakers/facilitators who are well versed with definitions need to support these trainings”.

A similar problem of the lack of health understanding of the statistical assistants was echoed in Kerala. A block staff said:

“Programme Managers needs to be informed that she as well as other officers in her office needs to be more closely involved with HMIS training & implementation. Also, District Office needs to converge diverse skills & knowledge that they have to make best use of HMIS. Statistical Assistants lack understanding of data elements and reporting or they do not undertake the verification assignment given to them”

There was the additional institutional problem relating to the recruitment of contractual staff, where all of them did not seem to have the required skills for HMIS, as described by a Block staff in the state of Orissa:

Under the NRHM mass recruitment of the contractual staff has been done. Out of total ANMs which have been recruited most needs skill up gradation as their literacy level is poor and needs to be improved. This newly recruited staff needs to be well trained in recording and reporting data.

In summary, poor quality including data incompleteness and inconsistency are serious challenges still confronting the HMIS. Here often, the larger challenge is sometimes in the way the problem is defined, where HMIS is branded as the problem, instead of being treated as a symptom of deeper institutional conditions which needs to be investigated and addressed through longer term measures rather than the quick fix method such as of identifying and normalizing outliers through statistical

methods. From the discussion above, inconsistencies and incompleteness need to be investigated for:

- a. Patterns across districts, and even further across blocks and facilities, for states where such data is available.
- b. Patterns across periods.
- c. Patterns across data element categories.

Analysis of patterns carry valuable information, and HMIS becomes a tool available to carry this out and identify and distinguish between data and institutional or programme artifacts. While the former reflects a problem in data such as a typing error, the latter indicates that the data is correct and it reflects maybe limitations in the programme component, for example as in the table above maybe MTP services are actually not available. However, to be able to carry out such an analysis, which can contribute to longer term and sustainable improvements, the HMIS needs to be treated not only as the source of the problem where people may be making typing errors or manipulating numbers, but as a tool to be able to drill down to and analyze the problem and identify alternative explanations of the situation. A reformulation of the perspective towards HMIS is urgently required where we move from the notion that the problems are only about reporting errors and manipulation and that the HMIS should help understanding the deeper problematic conditions of the health system. This reformulation then requires a fundamental shift in who carries out such analysis. Statisticians who see the situation primarily from the lens of “data” may not be addressing the public health context that shapes the data, and the analysis of statistical trends thus needs to be complemented with a public health interpretation. Else, we may continue to be addressing the wrong problem, and reprimanding state and district staff for problems out of their control, and their response is in the form of a “normalization” of data which does not show up as an outlier painted in red on the Excel sheets.

The unfulfilled promise of integration

Integration is a key goal of the NRHM, positioned as a umbrella program, in which the various national programs (e.g. IDSP, RNTCP, NVBDCP etc) need to be subsumed. HMIS, seen from this perspective of supporting the achievement of integration, can be pinned down to serving two key goals. The first is to help in the integration of the independent information systems that have historically been created to support their respective programs. Second, HMIS can serve as a tool to help integrate programmatic issues, for example related to strengthening the ANC testing component of the HIV/AIDS intervention related to Parent to Child Transmission. Since currently these two components of ANC and HIV testing fall under the purview of two different health programmes, the programmatic components have not been integrated. The HMIS can become a useful tool to carry out such integration activities. The integration of the reporting channels is not possible to develop if the institutional agreements to do so have not taken place. A ministry staff said:

“This is a biggest challenge for us and other programs need to be incorporated with the program management. However I see problem is with the type of data that we report. Disease reporting doesn’t follow the trend of routine reporting and needs to be reported separately. Other program such as TB has separate and strong reporting system funded by funding agency and they don’t want to integrate. We has till now integrated vector-born disease control program and are trying to incorporate more in coming years.”

At the national level, the early attempts to integrate focused on bringing the UIP (Universal Immunization Programme) dataset of immunization as a part of the HMIS and initial agreements were made to merge the datasets, and also with it stop the use of the RIMS (Routine Immunization Management System) software that had been in use in a fragmented manner across districts in the country. These efforts had only proved to be partially effective, with the programme division writing to the states to restart RIMS as they were unhappy with the analysis reports not being made available to them from the national web portal. These different signals emanating from the national level contributed to ambiguity in the states and districts as to what data should be collected and

which software should be used for reporting. While the initial letter of the MD to the states indicated that other programmes would be integrated in phases, not much headway had been made. Discussions on this matter in the Ministry had been inconclusive as suggestions by M&E division to incorporate Malaria or TB data in the web portal district format was rather unsatisfactory as what the programme division wanted was integration from the facility and not district level.

The same situation of fragmentation as in the national level existed also in the states. The different programmes including TB, Malaria, Immunization, and IDSP continued to have their own systems, software, human resources and training budgets. The institutional will and leadership to carry out such integration seemed to be lacking. At another level, there also seemed to be a lack of integration between the Directorate (who have and understand the data) and the NRHM structure (who have the infrastructure and resources). An extreme case of this split was found in the State of Uttar Pradesh where the cadre of the statistical staff (the earlier custodians of data) who argued that they did not have access to computers and other resources and also the authority, and were thus reluctant to work in harmony with the NRHM structure. As a result, there were serious gaps in the data, a problem which cannot be addressed at the national level through the analysis of outliers, but required a stronger structure of governance that advocated institutional integration in all the dimensions that it entailed not just data.

Another consequence of this institutional split at the state level was the absence of accountability and ownership of data. When presentations on data status were made in the State level, it was often seen that the programme staff (such as the State Immunization Officer) would stand up and vehemently argue that the HMIS data being presented was wrong, and his or her figures (obtained through the RIMS information channel) were higher and correct. The reason underlying this was that institutionally, the integration had not taken place and the programme staff at all levels were not taking ownership of HMIS data and neither were they engaged in the process of data verification. Similarly, was the case in Jammu and Kashmir where the ANM had to fill two sets of

reports containing overlapping data – one for the HMIS and the other for the Family Welfare Department. Since the basis for both these set of reports was different (one based on facility reporting and the other on Area reporting), the figures right at the foundation were divergent, leading to lack of trust in the state directorate over the HMIS data which naturally reflected lower figures than those reported in the HMIS. Further, as the national level programme managers started being frustrated at not being provided analysis reports from the web portal, they independently started their information flows leading to duplication and fragmentation. An ANM supervisor in Kerala said:

“One major problem is with the number of forms ANM has to fill. GOI has reduced the forms required earlier but new forms are coming day by day now they have send mother child tracking form to fill and send. It is impossible for ANM to do all this.”

As additional forms are mandated to be filled, the load of data collection on the field workers is enhanced. A district staff member in Kerala commented:

“The reporting format also doesn’t solve all reporting problems. In the reporting format we have quality data element related to sterilization but we don’t have any data elements for quality in blindness control program. Cataract operations also need to be monitored for quality as mostly they are done in camps and during last year itself 34 cases of eye surgery failure reported from the district. Now we can’t add anything in the form and they expect us to report quality data. I don’t know whether this reporting is for us or for them”.

Similarly, a district staff described the problem of fragmentation at the state level:

“There are a number of other reporting channels in the state, by daily reporting and uploading etc, which is not possible all the time due to infrequent internet connection, also even after entry state people call and ask data for the few elements over telephone again. Currently every reporting system is working as stand alone. The burden of the field staff

and data operators need to be reduced by synchronizing all channels together and by single reporting mechanism.”

Processes of data verification and ownership are not possible to achieve without an integrated model. Since the district dataset formats contained integrated data relating to different programs of immunization, Family Welfare, NRHM etc, different components of the formats needed to be owned and verified by the respective programme in charge at the different levels. In the absence of this ownership, the NRHM staff at the block and district had to take responsibility for the data. Coming from non public-health backgrounds (mostly computers), this staff did not understand the context of the data, and this knowledge gap often contributed to data errors. For example, abnormal polio cases being reported may not be picked up by computer trained persons who did not understand the difference between polio and AFP. Unless and until there was an institutionalization of the process of verification and ownership of data by the programme officers who understood the data, the blame for the problems would continue to be placed on the data entry operators for wrong numbers – who were nothing other than data entry operators. Again, it required a reformulation of the problem of not one of data entry operators entering wrong data or manipulating numbers, but that of programme divisions not taking ownership and accountability of data from the source of data to the higher levels.

In summary, integration – more institutional rather than technical – was a key challenge facing the HMIS with serious consequences on quality and use of data. Addressing them required strong measures of governance, and unless and until these were addressed, all those concerned in reform would continue to be barking down the wrong tree.

The weak culture of information use

The Indian HMIS has historically been trapped in the domain of data, with little movement to the stage of information generation and much lesser to knowledge creation and its use in practice. The reasons for this entrapment are many, ranging from the centralized form of functioning the shackles

of which NRHM seeks to break, the dominance of statisticians in the control of the HMIS, the near absence of public health specialists responsible for HMIS, the dominance of vendors who have managed to thrive in a framework of “sell and run,” and the role of donors in promoting vertical programs and the islands of systems and experts to support them. All these conditions have arguably contributed to a situation where the perspective on data is of:

A. More is better.

B. Data is for upward reporting and not for local action.

C. Data represents an independent statistical artifact rather than a public health event.

D. The national taking a role of monitoring more than evaluation and impact analysis.

How does one break out of this culture and move towards one that is more “public health friendly” is a question with no ready-made answers and would take years and not months to achieve. South Africa, who can boast of having one of the most effective HMIS in the developing world with respect to information use, have taken more than a decade to achieve this stage. And in achieving this, a number of interventions have been carried out such as regular and continuous in-service training that has been based out of the School of Public Health, University of Western Cape (Braa and Hedberg, 2002). Thailand, another country which boasts of an effective HMIS has its insurance system linked to the HMIS data, thus providing an institutional motivation for maintaining an updated system. In India, where there is a strong culture of centralized control, bringing in changes towards local information use is deeply challenging (Sahay and Lewis 2010). In one meeting, a senior officer in the Ministry of Health told me during a presentation:

“Please don’t spend too much time in asking the states what local elements are needed. We don’t need to much flexibility, let them follow uniform guidelines of the Ministry, otherwise there will be too much chaos.”

In India, there are some fragmented examples of local use of information. In Kerala, I have attended a monthly Senior Medical Officers conference where the Mission Director discussed the state analysis with the district teams, including issues of data quality and health status. There was

an effective conversation over data that took place. Some of the district medical officers, I was told in discussions with them have now taken the process further by having similar interactions with the block staff on a monthly basis. There is thus an evidence of a certain degree of institutionalization taking place. In Manipur, we have been witness to interesting exchanges between the state and district teams over data, on action points identified, and also measures of improvements that need to be taken. Further, the districts have themselves carried out the analysis of data quality and health indicators of their districts, using the DHIS2 to drill down to the facility level to identify areas of action. Many of the North Eastern States and districts in Bihar have used the HMIS data as a part of their district health action plans. Similar has been the case for some other states to make their state plans.

Two main comments can be made over the examples of data analysis and use which have been cited above. Firstly, the focus has been largely around data quality and completeness – not really towards making programme improvements. And since there are many “abnormalities” that are visible in the data, the discussions on analysis is easily redirected towards discussing these issues. Secondly, many of the attempts towards use of information have been mandated from above, rather than coming from their individual volition of strengthening local action. However, seen in a process perspective where such conversations were largely absent till quite recently, these dialogues can be seen as a step in the right direction. But these examples remain rather limited and local, and efforts need to be made towards making them more systemic and institutionalized. There is a long road to travel towards that, and fundamental to that is a key cultural shift that needs to be made away from building mechanical skills of computer usage (as often HMIS is equated with) to inculcating a mindset and education of public health inspired informatics.

In conclusion, in this section the focus has been on making a qualitative assessment of the state of the Indian HMIS with respect to information use, and an analysis of the underlying reasons contributing to this condition. This analysis supplements the more quantitative assessment provided

in the previous chapter using the tool of the readiness matrix. Given this assessment, in the next section the focus is on describing what I see are some of the actions points and ways forward.

6.3 Strategizing the way forward

In this section, the aim is to try and identify some strategic steps in taking the process of HMIS reform and implementation forward, with the normative aim of strengthening its focus on the “use of information for action” and in making them more “public health friendly” such that the systems lie more squarely in the domain of the public health users. To understand the strategic steps required, it is firstly important to spell out the normative goals of where we want to be and the associated timeframe for this movement. With this aim in mind, the following questions are pertinent.

- a. What is the “gold standard” that the Indian HMIS should be striving to attain?
- b. What was the situation of the Indian HMIS when the research process started in January 2008?.
- c. What were the key interventions carried out within the framework of the HMIS division of NHSRC of which this research was a part with its various collaboration partners?
- d. What are some of the gaps that can be identified in the current status of the Indian HMIS with respect to the normative gold standard?.
- e. What are some of the interventions required to be introduced to try and address some of these gaps?

As a summary, first these above questions are summarized in the form of a schematic, and then further discussed.

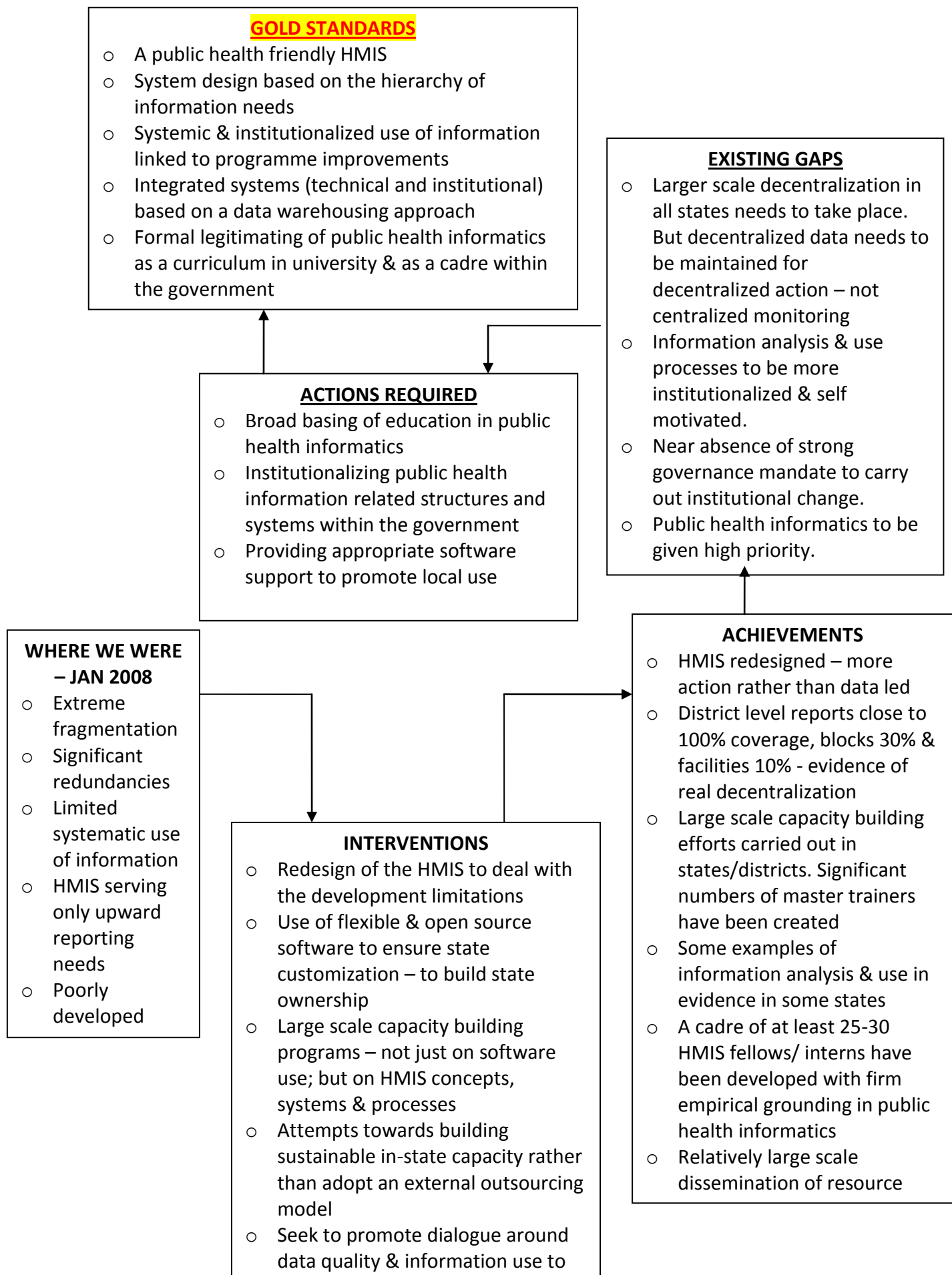


Figure 6-6: A strategic framework for identifying action

The earlier chapters of this thesis have discussed issues relating to the existing situation, some of the key interventions carried out, and the gains that were made and also not made. The two issues that have not yet been discussed include that of the “gold standard” and the strategic interventions identified to try and achieve this normative goal. These are now discussed.

The HMIS “Gold Standard”

Broadly, the gold standard is visualized in terms of a “public health friendly” HMIS that includes both technical and institutional dimensions. At the outset, it is important to understand what the goal of a “public health friendly” HMIS is, what should be aimed for and what its defining characteristics are. A “public health friendly” vision of HMIS is one which focuses on how the information generated from the HMIS is geared towards supporting public health action and interventions at various levels from that of the community, the field level service providers, the medical doctors in peripheral facilities, the district and state administrators, the health program managers at district and state levels, to the national policy makers. While this may seem a rather obvious aim of a HMIS, what is seen repeatedly in India and in many countries across the world is that HMIS efforts tend to focus on the tool – the computer or the device like the mobile or PDA – rather than on what the generated information is to be used for – the means becomes more important than the end itself. Within such a framework, the focus gets necessarily constrained to issues of data rather than how this data can be converted to useful information, and more importantly into knowledge which implies using the information to identify and implement appropriate actions. To operationalize such a goal in practice, its underlying characteristics need to be understood and an attempt is made to summarize them below:

Focus on information use: Technology for information and information for action: A primary focus on information use rather than on the tool. For example, planning budgets could establish norms where 80-90% of HMIS budgets are towards capacity building, implementation and hand holding support. Currently, the reverse is the case with hardware, software and equipment purchase

accounting for the bulk of budgets. The technology supporting the HMIS needs to be designed and developed in a way that it can process the data (validation checks) and convert it to useful information through easy to use representations of chart, graphs and maps. How this information is then converted into action and knowledge largely depends on institutional conditions of leadership, motivation (in contrast to the dominant culture of reprimand that exists), programme level ownership and capacity building focus and efforts.

Decentralized information for decentralized action: Decentralized information is based on the globally established principle of hierarchy of information (representing a pyramid) with the lowest level requiring the most disaggregated information (eg the ANM need to know the names and addresses of pregnant women) while the national level the most aggregated, so they need to receive reports on aggregated indicators (such as % of institutional delivery) to be able to measure programme impact and take policy measures. Currently, the Indian HMIS information flow largely represents a cylinder with all data being collected by sub center also flowing in raw form (as data elements) rather than as processed information (as indicators). By shaping the information flow as a pyramid based on varying information needs of different levels, the efforts can be focused towards decentralized information for decentralized action – rather than centralized information for centralized action.

Integration of information flows: data warehouse approach: Globally, research has established that integration of information systems represents the largest challenge to effective HMIS. Integration takes place in multiple dimensions, but the institutional integration is far more complex to achieve than the technical one. A case in point is the effort to integrate the RIMS (Routine Immunization Monitoring System) with the routine HMIS. While technically the flows were integrated, as combined datasets, in many states there is the case of the national level programme division still requesting for the information in the earlier format and flow. Globally, the trend is towards the development of integrated data warehouse (the WHO calls it the Public Health

Information Toolkit) based on open standards and open software to facilitate data interoperability irrespective of the technical systems which may be used. The approach of creating “a single window of truth” which does not interoperate with other systems runs counter to this thinking, and leads to further fragmentation in the longer run.

Collaborative participatory design: promoting flexibility and user control: Participation of end users into processes of system design, development and use promotes more ownership of systems, stronger capacity to use them, and systems better configured to support more focused use. Research has established that more than 90% of HMIS systems are complete or partial failures because of “design-reality” gaps, implying a deep schism between the worlds of technology development and use. This gap relates to the design assumptions that are inscribed in the technology and how they are distant from the reality of the use context. For example, a centrally designed system which only allows for web-accessed use is distant from the reality of the user where such access is non-existent. Or the promotion of high-priced and sophisticated statistical packages does not match with the reality of the user who is insufficient in statistical expertise and further who can get all their analysis functions required performed by an off-line Excel system. Participatory design and use provides a mechanism to bridge this schism and create more public health friendly systems. This requires for a tolerance and even encouragement of a prototyping approach where systems are never seen to be frozen, but represent versions fluid in time and space. Guiding principles of participatory design is to have flexible systems aimed at developing user control (Braa and Sahay 2011) – where users can customize their data and reporting needs within their local context while they can simultaneously adhere to the mandatory requirements of the levels above. Inflexible systems, both in terms of technical design (one fixed dataset for all districts for example) and contractual arrangements (proprietary owned systems which requires vendors intervention for making every change), has been established by research (eg Braa and Sahay 2011) to be a recipe for disaster for HMIS and information systems more broadly.

Networks of action to support scaling and sustainability: Experience of HMIS implementations globally point to the problem of systems dying as pilots, and being of little use to managers who want full scale data. Such small scale experiments tend to thrive in an environment of limited accountability and frequent movement of officers. To scale and sustain systems remain a primary challenge for HMIS implementers, and research points to the strategy of creating “networks of action” wherein users and developers of the technical systems support and strengthen each other by the sharing of experiences, advocacy, ideas, products, software, and training resources. This network model necessarily requires a shift from a centralized model of bureaucracy based on principles of discipline, surveillance and reprimand, to one where the onus is on the network members themselves to share and learn through these experiences. For example, while in the early days we may need a technical group to provide the support, but with time we could strive for a situation where users start to solve each other’s problems – thus broadening the base of capacity and making the network more robust. A network model which is based on sharing and learning thrives on an “open source configuration” where community based resources can be accessed by all, and individual enhancements to these resources then feed back to the central repository with open access. This contrasts with the centralized model where the user for example depends on the central level to carry out analysis for them on data quality and health status and then send them the reports to act upon.

The above discussion has been summarized (as in Figure 6.6) to the following dimensions:

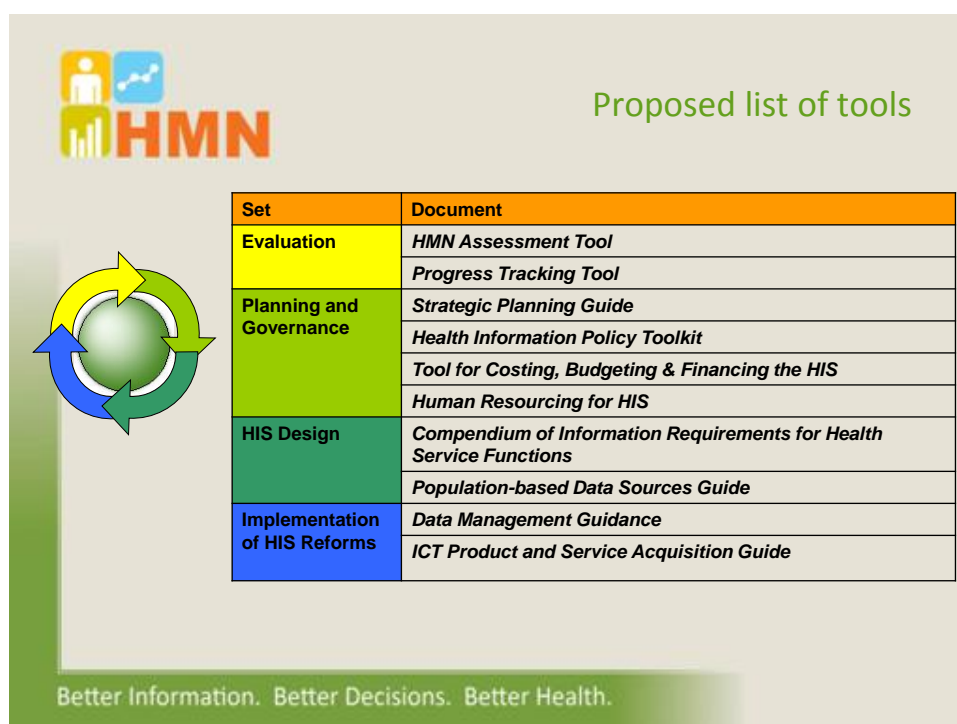
- A HMIS based on the hierarchy of information needs.
- Systemic & institutionalized use of information linked to programme improvements.
- Integrated systems (technical and institutional) based on a data warehousing approach.
- Formal legitimating of public health informatics as a curriculum in university and as a cadre within the government.
- Software architecture based on open standards & code freely available with state.
- HMIS accorded high priority in state working.

These points can broadly be divided into two categories of technical and institutional. The first technical point concerns the design of the HMIS, which is based on the hierarchy of information needs. This hierarchy acknowledges the varying information needs of different administrative levels of the health system, and seeks to design a HMIS that can meet these flexible needs. The second technical point concerns the approach to create a data warehouse which serves as a mechanism for integration, something that has been identified as the crying need by both researchers and practice. Achieving this integrated state fundamentally requires the adoption of open source tools and standards. The institutional points relate to providing legitimacy, priority and thus budgets to the HMIS, so that it becomes an institutionalized and integral part of the working of the health system.

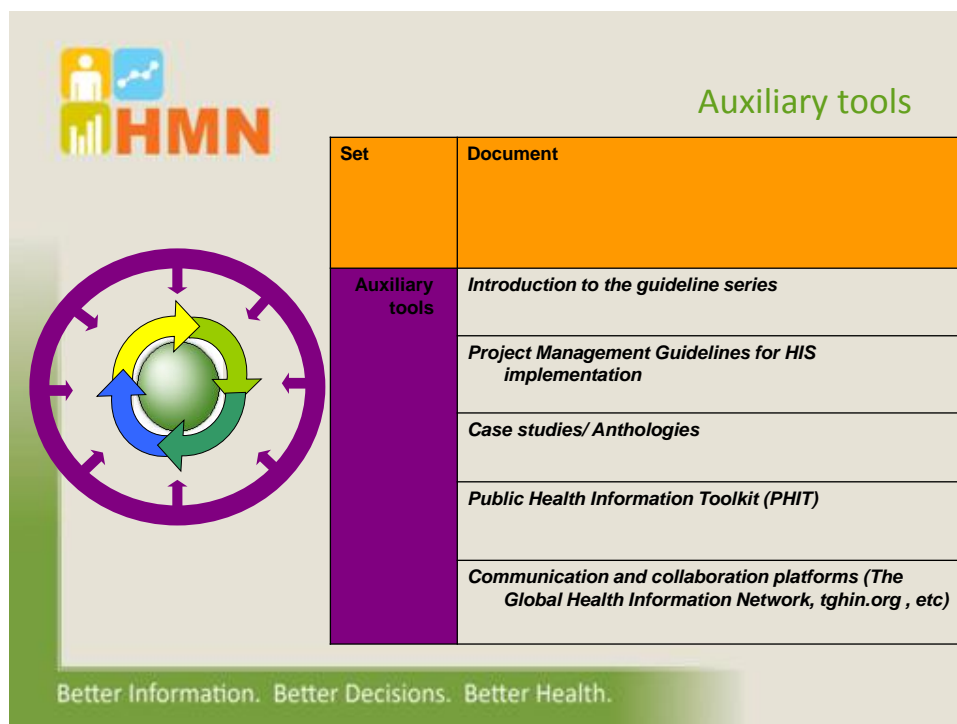
Strengthening capacity building through the use of standardized tools: Strengthening processes of HMIS implementation, scaling and maturing necessarily require the improvement of the effectiveness of processes of capacity building. Capacity building strengthening requires firstly their standardization and secondly systems of measuring or evaluating their effectiveness so as to diagnose more minutely what the specific areas of improvement that need to be incorporated into the capacity building efforts are. In this thesis, for example, the Readiness Matrix has been presented which helps to diagnose what some of the limitations in the system with respect to information use are. This detailed diagnosis can help to incorporate relevant interventions into capacity building efforts aimed at addressing gaps identified.

Like the Readiness Matrix, there are other “tools” which put together could form a “toolkit” to help strengthen the HMIS from a health systems perspective. The metaphor of a toolkit helps to understand the package of tools that planners and doers of HMIS need to have at hand to ensure its smooth progress. Like a toolkit for a carpenter will include screwdrivers, hammers and saws to allow him or her to carry out different kinds of tasks, similarly the toolkit for a HMIS planner can

include tools for varying purposes such as training manuals to support capacity building, user manuals to guide the use of software, questionnaires to help evaluate the maturity of the HMIS, and web based resources to enable access to particular types of relevant information. The important role of toolkits to support capacity building processes around HMIS has been recognized by HMN as depicted in their following two figures on tools and auxiliary tools respectively.



Box 6-1: HIS Tools identified by HMN



Box 6-2: HIS Auxiliary tools identified by HMN

Some examples of different types of toolkits are summarized in the table below.

Tool kit	Examples	Level of use
Training Manuals	<p>User manuals for software / to help develop individual level competencies in understanding and using the software.</p> <p>User manuals for information analysis and use to help develop individual level competencies to understand principles of information analysis and how it can be put to support action.</p> <p>User manuals for data management to help develop understanding of basic principles of information flow, data, indicators, data quality and validation.</p> <p>Training methodology handbook on how to carry out training on HIS at state and district levels.</p>	
Dictionaries	<p>Data dictionaries which describe data being collected in the HIS, including details of its meaning, how it is recorded, which indicators it is used to generate, and common errors made.</p> <p>Indicator dictionaries which describe useful indicators for health programmes, formulas for generation, what interventions they can help to design, how to make interpretations, their relationship with related indicators and common errors made.</p>	
Frameworks	<p>Implementation planning framework which helps to identify the various processes that need to be in place at different stages of the implementation process.</p> <p>To identify infrastructure related gaps for supporting an effective health information system</p>	
Assessment	Readiness Matrix to assess readiness of health system to use information for	

tools	<p>action.</p> <p>Talli Tool for assessing levels of information usage</p> <p>IMF Data Quality Assessment Framework</p> <p>Assessing the maturing of various processes such as training, technical support, implementation, or data quality.</p> <p>Assessing maturity of the health information system.</p>	
Survey questionnaire	<p>User satisfaction survey related to software use</p> <p>Trainee satisfaction related to training programme conducted</p>	
Competency tests and associated certification	<p>Software competency tests and certification levels</p> <p>Public health competency tests and certification levels</p>	
Web based resources	<p>Software code repositories</p> <p>Survey data, like NFHS and DLHS in India</p> <p>Relevant web links on manuals and handbooks, eg WHO Toolkits on monitoring health systems strengthening – WHO HIS http://www.who.int/healthinfo/systems/WHO_MBHSS_2010_full_web.pdf http://www.who.int/healthinfo/systems/WHO_MBHSS_2010_section3_web.pdf</p> <p>Monitoring the building blocks of health systems - a handbook of indicators and their measurement strategies http://www.who.int/healthinfo/statistics/toolkit_hss/EN_PDF_Toolkit_HSS_InformationSystems.pdf</p>	

Table 6-3: Examples of required tools

A brief overview of two of these tools is given below:

Tali tool to assess levels of information usage: This tool was developed by HISP South Africa in early 2000 that helped to identify three levels of information usage, and the detailed criteria by which a facility or a district system could be assessed and placed into level 1, 2 or 3. Assessment can be done using a qualitative assessment supported by a checklist containing the different criteria of each level (See Annexure 1).

HMN Assessment tool for National HIS: An assessment tool was developed by Arthur Heywood, Jorn Braa, Sundeep Sahay, and Calle Hedberg for the Health Metrics Network in collaboration with representatives from the health services and other stakeholders from the following countries: South Africa, Botswana, Malawi, Mozambique, Tanzania, Ethiopia, India, Vietnam and Thailand. This

tool aimed at assessing the status of nations on their HIS, by quantifying achievements of countries according to a normative framework across 11 categories. These categories were identified based on HIS related **problems** found to be endemic at all levels of the health administration. This included:

1. Fragmentation: a lack of coordination and integration among numerous sub-systems where each health program runs their own system with little regard as to how this is integrated with the overall HIS.
2. Excessive data and reporting demands on health workers, with multiple uncoordinated forms overlapping each other and leaving gaps.
3. Lack of standardisation and alignment within and between data sets and reporting forms contributing to poor quality of data and the information that can be derived from it.
4. Management hardly uses existing information for planning and monitoring.
5. Staff responsible for the HIS are inadequately trained and under-skilled at all levels.
6. Insufficient financial and political commitment to the HIS at the national level.

To try and address these adverse conditions, a normative framework was formulated representing conditions that should necessarily be in place (See Table below).

Context and resources	Legal and regulatory framework: Policy and priority Resources: Human, financial and equipment Data flow and information infrastructure Management: National and local HIS committees
Process	Integration: Institutional, data and technical . National indicators and data sets. Software at the District
Outputs	Quality of data and information Use of information: mechanisms promoting information use Information culture. Information for action Dissemination and advocacy

Table 6-4: Normative framework for HIS assessment

This tool was used by a network of researchers to make an assessment of the National HMIS of 11 countries including 3 States in India. Results indicated that except for Thailand and South Africa, a well functioning HMIS was not identified in any of the surveyed countries. Various best practices, especially relating to addressing the problem of fragmentation were identified through the practices seen in Thailand and South Africa. While this tool was originally designed to make a national level assessment, it may be customized to do a similar exercise at the state or province and district levels.

The above examples are only indicative of the kind of tools that can be used to support capacity building in HMIS, but many more tools are needed as summarized in the table earlier. These tools need to be necessarily developed in networks of action so that resources are optimally used and freely shared, and also to enable that multiple learnings going into the design, development and revisions of these tools. More importantly, each member has the possibility to learn from the experiences of others, and to contribute their learning to the rest of the network. This is the guiding principle and essence of the network of action – the possibility to learn together, and the strength of collective learning is more than individual learning. The use of web based resources like the Wiki makes it very possible for electronic sharing of resources and storing it in repositories which can help provide access to all interested.

After discussing in some detail the defining characteristics of HMIS which is conceptualized as the gold standard which the Indian HMIS should strive for, in the next section those interventions are discussed which is felt can help achieve this goal. Deliberately, the issues discussed are seen to be of strategic importance, rather than the more operational ones.

Identified interventions to achieve the gold standard

At a strategic level, three key interventions are identified to help try and achieve this gold standard:

1. Broad basing of education in public health informatics.

2. Institutionalizing public health information related structures and systems in the government.
3. Providing appropriate software support that encourages local information use.

Each of these points are now discussed.

Broad basing and institutionalizing of education in public health informatics: Like most programmes in computer science in India, the educational focus is primarily on the development of technical skills such as programming and networks for example. There is more limited focus in such programmes on the aspect of information systems which deals with the interaction between technology and the application domain in particular situated contexts. Various research studies in this area have attributed the large success of the software outsourcing industry in India to be because of the large numbers of high quality programmers, but the weakness in being able to create global products with high intellectual property. This weakness has been attributed to the limited focus on the information systems aspect of technology which would help to understand how the technology gets integrated and institutionalized within a use context. In the UK, university authorities have recognized the need for specialists who can bridge the gap between technology and use, and made such information systems courses an integral component of curriculum relating to Masters studies in computers. Likewise, businesses too have acknowledged this need for bridging specialists and have started to advertise for positions such as “business analysts” or “hearts and minds specialists” (Braa and Sahay 2011).

Drawing from the above trends, we can try to understand its implications for educational programs in public health informatics. In India, the domain of public health informatics is not an established discipline and typically Masters in Public Health courses don't pay any serious attention to courses on Health Informatics. There are some exceptions to this, like for example Jamia Hamdard University in Delhi is running a Masters programme in Public Health Informatics and Achuta Menon Institute in Kerala is planning to start a module in Medical Technologies within their MPH programme. However, these are exceptions. On the other side of this field, educational programmes

in computer science or informatics, rarely do they run any specializations in public health. As a result, there exists a real gap in the production of specialists who are grounded in the public health domain and have competencies enough in informatics that they are able to apply these computerized tools in addressing public health problems and challenges. There is thus this critical gap between technology and information use, and while there are decent computer specialists in play, they tend to be weak in domain expertise and have limited capabilities in building bridges between technology and information use within a health systems framework. To date, this gap has tended to be filled by statisticians, and this too comes with its own limitations of being less able to nurture a public health grounded perspective towards information use, due to a statistical rather than a public health slant being likely to be introduced.

There is thus this critical need for broad basing and institutionalization of educational programmes which seek to develop public health information specialists who have for example the skill sets to be able to support the state health systems in developing tools to carry out the analysis and use of information, and build capacity of health programme managers to be able to understand issues of data quality, how to make improvements in them, how to interpret and analyze health indicators and feed such understanding into making programme improvements. While this may appear a very limited focus of study, it is critical and urgent as governments, both national and states, are making large investments in technology projects and not getting the real benefits from them. Recently, the Monitoring and Evaluation division of the national level purchased at a high cost statistical packages as a part of the HMIS initiative. From the perspective of this thesis, this investment can be described as flawed as conducting sophisticated statistical analysis is not the primary need of the health system, and further the capacity to use such a package simply does not exist outside a select few research scholars and experts. If the aim was to broaden the base analysis and use of information and orient users towards making programme improvements, then appropriate tools need to be provided to the health managers to do the same. Centralization of knowledge and

defining the flow of this knowledge in a diffusion model from the centre to the periphery is not the way to go in making health system architectural corrections as the NRHM envisages.

A successful model of grounding such public health informatics programmes in public health institutions is seen in South Africa. The School of Public Health, University of the Western Cape in Cape Town have been running such informatics specializations within their MPH programmes for many years. And more importantly, this school has become a hub for providing in service training for health services staff through the structure of summer school and winter school courses. Specialized courses, for example on GIS for public health or data analysis are offered as certificate or diploma courses by specialists in public health informatics. Over the years, more than 3000 staff have gone through such courses, which has helped them to take specialized skills to their respective work places. So, a combination of one year diploma or masters programmes in public health informatics coupled with focused in service courses which has a strong grounding in public health education, arguably has the potential to help broad base and institutionalize the required education.

In discussions with various universities in India, such as TISS, AIIMS, BITS Pilani, SRS Chennai, Sri Chitra Trivandrum, PGI Chandigarh and Jamia Hamdard, the need for such programmes has been acknowledged. Discussions have also taken place of these Universities with the University of Oslo, Norway, who have over the last decade or more collaborated with universities in South Africa, Mozambique, Ethiopia, Tanzania, Sri Lanka, Bangladesh and Malawi to establish such programmes both at the Masters and Doctoral levels. A wealth of experience, resource material, curriculum design knowledge thus exists, and the wheel need not be reinvented, These experiences can be studied, learned from and then customized to our local requirements and priorities. The evolutions made to this knowledge pool through our value additions can flow back to the network and made available to the others within an open source collaborative framework.

Institutionalizing public health information systems and processes in government: With respect to the HMIS, currently there are two sets of structures that are predominant. The first concerns the cadre of statisticians in the form of Monitoring and Evaluation officers or State Data Officers. The second is the cadre of the State, District and Block Managers who tend to come with Management or Computer backgrounds within the NRHM structure. In this, the missing structure is that relating to public health information officers, promoting structures and systems that promote public informatics thinking is an urgent priority.

How this is done is a non trivial task, and various measures can be taken. For example, the Monitoring and Evaluation division at the national level, which currently is made up primarily of Statisticians could be strengthened through adding and even being led by public health specialists. This can help to try and redefine the thrust of the monitoring and evaluation activities from one related to creating a data discipline through the analysis and correction of outliers, to one of an information discipline where the focus is on understanding the public health significance of data and how it can feed into making health programme improvements. The national level can consciously seek to shift their mandate from one of monitoring to that on evaluation, where indicators reach them and not raw data, and this is used for policy and impact analysis of programmes. This corresponds to the hierarchy or pyramid of information needs discussed earlier. A consequence of this thinking is that each level should focus on accessing data for only two levels below, so the national on state and district, and the state level for district and block. In this way, each level can work with data on which action is possible. If the national level tries to access sub centre wise data, then it only leads to information overload, and an absence of action. Important priorities get missed out in this process and policies are required to be established to sharpen this focus.

Similarly, at the State and district level attempts could be made to create a “State or District HMIS Cell” where both technical and public health related skills could be hosted. In the State unit,

technical skills needed are related to the management of servers, databases, and also being able to create local analysis reports such that the state becomes self sufficient in managing their own applications at all levels. Similar skill sets are not required at the district level, as with a server based application the state is capable of providing over all support. Further to the technical skills, the state cell could try to have at least two public health information specialists – with the primary responsibility for systematically carrying out analysis of data (for data quality and health status) and its dissemination both vertically from state to district and sub district, but also horizontally to health programme managers. This group would seek to institutionalize a process of routine analysis of data (in terms of quality and health indicators), including strengthening focus and capacity in using HMIS data for planning, monitoring and evaluation. They would also be responsible for processes of horizontal (across health programs) and vertical (down the levels of administration) dissemination, and its institutionalization including through routine reports, workshops, newsletters, web dissemination etc.

These HMIS cells need to focus efforts on strengthening of the demand side pull for information, by enrolling health program managers/officers to be able to routinely access and analyze data and putting it into use. Currently, the program managers are not engaged in the process of verification and use of the routine HMIS data. For this, as also seen in the case of best practice states of Kerala and Gujarat, the State Mission Director would need to champion this process by personally analyzing or examining the analysis of data and calling the districts and asking questions based on the data. These leaders can immediately be given online access to the application, and a special report be created and made available on the executive dashboard with key indicators that need to be monitored on a daily basis. Once the districts see this use of data at the top level, this will contribute to a believe a cultural shift in how they view data. Further, other best practices seen in other states like Monthly review meetings (chaired by Mission Director), rewarding high performing facilities, etc could be further incorporated to try and bring about this cultural shift.

Setting up such cells could also contribute to the efforts of integration. Most states have multiple information systems relating to RIMS, IDSP, Malaria, TB etc, with their own hardware, software, people, training budgets etc. There is a fair deal of redundancy created because of this, and their integration should be bought within the framework of the state HMIS cell. Synergies would be achieved on many fronts including use of resources, training, increased manpower, and also improving data quality through integrating information flows. Once this state level integration can be successfully carried out, similar integration processes can take place also at the district levels and below.

The district cell can play an important role in strengthening district and sub district level technical support: The sub district level support has been largely neglected with respect to capacity building. There is urgent need to correct this, and also to qualitatively shift the nature of support from mere data entry and data to moving to “information and action.” This requires dedicated support on issues relating to data quality strengthening, information use, data triangulation etc. This requires the placement of at least one person in each district with a strong public health information focus. Many states like Assam and Bihar have set up procedures on how data verification should take place, and this cell can help in their effective implementation.

An important component of setting up structures and systems to promote public health information systems is to try and make a shift from the culture of reprimand which currently exists to one which encourages truthful reporting. For example, service providers fear to report maternal and infant deaths because of the fear of adverse consequences that may arise from that. We find in many states where now deaths being reported, such as Uttarakhand because of the use of facility wise line listing, these figures are often forced out by being classified as outliers because in previous months they showed zero. As the staff is scared of outliers being associated against their respective facilities, they tend to hide what is seen as abnormal data by not reporting them at all. In review meetings, therefore the focus should be not on how outliers should be normalized, but instead

taking a process perspective of understanding from a public health standpoint of why that data came to be, and providing encouragement and motivation for truthful reporting. An output based approach where the data in the portal is seen as a product independent of the processes that created it needs to be thus replaced with a process based understanding of how that data came to be.

The above requires, in addition to the mindset shift, also a large scale capacity building initiative targeted at the health service providers. Such efforts have been largely absent with the dominant focus being on states, districts and to a more limited extent at the blocks. The focus at the lowest level needs to be quite different, attempting to build understanding on the meaning of data elements, information flows, formats, and how the information being collected is also useful for local action and not just upward reporting. The ANMs tend to be on the receiving end of all new HMIS initiatives in terms of collecting additional data, a case in point being the recent introduction of the tracking system, with not commensurate attention being paid to the provision of more resources and support to them. Motivating them through more support and encouragement will go a long way in strengthening the whole foundation of the HMIS, and improving the public health dimension of it. For example, where the ANMs are doing data entry and not contractual data entry operators (like in Kerala), arguably the data quality and ownership of it is higher as they have a better understanding of what the data means. Motivating these users in local use of information, a best practice seen in South Africa, has helped in developing a quality HMIS, and is something which India can try to emulate.

Providing appropriate software tools to encourage local use of information: Appropriate software support lies at the heart of an effective HMIS. While we have already discussed in detail the perspective that should be encouraged around technology, as a tool and not an end, in this section we discuss specifically the characteristics seen as appropriate.

Promotes integration of systems: Globally, the trend within the debate of integration is towards development of integrated open source systems with a focus on interoperability of data flows between systems. This implies for example, the individual data that will be collected through the tracking system should be able to be aggregated and imported into the facility based system. Further, the system responsible for capturing accounting information at the transaction level should be able to aggregate data and feed into the integrated system. States which are using DHIS2 for facility based reporting should be allowed to export that data into the web portal, and not have the same data also be collected separately for the portal. To allow such interoperability, it is crucial that the systems are open and also standards for data exchange are in place. The WHO is currently in the process of defining a Public Health Information Toolkit and such data exchange standards (called SDMX.HD). It would be useful to examine these efforts and align the Indian HMIS in using these tools and standards.

Promotes a data warehousing approach: Similar to the above, is the use of a data warehousing approach which promotes the flow of data in a common repository which then allows the use of common dashboards and analysis and other reporting tools to address needs of different programmes and users. Currently, we find programmes wanting to continue with their existing systems because they see their analysis not being provided by the HMIS. However, a data warehouse approach can help allay such fears as what reports the users require can be generated from the common pool of data. Such an approach is now being promoted globally to break out of the historical problem of compartmentalized and vertical systems, and the Indian HMIS could also strategize on how our different systems can be evolved within such a framework.

Providing flexibility and local control to users: The hierarchy of information principles allows users to add locally relevant data elements and indicators as long as they don't remove what is required for the level above. So, a sub district level facility can add locally required data as long as it does not change what the district wants and so forth. Implementing this principles needs a

software that is flexible, easy to use and in the control of users while maintaining some central level controls.

Provides easy to use analysis tools: Effective programme management, requires not sophisticated statistical tools for regressions and modeling, but simple tools that allow representation of trends in graphs, charts, maps, and easy drill down facilities to be able to investigate the source of the problem which can allow for effective and focused action.

Caters to the multiplicity of infrastructure that the health system has: The level of infrastructure inevitably is variable in the health system, where in some places for example there may be internet access and in others there may not even be reliable electricity. The software should cater to these multiple environments, for example to allow both online and offline use of the software. Where there may be no internet, the software could allow for integration with mobile reporting which can help to transcend some of the internet level limitations. If both online and offline access are possible, software tools then need to be in place for allowing import, export and synchronization of databases.

In summary, national level policy needs to be established on the use of software tools that meet these above characteristics defined above. Without this in place, we will continue to be locked into vendor defined proprietary systems that run contrary to the desired aims of decentralization and integration. After having discussed in detail the nature of strategic interventions that could contribute to the overall evolution of the Indian HMIS, in the next section the discussion focuses on how the existing systems and data can be leveraged on to help promote the use of information of local action.

Breaking the vicious cycle of data non-use

The Indian HMIS, as many so in the developing world, tends to be locked in a cycle which broadly can be described as follows:

1. Historically, data from routine HMIS has been defined as being poor quality and thus not trusted and used.
2. For reporting on performance, the national level then relies on survey data (NFHS, DLHS, SRS etc), ignoring the routine HMIS data. Survey data does not provide the required granularity to support programme related everyday interventions, and its primary function is for upward reporting.
3. The more the routine data is not used and formally ridiculed, the less is the attention given to its process of strengthening.
4. The level of lack of trust in the routine data continues to be high resulting in its non-use.
5. This non-use then provides the legitimacy to the planners to collect additional data and purchase more modern (and expensive) technologies.

This vicious cycle described above needs to be urgently broken, for at least two reasons:

- i. The data currently on flow in the Indian routine HMIS is arguably of sufficient coverage and level of quality to be put to use by our planners.
- ii. If we examine our planning needs for information, the level of quality tolerance is not so extreme that the current HMIS data cannot satisfy.

Both these issues are now elaborated:

The data perspective: Level of coverage and quality: Currently, the Indian data status shows nearly 100% of districts and 30% of sub-district coverage. Given the right environment and support, this sub-district coverage can be heightened to at least 75% by the end of the current financial year. By all accounts, the volume of data available is non-trivial and quite sufficient to meet more than 90% needs of the planners. Further, while we are confronted with a significant issue of blanks and zeros (which may not actually be a data problem but a realistic reflection of the

situation on the ground), a clear examination of the issue will reveal that most of these zeros and blanks relate to figures of stocks, mortality details and reporting from private institutions. If we examine the reporting status on the “essential data elements” figures which by definition should be reported on and be non-zero (for example ANC registration, immunisation, etc) the figures tend to be a healthy 60% and higher. So, arguably there is data of adequate coverage, both in terms of geographical and facility coverage as well as by data element types.

The question then arises is of then why don't planners use this data? Often the tendency of these planners is to continue to look at the legacy data of for example 2007-08, 2008-09 and point to its incompleteness and quality for not using current data. Previously, data was reported as one consolidated state report (this is before current HMIS was introduced) so naturally the district data was not available in its entirety. In October 2008, when the implementation of the revised HMIS started, the most challenging task was getting district-wise legacy data from April to October 2008. It was challenging because firstly a lot of data was not available, and whatever was available was in a plethora of formats ranging from paper files, to word sheets to excel and access documents. The states have done their best in making that data available and uploading it on the portal. Digging graves of this incomplete and inadequate legacy data to a large extent may be a futile exercise, and diverts the attention from appreciating, strengthening and using what is now in flow. Further, appreciation of the progress made will do wonders for the confidence and motivation of the states to improve their current system. Constant reprimand for gaps which the current staff have little control over will continue to de-motivate them from the present task at hand.

Om summary, it is important to learn to live with the limits that exists which is a product of the historical legacy of systematic inefficiencies and instead to focus the attention on strengthening the present and future systems.

The planning perspective: level of quality tolerance needed: The mechanism of “statistical outlier” is employed by the national level statisticians to argue that the quality levels of data to not justify its use. Firstly, some questions can be raised about the application of the technique itself:

- i. The box plot method being used assumes certain form of statistical distribution followed by the data. Since the same technique is being used across the board for all data types, can we assume that the data on stocks follow similar statistical distribution as deliveries and immunization?
- ii. The box-plot technique computes the median for a data element over last 12-month values, and computes quartile ranges, including upper quartile and lower limits. The factor being used for the computation is 2, while what the statistical texts recommends is the use of the factor 1.5
- iii. In computing the median, non-reported data is being treated as zero, which then skews the median and subsequent identification of the quartile ranges and outliers

If outliers are drilled down further, for example in a state for about 10months data about 250-300 outliers are identified. Since each district reports about 227 data elements per month, then the percentage of outliers reported is:

$$\frac{\text{No. Of outliers identified}}{\text{No. Of districts} \times 10\text{months} \times 227} \times 100$$

This tends to be less than 1%. Further, with nearly 40% of these outliers concerning stocks data and 25-30% by mortality data (both of which arguably should not be subjected to outlier analysis), the total percentage of outliers in the state data tends to be less than 0.5%. The question this begs is “is this level of quality tolerance not acceptable for our planning needs?” And if this is not, what is?

Next, we need to examine what is the kind of information support that is required for our planning? Given, for example, the persisting problem of maternal mortality seen within a differential planning

framework – for high focus districts we need to have figures of district & block facilities providing deliveries, emergency obstetric services, health worker to population density, estimated pregnancies and incentives paid related data. More than 90% this data is arguably available in the HMIS and what is not can be easily obtained by a phone call to the district (for example, to get from the district medical incharge the number of gynecologists available in a district). Even if we take the quality levels identified by the outliers analysis, the HMIS is even in its current state with existing problems is quite capable of meeting the required level of information support for urgent planning needs.

Please note, not in the least is the argument being made that the existing HMIS is perfect and does not need to be critically examined and further improved. Instead, the argument being made is that in its present form and in relation to planning needs, there is a reasonable level of sufficiency in it to warrant its use. Further the more important point is that to establish a degree of trust and confidence in HMIS data, planners need to convey to the others they are not adverse to using it. Such use, as has been demonstrated by best practices in Kerala and Gujarat conveys to all concerned that HMIS is being taken seriously and everyone needs to put their best foot forward. A contrary message of lack of confidence and the non use of HMIS data will continue the overall neglect and apathy towards the HMIS, and continue then to be trapped in the vicious circle of data non-use.

We can further attempt to break out of this vicious cycle by having the districts to report only on actionable indicators rather than raw numbers. For example, with respect to deliveries it may be more effective if districts give figures of % of SCs, PHCs, CHCs etc not providing expected level of services (such as deliveries, safe births, C-sections, BEMOC services etc). This can then be used by planners to strengthen coverage of BEMOC services which can have direct implications on maternal mortality. Details of raw numbers of deliveries will always be available at state or district level and can be called upon if needed. Similarly, the names of pregnant women and their phone

numbers/addresses can be retained at the sub-district level than reported to the national level as is being currently envisaged. This represents the established principle of hierarchy of information where the most detailed information is at the lowest level and national level reviews aggregated and actionable information. Similarly, we can see other examples like stocks where national level reviews only percentage of stocks out while the lowest level maintains details of receipts and consumption of stocks.

Such measures will also help to redirect the attention from being continued to be locked in data to its transformation to information and knowledge, towards public health friendly systems.

Concluding, a fair degree of progress has been made in the reform of the HMIS on the “data side” of things, and we are now seeing the seeds of change taking place on the “information side,” but there is still limited evidence of progress to the ‘knowledge side.’ But given that this level of change has been achieved in the short span of last two years, it is a commendable effort, especially when compared with experiences like in South Africa where it has taken nearly a decade to reach the knowledge stage. Now in South Africa, health budgets are being formulated using the HMIS data. We can quite easily reach this stage in the next couple of years, but fundamental to this is we must build and express trust and confidence in our systems.

6.4 Study limitations

A key limitation of this study could be in terms of getting the right balance between action and research, which is always an issue in an action research study. In this study, the bias was towards action, as there was an intensive engagement with the practicalities of making system improvements from design, development, and implementation in its various facets including the engagement with the politics of things. Given this, the research component including systematic data recording and data analysis at times was placed in the background. Writing this thesis has helped to some extent to redress this balance. Further, the quality of research could have been

further enhanced if there had been more opportunities for face to face discussions with my supervisor especially in stages of data analysis. Not only would I have gained from his insights but would have also helped to develop multiple and possibly more objective interpretations of events, given that he was distant, both physically and emotionally from the field. However, such visits and meetings have not been possible because of distance and time constraints, and I have tried my best to gain comments electronically. Comments gained during the writing of the proposal especially proved invaluable to me as it provided a firm foundation on which to build the thesis.

Chapter 7 : Conclusions and Recommendations

This concluding chapter presents some key summary points from this thesis. The aim of this thesis was to probe into the enduring question of “why is health information not used in practice?” This is a non-trivial question to explore for at least two reasons. Firstly, governments the world over are inventing millions of dollars into the procurement of new technologies in the promise that their information systems will be automatically strengthened. This promise has by and large remained to be utopian and unrealized, with studies documenting that 90% of such initiatives as partial or complete failures. A key criteria to understand that a system has failed to deliver is its inability to contribute to information use aimed at making health programme improvements. Secondly, there is an increasing realization in the communities of both practice and research, at the international and national levels, that health information should be privileged as a strategic resource to make health programme improvements, and the achievements of health targets such as the MDGs. Despite this acknowledgement, what we find are governments still anchored to the data side of things, and not paying adequate attention to move from data to information and more importantly to knowledge.

The interesting question then is to understand why are we not moving as urgently enough on these normative goals of strengthening health information use? In this thesis, these goals have been described through the metaphor of a “gold standard” and three strategic steps have been identified to try and reach this. The first concerns the broad basing of educational programmes in the country which focused on building a cadre of public health information specialists. Such people are not technologists or pure public health professionals, but those who understand the problem domain and have the required technical expertise to formulate solutions to address the problem that includes both the technical and institutional dimensions. Such a cadre of people do not currently exist in India and also most other countries, and it becomes important to look at successful attempts towards this quest, such as from South Africa.

The second suggestion is in the form of institutionalizing structures and processes in the government, at both national and state levels, that are aimed at strengthening a public health informatics perspective within a health systems framework. Such a task is necessarily non-trivial, as it involves shifting the power balance from the statisticians to one that privileges public health. Such power structures are deeply embedded in institutional systems, and shifting them is necessarily a political task requiring strong and focused governance and will. Without trying to downplay the importance of statistics, the argument is that if local level action towards programme improvements are to be made, then the focus of how information is processed, analyzed, interpreted and used needs to be very different. It is argued that attempts towards such a shift are explicitly embedded into health reform programmes.

The third and final recommendation is in terms of the technologies in use. Globally, two trends are visible in the arena of health information systems. The first is the movement from standard systems to integrated architectures, to allow for more effective information use and prevent duplication and compartmentalization which have been the bane of health information systems. The second is the related movement towards the use of open source tools and open standards which can allow for this integration and interoperability. However, governments have been slow to leverage on these global trends, and in many cases continue to be locked into proprietary systems. While undoubtedly it is the more expensive option, it also suffers from creating lock in to vendors, who most often do not have the public health perspective to design public health friendly systems.

All the issues raised above are strategic in nature and long term. Implementing them will require a commitment and understanding at the highest political level. We hope this would be the direction that India, and also other countries in the South, would move towards.

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Appendix 1: The Readiness Matrix for assessing state readiness to use information for action

Technology				
Sub-dimension:	Level: 0	1	2	3
<i>Software customization:</i>	No additional customization requested	Minimum customization requested	Significant customization requested carried out	Established institutional procedure in place for dealing with customization requests
<i>Server capacity:</i>	No server used	NHSRC shared server used	Own server used	Own server self managed
<i>Internet access:</i>	Only available at state level	Available in most cases at District level	Available in most cases at Block level	Available in most cases PHC-level
<i>Completeness:</i>	No reporting	Very low level of completeness (< 40%)	Significantly complete (> 40%)	Fully complete
<i>Accuracy:</i>	No checking being done	Significant validation queries raised (>25%) during checking	Minimal validation queries raised (<25%) during changes	No validation queries raised during changes
<i>Verification procedures in place:</i>	No procedure in place	Informal procedures existing	Detailed written procedures signed, distributed.	Detailed written procedures signed, distributed and followed
Human Capacity				
Sub-dimension:	Level: 0	1	2	3
<i>Adequacy of team:</i>	State team not established	State team in place	Public health components in state team	District team also in place
<i>Adequacy of training:</i>	Limited training at state and district levels	Primarily technical focus in training	Use of information training carried out	State trainers in place who are capable of conducting training
<i>Advocacy on information for action:</i>	No advocates at state level	Some external advocates at state level	Internal advocates	Advocates also present at district level
<i>Regularity of upward reports:</i>	Not being submitted without external intervention	Partial submission taking place, but not completely independently	Significantly completion rate being done independently	100% complete, timely and independently
<i>Practice of feedback reports:</i>	No practice existing	Some practice of feedback, mostly informal	Regular systematic feedback through written	Well established institutions for feedback including

			communication	discussions
Procedure for data verification:	No procedure existing	Only taking place at district level	Some verification also taking place at Block level	All levels systematic procedure in place, including feedback on changes made
Institutional Capacity				
Sub-dimension:	Level: 0	1	2	3
Involvement of program management:	No involvement of programme officers	Limited involvement of programme officers	Significant involvement of programme managers	Program manager formally part of the HMIS-team
HIMS budgets in place:	No clear budget line for HMIS	Only state budget defined for HMIS	District offices also have HMIS budget in place	MO at PHC-level also have HMIS budget in place
Integration of systems:	Stand alone HMIS	One or two systems integrated with HMIS (RIMS, IDSP)	More than two systems integrated	All systems under one institutional structure
Data analysis:	Not carried out	Externally being done	Frequently done internally	Systematically done internally
Feedback reports being generated:	Not carried out	Externally being done	Frequently done internally	Systematically done internally
Action taken:	No action	Limited action	Some regular action	State PIPs being made based on HMIS

Appendix 2: State Wise HMIS Implementation Status

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
1	Assam	<ul style="list-style-type: none"> Online state application available but now state directly using web portal for data entry State & district teams in place Regular reporting Formats printed & disseminated up to facility level Information of action workshop completed for state team Process of data verification & feedback process at each level to be established State HMIS server established HMIS resource material distributed up to block level HMIS support through NE RRC Team 	<ul style="list-style-type: none"> 4 trainings completed for state & district teams. 2 master trainers at state level & one each at district 3 joint trainings with all NE states 	<ul style="list-style-type: none"> State reporting district level data Reporting regular 	<ul style="list-style-type: none"> Strengthening of block teams for facility level data capturing in state application 	<ul style="list-style-type: none"> State planning to use facility master of web portal.
2	Bihar	<ul style="list-style-type: none"> Online state application available up to block level State & district teams in place 2 rounds of district level training completed in which block staff attended At least 78 Master trainers identified – 2 member state team and 1 for each district HMIS Intern in place Regular reporting, from Dec at block level Formats disseminated up to block level Two Information of action workshops completed at state level HMIS resource material distributed up to block level Govt order issued for process of data verification & feedback process at each level established & notified 	<p>Training up to Block Level</p> <ul style="list-style-type: none"> 2 training sessions completed for state & district teams at state level Block level trainings in each district completed twice Two orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> April 08 to March 09 – district Level reporting April 09 reporting from Block level upwards 95% of blocks reporting in state application Regular reporting 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry State exploring option of third party technical support to strengthen district systems UNFPA-IIHMR team in place with mandate to support peripheral facilities systems with focus on tracking system 	<ul style="list-style-type: none"> State plans sub centre wise data entry by Apr 10 along with tracking systems
3	Chandigarh	<ul style="list-style-type: none"> Online state application available up to facility level State & facility teams in place 4 Master trainers identified HMIS Fellow in place Regular reporting 	<p>Training up to facility Level</p> <ul style="list-style-type: none"> 2 training sessions completed for state teams Facility level trainings 	<ul style="list-style-type: none"> April 08 to March 09 – district Level reporting April 09 reporting 	<ul style="list-style-type: none"> Hand-holding support required at facility level for facility level data entry 	<ul style="list-style-type: none"> Strengthening HMIS teams and application for the state

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		<ul style="list-style-type: none"> Formats disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established & notified HMIS resource material distributed up to facility level 	<ul style="list-style-type: none"> completed Two orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> from facility level Regular reporting 		<ul style="list-style-type: none"> Further facility datasets customization required
4	Chhattisgarh	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State team in place One NHSRC intern in place Intern carrying out district wise training – 7 covered till date Sub center data set customization carried out Formats printed & disseminated up to facility level Process of data verification & feedback process to be established 	<ul style="list-style-type: none"> Training up to district Level 1 training session completed for state & district teams at state level 7 district level trainings carried out through NHSRC intern 	<ul style="list-style-type: none"> State reporting district Level data regular SC wise data entry initiated in 7 districts. April 1, expect all districts to report by SCs 	<ul style="list-style-type: none"> Hand-holding support required for capturing block level data Integrated state level training required for all districts 	<ul style="list-style-type: none"> Training of district & block teams ongoing from Dec Block level technical support to be strengthened
5	Gujarat	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 56 Master trainers available – 4 member state team and 2 for each district HMIS Fellow in place till Jan. Replacement to be found Regular reporting Formats printed & disseminated up to facility level in Gujarati language Information of action workshop completed at state level Process of data verification & feedback process at each level established & notified State HMIS server in place HMIS resource material distributed up to facility level 	<ul style="list-style-type: none"> Training up to sub-block level 2 training sessions completed for state & district teams at state level Block level trainings in each district completed Two orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> Sub-centre level data being reported from April 08 All sub-centres reporting in state application Regular reporting 	<ul style="list-style-type: none"> State has successfully established sustainable HMIS support mechanism 	<ul style="list-style-type: none"> State self sustainable except for technical server support Mobile pilot implemented in one block.

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
6	HP	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 24 Master trainers identified – 2 member state team and 2 for each district HMIS Fellow in place Regular reporting Formats printed & disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established & notified HMIS resource material distributed up to block level 	<p>Training up to block level</p> <ul style="list-style-type: none"> 2 training sessions completed for state & district teams at state level Block level trainings at district level in process Orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> April 08 to Dec 08 district Level reporting Jan 09 onwards block wise reporting April 10 onwards sub centre wise data entry for whole state 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 in a phased manner Mobile pilot conducted in one block
7	J&K	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 25 Master trainers identified – 2 member state team and 1 for each district HMIS Fellow in place for both Jammu and Kashmir. Additionally one intern in Kashmir Regular reporting Formats printed & disseminated up to facility level Information of action workshop completed twice for both divisions Process of data verification & feedback process at each level established HMIS resource material distributed up to block level 	<p>Training up to block level</p> <ul style="list-style-type: none"> 2 training sessions completed for state & district teams at state level Block level trainings at district level completed Orientation and training sessions for state directorate team in both divisions 	<ul style="list-style-type: none"> April 08 to March 08 district Level reporting; April 09 onwards PHC level data reporting Regular reporting 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> Focus on data quality, strengthening analysis and feedback mechanisms
8	Karnataka	<ul style="list-style-type: none"> Online state application available with facilities up to PHC level State & district teams in place 35 Master trainers identified – 6 member state team and 1 for each district HMIS Fellow in place Regular reporting Formats printed & 	<p>Training up to sub-block level</p> <ul style="list-style-type: none"> 3 training sessions completed for state & district & block teams at state level Two orientation and training 	<ul style="list-style-type: none"> PHC level data being reported from Dec 08 All PHCs reporting in state application 	<ul style="list-style-type: none"> State has successfully established sustainable HMIS support mechanism with an effective and active state HMIS team in place 	<ul style="list-style-type: none"> State largely sustainable Focus on new applications like hospital, leprosy tracking,

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		disseminated up to facility level <ul style="list-style-type: none"> • GIS integrated to the PHC level • Information of action workshop completed at state level • Process of data verification & feedback process at each level established & notified • HMIS resource material distributed up to block level 	sessions for state directorate team	<ul style="list-style-type: none"> • Regular reporting 		case tracking <ul style="list-style-type: none"> • Strengthening support for tracking system
9	Kerala	<ul style="list-style-type: none"> • Online state application available with facilities up to sub-centre level • State & district teams in place • 32 Master trainers identified – 4 member state team and 2 for each district • Regular reporting • Formats printed & disseminated up to facility level • Monthly SMO meeting in which analysis discussed at state and district levels • Process of data verification & feedback process at each level established & notified • State HMIS server in place • HMIS resource material distributed up to facility level 	Training up to sub-block level <ul style="list-style-type: none"> • Trainings and implementation support being done through technical support agency, identified by the state 	<ul style="list-style-type: none"> • Sub-centre level data being reported from April 08 • All sub-centres reporting in state application • Regular reporting 	<ul style="list-style-type: none"> • State has successfully established sustainable HMIS support mechanism – a best practice model 	<ul style="list-style-type: none"> • Mobile pilot implemented in one block • Process of tracking system roll out in place
10	Maharashtra	<ul style="list-style-type: none"> • Online state application available with facilities up to Block level • State & district teams in place • Customization carried out for integrated formats • 42 Master trainers identified – 10 member state team and 1 for each district • HMIS Fellow in place • Regular reporting • Formats printed & disseminated up to facility level • Translation carried out in Marathi • Information of action workshop completed at state level • Process of data verification & feedback process at each 	Training up to district level <ul style="list-style-type: none"> • 2 training sessions completed for state & district teams at state level • Two orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> • District level data with corporations being reported from April 08 • All districts reporting regularly in state application • State plans facility level data entry from April for integrate 	<ul style="list-style-type: none"> • Hand-holding support required at block level for facility level data entry for integrated dataset 	<ul style="list-style-type: none"> • State plans to implement customized facility based formats from April 10 • State and district teams together with NHSRC support will carry out training • Name

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		level established & notified <ul style="list-style-type: none"> • HMIS resource material distributed up to block level 		d data set		based Leprosy Information System from April 10
1 1	Manipur	<ul style="list-style-type: none"> • Online state application available with facilities up to sub-centre level • State & district teams in place • 15 Master trainers identified – 4 member state team and 1 for each district • Regular reporting • Formats printed & disseminated up to facility level • Information of action workshop completed at state level twice • Process of data verification & feedback process at each level established • State HMIS server on NE Server established • HMIS resource material distributed up to block level • HMIS support through NHSRC and NE RRC Team 	Training up to block level <ul style="list-style-type: none"> • 3 training sessions completed for state & district teams at state level • Block level trainings at state level completed • Orientation and training sessions for state directorate team • 3 joint trainings with all NE states 	<ul style="list-style-type: none"> • April 08 to March 08 district Level reporting; April 09 onwards PHC level data reporting ; Sept 09 onwards sub-centre data reported • Regular reporting 	<ul style="list-style-type: none"> • Hand-holding support required at block level for facility level data entry • Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> • Plan to start mobile project for SC in hilly areas • Strengthening process of data quality and integrity strengthening • State and district team together with NHSRC support is self sufficient
1 2	Meghalaya	<ul style="list-style-type: none"> • Online state application available with facilities up to sub-centre level • State & district teams in place • 17 Master trainers identified – 6 member state team and 1 for each district • Regular reporting • Formats printed & disseminated up to facility level • Information of action workshop completed at state level • Process of data verification & feedback process at each 	Training up to block level <ul style="list-style-type: none"> • 3 training sessions completed for state & district teams at state level • Block level trainings at state level completed • Orientation and training sessions for state directorate 	<ul style="list-style-type: none"> • April 08 to March 08 district Level reporting; April 09 onwards block level data reported • Facility reporting irregular since Sept 09 due to 	<ul style="list-style-type: none"> • Hand-holding support required at block level for facility level data entry • Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> • State plans facility level data entry by Dec 09

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		level established <ul style="list-style-type: none"> State HMIS on NE Server established HMIS resource material distributed up to block level HMIS support through NE RRC Team 	team <ul style="list-style-type: none"> 3 joint trainings with all NE states 	firewall problems		
13	Mizoram	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 12 Master trainers identified – 2 member state team and 1 for each district Regular reporting Formats printed & disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established State HMIS server on NE Server established HMIS resource material distributed up to block level HMIS support through NE RRC Team 	Training up to block level <ul style="list-style-type: none"> 3 training sessions completed for state & district teams at state level Block level trainings at state level completed Orientation and training sessions for state directorate team 3 joint trainings with all NE states 	<ul style="list-style-type: none"> April 08 to March 08 district Level reporting April 09 onwards PHC level data reporting Sept 09 onwards sub-centre data reported 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> Strengthening process of data quality and integrity strengthening State and district team together with NHSRC support is self sufficient
14	MP	<ul style="list-style-type: none"> Online state application available with facilities up to Block level State & district teams in place 56 Master trainers identified– 6 member state team (SDO + DP support) and 1 for each district Regular reporting GIS integrated HMIS Fellow in place Formats disseminated up to facility level in Hindi Information of action workshop completed at state level Process of data verification & feedback process at each level established HMIS resource material distributed up to block level 	Training up to block level <ul style="list-style-type: none"> 4 training sessions completed for state & district teams at state level Block level trainings at state level initiating Orientation and training sessions for state directorate team Use of information workshop carried out 	<ul style="list-style-type: none"> April 08 to Oct 08 district Level reporting Nov 08 onwards Block level data reporting Regular reporting 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers Data quality processes need to be strengthened 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 State plans to start name based system from April 10

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
15	Nagaland	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 14 Master trainers identified – 3 member state team and 1 for each district Regular reporting Formats printed & disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established State HMIS on NE Server established HMIS resource material distributed up to block level HMIS support through NHSRC and NE RRC Team 	<p>Training up to block level</p> <ul style="list-style-type: none"> 3 training sessions completed for state & district teams at state level Block level trainings at state level completed Orientation and training sessions for state directorate team 3 joint trainings with all NE states 	<ul style="list-style-type: none"> April 08 to March 09 district Level reporting Facility level data reporting from Dec 09 onwards 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers Infrastructure strengthening crucial 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 District level trainings planned in April 10 Mobile pilot implemented in 1 block Tracking system to be implemented from April 10
16	Orissa	<ul style="list-style-type: none"> Online state application available with facilities up to Block level State & district teams in place 64 Master trainers identified– 4 member state team and 2 for each district Regular reporting HMIS Fellow in place and 2 Interns Formats printed and disseminated up to facility level Information of action workshop completed at state level twice Process of data verification & feedback process at each level established HMIS resource material distributed up to block level 	<p>Training up to block level</p> <ul style="list-style-type: none"> 5 training sessions completed for state & district teams at state level Block level trainings at state level initiating Orientation and training sessions for state directorate team completed Zonal trainings completed 	<ul style="list-style-type: none"> April 08 to Oct 08 district Level reporting Nov 08 onwards Block level data reporting 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 Tracking system implementation from April 10

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
17	Punjab	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 42 Master trainers identified– 2 member state team and 2 for each district HMIS Fellow in place Formats disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established HMIS resource material distributed up to block level 	Training up to block level <ul style="list-style-type: none"> 4 training sessions completed for state & district teams at state level Block/district trainings at state level completed HMIS data being used in CMO review meetings 	<ul style="list-style-type: none"> April 08 to Oct 08 district Level reporting Nov 08 to March 09 Block level data reporting April 09 to June 09 PHC level data entry July 09 onwards facility based data entry 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> State plans to start mobile based facility reporting from Jan 10 Tracking system implementation from April 10 Strengthening processes of analysis and feedback
18	Sikkim	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 6 Master trainers identified – 2 member state team and 1 for each district Regular reporting Formats printed & disseminated up to facility level Process of data verification & feedback process established State HMIS server on NE Server established HMIS resource material distributed HMIS support through NE RRC Team 	Training up to district level <ul style="list-style-type: none"> 2 training sessions completed for state & district teams Orientation and training sessions for state directorate team 3 joint trainings with all NE states 	<ul style="list-style-type: none"> April 08 to March 09 district Level reporting Facility level data reporting from Dec 09 onwards Reporting irregular due to firewall issues 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers Strengthening of infrastructure 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 Tracking system implementation from April 10
19	Tamil Nadu	<ul style="list-style-type: none"> Online state application available with facilities up to block level State & district teams in place 33 Master trainers identified – 4 member state team and 1 for each district Regular reporting by districts 	Training up to block level <ul style="list-style-type: none"> 3 training sessions completed for state & district teams at state level Orientation and training 	<ul style="list-style-type: none"> April 08 onwards district level reporting TCS PHC system being finalized, then will 	<ul style="list-style-type: none"> Training structure adequate Multiplicity of systems require coherent integration strategy 	<ul style="list-style-type: none"> Focus on integration efforts

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		<ul style="list-style-type: none"> Formats printed & disseminated up to facility level System integration carried out Information of action workshop completed at state level Process of data verification & feedback process established HMIS resource material distributed 	sessions for state directorate team	be integrate with district system		
20	Uttarakhand	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place From Blocks, offline entry through installers 47 Master trainers identified– 4 member state team and 42 at district & block level Regular reporting HMIS Fellow in place and one intern Formats disseminated up to facility level Information of action workshop completed at state level Process of data verification & feedback process at each level established HMIS resource material distributed up to block level 	Training up to block level <ul style="list-style-type: none"> 4 training sessions completed for state & district teams at state level Block level trainings at state level completed Block level trainings at district level completed Orientation and training sessions for state directorate team 	<ul style="list-style-type: none"> April 08 to Oct 08 district Level reporting Nov 08 to Oct 09 Block level data reporting Dec 09 facility level data entry Regular reporting 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> Hospital Information Systems pilot Strengthening data analysis and feedback Tracking system to be implemented from April 10
21	West Bengal	<ul style="list-style-type: none"> Online state application available with facilities up to sub-centre level State & district teams in place 22 Master trainers identified– 3 member state team and 1 for each district Regular reporting HMIS Fellow in place till March 31 Formats disseminated up to facility level Format customization carried out Information of action 	Training up to block level <ul style="list-style-type: none"> 2 training sessions completed for state & district teams at state level Block level support ongoing Orientation and training sessions for state directorate 	<ul style="list-style-type: none"> April 08 to March 08 district Level reporting April 09 onwards Block level data reporting From April 10 facility level data entry 	<ul style="list-style-type: none"> Hand-holding support required at block level for facility level data entry Hiring of short term consultants for block level support & facilitate master trainers 	<ul style="list-style-type: none"> State plans facility level data entry by April 10 Tracking system to be implemented from April 10

		HMIS Status	Training Status	Data Reporting	Strengthening Requirements	Future Plans
		workshop completed at state level <ul style="list-style-type: none"> • Process of data verification & feedback process at each level established • HMIS resource material distributed 	team			
2 2	Haryana	<ul style="list-style-type: none"> • State had discontinued DHIS2 but now has restarted since Dec 2010 • HMIS Fellow in place • Formats customized till sub centre level • District wise training carried out in about 10 districts • HMIS resource material distributed 	<ul style="list-style-type: none"> • 2 training sessions completed for state & district teams at state level • Trainings now taking place district wise • Large scale facility wise training also carried out 	<ul style="list-style-type: none"> • District wise data entry from dec • Full state facility wise data entry from April 10 	<ul style="list-style-type: none"> • Strengthening of district teams • Strengthening culture of analysis and use of information 	<ul style="list-style-type: none"> • Tracking system to be implemented from April 10
2 3	Goa	<ul style="list-style-type: none"> • State invited NHSRC to implement DHIS2 from April 10 with tracking system • One day training workshop conducted 	One day training workshop conducted	<ul style="list-style-type: none"> • Processes commencing April 10 	<ul style="list-style-type: none"> • State self sufficient 	<ul style="list-style-type: none"> • Tracking system from April 10 • Facility wise data entry by April 10

Appendix 3: Situation Analysis of HMIS In Tamil Nadu

Mapping between State data element and National MIES data set.

In the national MIES data set there are 204 data elements out of which 127 data elements are routinely collected in current HMIS distributed between From 9 area report (60) and institutional report (67). This constitutes 65.6% of data coverage with respective to national MIES data set. Institutional report comprises of many different systems like ISMR, PHC online system, Monthly Institution Reports, HSC performance Report, PHC Performance Report, etc. 49 data elements can be collected by including these data elements in From 9 Area Report (16) and Institution report (28). With this addition we can get nearly 90% of data coverage. Further 17 data elements need policy intervention as these are the data that need to be collected from private facilities, Medical colleges and other state owned health institutions.

	No of data elements
Total Data Element	204
Collected from Form 9 Area Report	60
Collected from institutions	67
To be included in From 9 Area Report	17
To be collected from Institutions	28
Not collected need policy intervention	16
Not Relevant	5
Semi Annual / Annual	7

Data element collected form Form 9 Area Report	
Sl.No	Data Element
1	Total number of pregnant women Registered for ANC
2	Of which Number registered within first trimester
3	New women registered under JSY
4	Number of pregnant women given TT1
5	Number of pregnant women given TT2 or Booster
6	Total number of pregnant women given 100 IFA tablets
7	Number of Home Deliveries attended By SBA Trained (Doctor/Nurse/ANM)
8	Number of Home Deliveries attended By Non SBA (Trained TBA/Relatives/etc.)
9	Deliveries conducted at Public Institutions Total {(a) to (e)}

10	Number of Caesarean (C-Section) deliveries performed at Public facilities Total {(3.1.1) to (3.1.4)}
11	Live Birth Male
12	Live Birth Female
13	Live Birth Total {(a) + {b}}
14	Still Birth
15	Abortion (spontaneous/induced)
16	Number of Newborns weighed at birth Male
17	Number of Newborns weighed at birth Female
18	Number of Newborns having weight less than 2.5 kg Male
19	Number of Newborns having weight less than 2.5 kg Female
20	Number of cases of pregnant women with Obstetric Complications and attended at Public facilities PHC
21	Number of cases of pregnant women with Obstetric Complications and attended at Public facilities CHC
22	Number of cases of pregnant women with Obstetric Complications and attended at Public facilities Sub-divisional hospital/District Hospital
23	Number of NSV/Conventional Vasectomy conducted At Public facilities Total {(a) to (d)}
24	Number of Laparoscopic sterilizations conducted At Public facilities Total {(a) to (d)}
25	Number of Mini-lap sterilizations conducted At Public facilities Total {(a) to (d)}
26	Number of Post-Partum sterilizations conducted at Public facilities Total {(a) to (d)}
27	Number of IUD Insertions at Public facilities Total {(a) to (e)}
28	BCG
29	DPT1
30	DPT2
31	DPT3
32	OPV0 (Birth Dose)
33	OPV1
34	OPV2
35	OPV3
36	Hep-B1
37	Hep-B2
38	Hep-B3
39	Measles
40	Total number of children aged between 9 and 11 months who have been fully immunized (BCG+DPT123+OPV123+Measles) during the month Male
41	Total number of children aged between 9 and 11 months who have been fully immunized (BCG+DPT123+OPV123+Measles) during the month Female
42	Number of children more than 16 months who received the following DPT Booster
43	Number of children more than 16 months who received the following OPV Booster
44	Children more than 5 years given DT5
45	Children more than 10 years given TT10
46	Children more than 16 years given TT16
47	Adverse Event Following Immunisation (AEFI) Abscess
48	Adverse Event Following Immunisation (AEFI) Death
49	Adverse Event Following Immunisation (AEFI) Others
50	Number of Immunization sessions during the month Sessions planned
51	Number of Immunization sessions during the month Sessions held
52	Childhood Diseases (0-5 years) Diphtheria

53	Childhood Diseases (0-5 years) Pertussis
54	Childhood Diseases (0-5 years) Tetanus Neonatorum
55	Childhood Diseases (0-5 years) Tetanus others
56	Childhood Diseases (0-5 years) Polio
57	Childhood Diseases (0-5 years) Measles
58	Childhood Diseases (0-5 years) Diarrhea and dehydration
59	Childhood Diseases (0-5 years) Nos. admitted with Respiratory Infections

There are some data elements that are only collected from the PHC but not from the other institutions like RTI/STI treated, Lab test etc.

Data Collected from Institutions		
Sl.No	Data Element	Data Collected From
1	Deliveries conducted at Public Institutions SC	HSC Delivery Report
2	Deliveries conducted at Public Institutions PHC	ISMR
3	Deliveries conducted at Public Institutions CHC	ISMR
4	Deliveries conducted at Public Institutions Sub-divisional hospital/District Hospital	ISMR
5	Deliveries conducted at Public Institutions At Other State Owned Public Institutions	ISMR
6	Number of Caesarean (C-Section) deliveries performed at Public facilities CHC	Inst Report
7	Number of Caesarean (C-Section) deliveries performed at Public facilities Sub-divisional hospital/District Hospital	Inst Report
8	Number of MTPs conducted at Public Institutions Up to 12 weeks of pregnancy	MIF
9	Number of MTPs conducted at Public Institutions More than 12 weeks of pregnancy	MIF
10	Number of new RTI/STI for which treatment initiated Male	PHC Performance Report
11	Number of new RTI/STI for which treatment initiated Female	PHC Performance Report
12	Number of NSV/Conventional Vasectomy conducted At Public facilities At PHCs	ISMR
13	Number of NSV/Conventional Vasectomy conducted At Public facilities At CHCs	ISMR
14	Number of NSV/Conventional Vasectomy conducted At Public facilities At Sub-divisional hospitals/ District Hospitals	ISMR
15	Number of NSV/Conventional Vasectomy conducted At Private facilities	MIF
16	Number of Laparoscopic sterilizations conducted At Public facilities At PHCs	ISMR
17	Number of Laparoscopic sterilizations conducted At Public facilities At CHCs	ISMR
18	Number of Laparoscopic sterilizations conducted At Public facilities At Sub-divisional hospitals/ District Hospitals	ISMR
19	Number of Laparoscopic sterilizations conducted At Private facilities	MIF
20	Number of Mini-lap sterilizations conducted At Public facilities At PHCs	ISMR

21	Number of Mini-lap sterilizations conducted At Public facilities At CHCs	ISMR
22	Number of Mini-lap sterilizations conducted At Public facilities At Sub-divisional hospitals/ District Hospitals	ISMR
23	Number of Mini-lap sterilizations conducted At Private facilities	MIF
24	Number of Post-Partum sterilizations conducted at Public facilities At PHCs	ISMR
25	Number of Post-Partum sterilizations conducted at Public facilities At CHCs	ISMR
26	Number of Post-Partum sterilizations conducted at Public facilities At Sub-divisional hospitals/ District Hospitals	ISMR
27	Number of Post-Partum sterilizations conducted at Public facilities Private facilities	MIF
28	Number of IUD Insertions at Public facilities At PHCs	ISMR
29	Number of IUD Insertions at Public facilities At CHCs	ISMR
30	Number of IUD Insertions at Public facilities At Sub-divisional hospitals/ District Hospitals	ISMR
31	Number of IUD Insertions at Private facilities	MIF
32	Number of Oral Pills cycles distributed	MIF
33	Number of Condom pieces distributed	MIF
34	Number of Centchroman (weekly) pills given	MIF
35	Number of Emergency Contraceptive Pills distributed	MIF
36	Number of deaths following sterilization Male	MIF
37	Number of deaths following sterilization Female	MIF
38	Inpatients Admissions Male Children	ISMR
39	Inpatients Admissions Female Children	ISMR
40	Inpatients Admissions Male Adult	ISMR
41	Inpatients Admissions Female Adult	ISMR
42	Inpatients Admissions Total {(a) to (b)}	ISMR
43	Deaths Total {(a) to (b)}	ISMP
44	Operation major (General and spinal anesthesia)	Inst Report
45	Operation minor (No or local anesthesia)	ISMR
46	Hb Tests conducted	ISMR
47	No. of Hb tests conducted	ISMR
48	Of which numbers having Hb < 7 mg	ISMR For ANC
49	HIV tests conducted Male Tested	PHC Online System
50	HIV tests conducted Female-Non ANC Tested	PHC Online System
51	HIV tests conducted Female with ANC Tested	PHC Online System
52	HIV tests conducted Total {(a) to (c)} Tested	PHC Online System
53	HIV tests conducted Male Positive	PHC Online System
54	HIV tests conducted Female-Non ANC Positive	PHC Online System
55	HIV tests conducted Female with ANC Positive	PHC Online System
56	HIV tests conducted Total {(a) to (c)} Positive	PHC Online System
57	Widal tests conducted Tested	ISMR
58	Widal tests conducted Positive	ISMR
59	VDRL tests conducted Male Tested	PHC Online System

60	VDRL tests conducted Female-Non ANC Tested	PHC Online System
61	VDRL tests conducted Female with ANC Tested	PHC Online System
62	VDRL tests conducted Total {(a) to (c)} Tested	PHC Online System
63	VDRL tests conducted Male Positive	PHC Online System
64	VDRL tests conducted Female-Non ANC Positive	PHC Online System
65	VDRL tests conducted Female with ANC Positive	PHC Online System
66	VDRL tests conducted Total {(a) to (c)} Positive	PHC Online System
67	Blood smears examined	ISMR
67	Total Number of times the Ambulance was used for transporting patients during the month	Change the data element to number of patient transfer in a Ambulance

Data Element to be included in Form 9 Area Report	
Sl.No	Data Element
1	Number of pregnant women received 3 check ups
2	Pregnant women with Hypertension (BP>140/90) New cases detected at institution
3	Number having Hb level<11 (tested cases)
4	Number of newborns visited within 24 hours of Home Delivery
5	Number of mothers paid JSY incentive for Home deliveries
6	Of which Number discharged under 48 hours of delivery
7	Number of cases where JSY incentive paid to Mothers
8	Number of Newborns having weight less than 1.8 kg Male
9	Number of Newborns having weight less than 1.8 kg Female
10	Number of Newborns breast fed within 1 hour Male
11	Number of Newborns breast fed within 1 hour Female
12	Women receiving post partum checkup within 48 hours after delivery
13	Women getting a post partum check up between 48 hours and 14 days
14	Number of complications following sterilization Male
15	Number of complications following sterilization Female
16	Number of failures following sterilization Male
17	Number of failures following sterilization Female
18	Total number of children aged between 12 and 23 months who have been fully immunized (BCG+DPT123+OPV123+Measles) during the month Male
19	Total number of children aged between 12 and 23 months who have been fully immunized (BCG+DPT123+OPV123+Measles) during the month Female
20	Childhood Diseases (0-5 years) Malaria
21	Number of Anganwadi centres reported to have conducted VHNDs

There are 28 data elements that need to be collected from Public health institutions, two are from Sub Centre (HSC) and rest to be collected from PHC equivalent and CHC Equivalent (SDH/DH,etc).

Data Elements to be collected from Public Institutions		
Sl.No	Data Elements	To be collected from
1	Pregnant women with Hypertension (BP>140/90) Number of eclampsia cases managed during delivery	Institutional
2	Number having severe anaemia (Hb<7) treated at institution	Institutional
3	Number of Complicated pregnancies treated with IV antibiotics	Institutional
4	Number of Complicated pregnancies treated with IV antihypertensive/Magsulph injection	Institutional
5	Number of Complicated pregnancies treated with IV Oxytocis	Institutional
6	Number of Complicated pregnancies treated with Blood Transfusion	Institutional
7	PNC maternal complications attended	Institutional
8	Number of wet mount tests conducted	Institutional
9	Number of IUD Insertions at Public facilities At Sub-Centres	HSC
10	Number of IUD removals	Institutional
11	Number of patients operated for cataract	Institutional
12	Number of Intraocular Lens(IOL) implantations	Institutional
13	Number of school children detected with Refractive errors	Institutional
14	Number of children provided free glasses	Institutional
15	Number of eyes collected	Institutional
16	Number of eyes utilized	Institutional
17	Number of RKS meetings held during the month	Institutional
18	Deaths Male Children	Institutional
19	Deaths Female Children	Institutional
20	Deaths Male Adult	Institutional
21	Deaths Female Adult	Institutional
22	In-Patient Head Count at midnight	Institutional
23	OPD attendance (All)	HSC
24	Others services AYUSH	Institutional
25	Others services Dental Procedures	Institutional
26	Others services Adolescent counseling services	Institutional
27	Plasmodium Vivax test positive	Institutional
28	Plasmodium Falciparum test positive	Institutional

Semi Annul/Annual data element that can be collected on “On-Change” basis.

Sl.No	Data Elements
1	Instituions having NSV trained doctors
2	Number of CHC/ SDH/ DH functioning as an FRU
3	Number of PHCs functioning 24X7 (3 Staff Nurses)
4	Number of facilities having a Rogi Kalyan Samiti
5	Number of facilities having Ambulance services (Assured Referral Services) available
6	Number of Institutions having operational Sick New Born and Child Care Units
7	Number of functional Laparoscopes in CHC/SDH/DH

There are 16 data element that need policy intervention to collect data from private facilities, Medical colleges and other state owned public institution.

Sl.No	Data Elements not collected from other institutions
1	Number of private inst delivery cases where JSY incentive paid to Mothers
2	Number of Caesarean (C-Section) deliveries performed at Public facilities At Other State Owned Public Institutions
3	Number of Caesarean (C-Section) deliveries performed at Private facilities
4	Number of cases of pregnant women with Obstetric Complications and attended at Public facilities At Other State Owned Public Institutions
5	Number of cases of pregnant women with Obstetric Complications and attended at Private facilities
6	Number of MTPs conducted at Private Facilities
7	Number of NSV/Conventional Vasectomy conducted At Public facilities At Other State Owned Public Institutions
8	Number of Laparoscopic sterilizations conducted At Public facilities At Other State Owned Public Institutions
9	Number of Mini-lap sterilizations conducted At Public facilities At Other State Owned Public Institutions
10	Number of Post-Partum sterilizations conducted at Public facilities At Other State Owned Public Institutions
11	Number of IUD Insertions at Public facilities At Other State Owned Public Institutions
12	Number of children more than 16 months who received the following Measles, Mumps, Rubella (MMR) Vaccine
13	Vitamin A doseAdministered between 9 months and 5 years Dose-1
14	Vitamin A doseAdministered between 9 months and 5 years Dose-5
15	Vitamin A doseAdministered between 9 months and 5 years Dose-9

Data Elements that are not relevant

SI.No	Data Element Not Relavent
1	Number of cases where JSY incentive paid to ASHAs
2	Number of cases where JSY incentive paid to ANM or AWW (only for HPS States)
3	Number of institutional delivery cases where JSY incentive paid to ASHAs
4	Number of institutional delivery cases where JSY incentive paid to ANM or AWW (only for HPS States)
5	Number of sessions where ASHAs were present

Institution wise reporting system

- 1) Institutional Service Monitoring Report (ISMR) of PHC
- 2) PHC Online Reporting System

SI.No	Data Element
1	Number of Medical Officers (Doctors) Sanctioned
2	Number of Medical Officers (Doctors) In Position
3	Number of Staff Nurses Sanctioned
4	Number of Staff Nurses In Position
5	Number of ANM Sanctioned
6	Number of ANM In Position
7	Number of Sanitary Workers Sanctioned
8	Number of Sanitary Workers In Position
9	Number of Ante Natal Clinics Conducted
10	Number of Mothers examined
11	Total Delivery
12	Number of Deliveries conducted by Staff Nurse
13	Number of Still Births
14	Number of X Ray Taken
15	Number of ECG Taken
16	UltraSound Scanner taken – Pregnancy
17	UltraSound Scanner taken – Others
18	Number of MTPs done at PHC
19	Number of MTPs with Sterilisation done
20	Number of MTPs with Temporary methods done
21	Number of Laparoscopy sterilization done at PHC
22	Number of Mini-Lap sterilization done at PHC
23	Number of Vasectomy done at PHC
24	Number of IUD Insertion done at PHC
25	Number of RTI/STI Clinics conducted

26	Number of RTI/STI Clinics attendance
27	VDRL Test +ve Mothers
28	VDRL Test Other

Both the PHC Online system and ISMR are collecting PHC level data but with differences for example the PHC Online system is collecting disaggregated data for example by SC,ST,Other and Shift (1,2,3) wise, which is not been collected by ISMR.

On sample basis, we compared some common data elements from both the systems and found differences. The table below summarizes examples of some of these differences for the month of August 2008.

Sl.No	Data Element	District	Value in ISMR	Value in PHC Online System
1	Doctor Sanction	MADURAI	98	102
2	Doctor InPosition	MADURAI	95	94
3	Doctor Sanction	SALEM	150	151
4	Doctor InPosition	SALEM	147	145
5	Doctor Sanction	Ramanathapuram	49	50
6	Doctor InPosition	Ramanathapuram	42	41
7	ANM Sanction	MADURAI	49	48
8	ANM InPosition	MADURAI	49	48
9	ANM Sanction	SALEM	93	92
10	ANM InPosition	SALEM	91	88
11	ANM Sanction	Ramanathapuram	30	31
12	ANM InPosition	Ramanathapuram	30	31

There are also differences in the reporting units (Number of PHCs) as included in two systems. For example

Sl.No	District Name	Reporting Unit	
		in ISMR	PHC Online System
1	Vellore	35	34
2	Coimbatore	38	36
3	Thanjavur	58	55

Appendix 4: information sheet for respondents

Name

Designation

Number of years in current post:

Facility type and location:

Responsibility towards HMIS:

Trainings attended on HMIS:

Appendix 5: some key definitions

Data element: The basic unit on which data is collected in the HMIS, for example: Number of children given BCG vaccination.

Indicator: Represents a processed form of data element when it is divided by some form of a reference or target population, and multiplied by a factor, for example: % of BCG Coverage: Number of children given BCG vaccination/Estimated number of Live Births (Multiplied) by 100.

Information for action: When information generated from the HMIS is used for supporting action, such as related to monitoring, evaluation, planning, and guiding everyday activities of health staff.

Information use: The practice of using information for action.

Sub centre: The outreach centre in the Indian primary health care system, which is responsible for providing health services to a population of about 5000.

Primary Health Care centre: The lowest point in the Indian primary health care system where there is a medical doctor, which is responsible for providing health services to a population of about 40000.
