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Systems Development in the Health Sector in India

- Implementing a Health Information System in a Local Rural Context

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Cand Scient Thesis

Abstract

This thesis presents a study of systems development within a poor rural area in Andhra Pradesh, India. During my fieldwork I took part in a project called HISP (Health Information System Programme), which aims at supporting local management and health care delivery. The focus has been on the implementation of the district health information system (DHIS), within the health sector. Objectives of HISP are to support development of a sustainable health information system, to enable health workers to use their own information to improve coverage and the quality of health care at the local level.

The introduction of DHIS is complex since it implies a change affecting the whole health sector and the people involved. A context sensitive approach, which take the whole situation into account is emphasised by many authors when developing systems in a "third-world" context.

After being part of the implementation and adaptation phase of DHIS, I performed an analysis of health data collected in the pilot area, in order to look at the potential for the new health information system to ultimately improve health services in the area. Finally, I present suggestions for further expansion of the pilot project based on my findings.

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1 Introduction

This thesis is based on fieldwork performed from January to March 2002 in Kuppam, a small town in a poor rural setting in the state of Andhra Pradesh, India. In this thesis I want to examine what implications the context has on the process when developing a district health information system (DHIS) in rural India. Then I will look at the potential for the new DHIS to make a difference and ultimately improve health care delivery.

Actuality

The history of systems development contains several failure stories, and one reason for this is the use of context insensitive approaches (e.g. Walsham 2001, Braa 1997). This applies especially to systems development in "third-world" contexts, where typically the systems originally have been constructed for the developed countries, within their context of human resources and technical infrastructure, and in order to serve their needs.

When "transferring" systems and approaches to systems development from the "North" to the very different context of the "South", failed projects will very often be the result (Walsham 2001). I will address this general problem of "technology transfer" through the importance given to context in Information Systems (ISs) development by a number of scholars (e.g. Walsham 1993, 2001, Braa *et al.* 1995, Heeks *et al.* 1999). Context is the situation where systems development takes place and can be seen as something which is pre-given but continuously shaped by human agency. There are different kinds of context such as cultural, political, social and economic contexts that influence systems development processes (Sahay 2002).

The introduction of appropriate ISs in developing countries is seen as a way to accelerate the socio-economic development, but getting the process to work is not an easy task. The familiarity with technology is often absent in rural areas and if the IS is developed locally, the task is often performed by experts from the West (Soriyan 2001).

Braa (1997) points out two major differences concerning IT in the third and the first world, apart from the obvious differences in economy, infrastructure and human resources. First, IT more easily adapted in the first world context than in the third world. The economic and social life in the first world is more formalised and structured than what is the case in the third world. Since information technologies are formal systems, there are

many areas it can be applied to. The other difference concerns the impact of use of IT. Introducing IT often requires more significant changes and improvements in third world context than in first world ones. One similarity though, is that established organizations in general are difficult to change due to historical and socio–cultural reasons (Braa 1997).

Motivation

I got familiar with the HISP through some of the professors at the University of Oslo, working within the project. The ones mentioned are much into the project in the sense of interest, ideology and time. To be part of a project developing an IS in a deprived area in India, very much appealed to me.

Also, writing this thesis gave me the opportunity to work with a project in a context that differs extremely from what I live in.

Limitations

I will address and discuss the broader issues of systems development in developing countries through my own experience as a participant in a project developing ISs for primary health care in a rural area in India. I will therefore limit my examples to HISs for primary health care in rural settings. I will not focus on technical issues, but look at the introduction of a HIS in a broader perspective by understanding the role of the broader context on the system development process.

This thesis touches upon a lot of different topics, which I feel is a necessity in order to be able to understand the context. The issues presented were those I identified to influence the systems development process in one way or another. Limitation of the problem area was not an easy task, as there are several constraints interleaved in each other.

1.1 Problem area

Kuppam, with a population of 320 000 people, is a small rural community in the south-west end of the Chittoor district, in the state of Andhra Pradesh. Chittoor, with its population of about 3.75 million, is one of the poorer districts in Andhra Pradesh.

The problem area is the lowest level of the health sector providing primary health care to the peripheral area; the primary health centre, including its sub-centres is the origin of all primary health care data and statistics being generated in the health system. The district has 84 primary health centres, and my focus was on the nine primary health centres in Kuppam.

1.2 Problems addressed

My first objective of this thesis is to study the conditions and constraints when performing systems development at local levels in the health sector in Andhra Pradesh, India. A particular focus is on the importance of the context for systems development.

My first research question is:

- What are the conditions and constraints for systems development at local levels within the health sector in India?

After describing and discussing the results of my field work, a context which is very different from what we are used to in Norway, I will try to address a second question:

- What is the potential for the new HIS to make a difference and ultimately help to improve health care delivery?

1.3 Research approach

In order to be able to explore the problems addressed, I have seen it necessary to use several, quite different research methods.

HISP employ action research in order to involve the wider social system in the design and development of the DHIS. The action research component has involved me being part of the systems development and training processes. I have also given feedback to the health authorities and to the HISP team. Part of this feedback was a qualitative and quantitative analysis of health data collected in the area where the pilot project was initiated.

During the fieldwork I have performed interviews, observations and two surveys in means of an evaluation and a questionnaire.

1.4 Information about chapters ahead

The remainder of this thesis is organized as follows:

Chapter 2 – Information Systems and Systems Development: consists of my theoretical approach, which includes topics that I can use to build my findings in Chapter 7 on together with strategies for systems development.

Chapter 3 – Health Information Systems in Developing Countries: introduces HIS in developing countries, describing the challenges

and opportunities within the domain of IT and health systems in developing countries.

Chapter 4 – Research Approach: presents research approaches generally used in information systems together with my choice and justification of research approach.

Chapter 5 - Health Information Systems Programme: gives a background of HISP.

Chapter 6 – India, Healthcare and Andhra Pradesh: provides an introduction to the broader context within the pilot project is situated.

Chapter 7 – Developing a health information system in a pilot area: contains my empirical work and findings during the field work in Andhra Pradesh, India.

Chapter 8 – Analysis of Health Data from the Pilot Area Using the DHIS: presents an analysis of health data collected from the pilot area, Kuppam. This chapter contains parts from a report written in collaboration with Jørgen Darre, a member of the HISP India team and co-student at the University of Oslo. The analysis highlights and examines health data quality in the pilot area.

Chapter 9 – Discussion: consists of a discussion of my empirical findings.

Chapter 10 – Conclusion: summarizes this thesis. In addition it provides suggestions for further development of the pilot project.

2 Information Systems and Systems Development

This chapter provides theoretical considerations to support my findings in later chapters.

2.1 Implications of context in IS

In order to understand the role of ISs and its development and use, several theoretical approaches can be applied. This section is dedicated to some scholars which findings put particular emphasis on the context. Although my focus is on the third world context, these theories make no distinction to the context of the first or the third world.

> *"The context is the situation within which systems development takes place"*
>
> (Sahay 2002, intro)

Braa & Nermunkh (1997) and Walsham (1993) are amongst those who state the fact that ISs are part of something much bigger than the concept of a computer. The IS is part of the social context, which involves e.g. people, cultures and norms, thus when introducing new technology Braa & Hedberg (2000) points out the importance of focusing on the people involved, and not only the technology.

2.1.1 Information systems as social systems

> *"Information systems (IS) can be defined as systems of human and technical components that accept, store, process, output and transmit information. They may be based on any combination of human endeavours, paper-based methods and IT."*
>
> (Heeks 1998, p.5)

Kling & Scacchi (1982) present a theoretical framework, web models, for understanding the connection of large ISs and its social and political context. ISs are regarded as complex social objects as embedded in a social context. This view, they argue, is in contrast to the traditional discrete-entity perspective on organisations and ISs, which focus on technological features. Discrete-entity models do not pay attention to the social context of

computing development, and by this they gain simplicity. Web models define the social context around the computer system by including the *social relations* between the involved actors, the *infrastructure* available for its support and the organizations previous *history* concerning computer-based technology.

Building on the web models, Walsham *et al.* (1990) state that large ISs are best understood as social systems and can be viewed as a web of social and technical elements. The IS is part of the social context, which consist of complex social actions. Different ISs will typically interact more or less loosely within what Hanseth (2000) terms an Information Infrastructure. The development of an IS will therefore typically involve some sort of inter-connectivity with other systems through shared standards of data and reporting. Consequently, development of such systems will normally involve "negotiation" with many other systems (Hanseth 2000), which again can be problematic due to e.g. different organisations, people, groups and standards.

Braa & Sørensen (1998) look at systems as heterogeneous networks where people and technologies are connected and '*everything is connected to everything'*. An IS interlinks multiple elements, such as people, routines and forms. One of the first tasks to perform when developing an IS is to study the existing systems and the interconnections.

Various authors, for example Hull (1994), Braa *et al.* (1995), Heeks *et al.* (1999), have pointed out the importance of systems development being culturally appropriate, and that solutions cannot be transplanted. A common problem is that expatriates do not understand the problem before they implement their solutions. It is although important that any changes do not interfere with something that is functioning well (Hull 1994). The more you change, the greater is the risk of failure (Heeks *et al.* 1999).

2.1.2 Organisational change and systems development

The design of the new system should not entail a radical change in the way people perform their jobs. Analysis has shown that the closer the design of the IS is to the current work practices, the higher the likelihood is that the users will accept the system (Silva 2001). Dahlbom & Mathiassen (1995) on the other hand, argue that:

> *"The very idea of systems development is to change organizations."*
>
> (ibid., p.270)

Introducing computers implies changes to the organization. The problems are rarely solved, but the situation is different. Changing a social organization is hard, especially to the better. Systems development is a

creative process and it needs entrepreneurs that can cope with the changes involved and suggest novel solutions (Dahlbom & Mathiassen 1995).

Dodd & Fortune (1995) also state that the greater change the health care IS represents, the larger is the risk of failure. On the other hand, if less change increases the possibility for system success, it might also reduce the organisational benefits of the system (Heeks *et al.* 1999).

Pettigrew (1987) identifies vertical and horizontal levels and the interconnections between those levels through time in a contextualist analysis. Walsham (1993) uses this approach to understand organizational change, because of its focus on multi-level contexts, process and the link between process and context.

Due to the politics inscribed in the existing health information in South Africa, *"the process to change the system has been complicated and intimately linked to the wider political, social and health sector changes in South Africa."* (Braa & Hedberg 2000). Social systems are resistant to change, and to cope with understanding these kinds of ISs, *"the larger social system needs to become part of the study"* (Braa & Nermunkh 1997).

2.1.3 Information infrastructure

Hanseth (2000) defines information infrastructure as a complex web of ISs, including human, social and technical components, that grow over time and that are intertwined. Infrastructures have three types of aspects; they are *enabling* in the sense that they are supporting a wide range of activities, and it is *shared* by a larger community or group. Finally, infrastructures have *openness;* there are no limits to number of possible actors involved, being human or technical.

Infrastructures are never developed from scratch; they are always based on a previous infrastructure, known as the *installed base*. Over time, as infrastructures have to adapt to new requirements, a new and larger installed base is slowly created and thus reinforcing itself. However, the infrastructure must be based on concepts of the "old" installed base, thus it is difficult to implement substantial changes, which implies that changes need to be incremental and piecemeal (Hanseth 2000).

Braa & Nermunkh (1997) combine Walsham's view of ISs being social systems (ref. section 2.1.1) while at the same time being information infrastructures, and state that the *installed base* is made up of a web of social systems.

2.1.4 Structuration theory

As a consequence of all the difficulties system development has encountered, the tendency now is that system development starts to draw

upon other fields like anthropology, social theory, sociology of knowledge and philosophy (Sahay 2002). One sociologist whose theory has become one of the main strands of "qualitative", interpretivist mode of research in the IS community, is Anthony Gidden's structuration theory (Livari 1998). The structuration theory is not a methodology for systems development, but the theory can provide a fundamental understanding of organizational context, which might be useful in order to perform successful systems development.

One of the means of the theory was to resolve a debate between two social theories, one focusing on human agents and human actions, and the other focusing on the structure of social systems. These two directions can be thought of as context and process, respectively. Giddens' way to resolve this debate is to look at agents and structures represented as a duality, which is something that influence and draw upon each other (Walsham 1993). As Giddens puts it:

> *'By the **duality of structure** I mean that social structures are both constituted by human agency, and yet at the same time are the very **medium** of this constitution'*
>
> (Giddens 1976, p.121)

Structure is shaped by human interactions. Hence, social structures are produced and reproduced (Walsham 1993).

> *'A structure can be described 'out of time', but its 'functioning' cannot.*'
>
> (Giddens 1976, p.119)

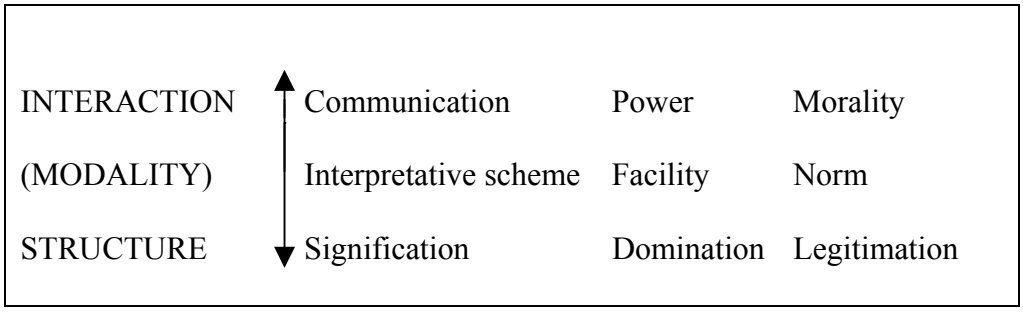

Figure 1: Duality of structure in social interaction (Giddens 1976, p.122)

The theory is illustrated in Figure 1. Social structures and human interaction are divided into three dimensions and interlinked by three modalities, which refer to the mediation of interaction and structure in processes of social reproduction. The three dimensions are very closely interlinked and exist as a whole, but are divided in the diagram for analytical reasons to show how one interpret the connections between human interaction and structures. While the first line holds issues related to interaction, the third line is

indications of structures (Giddens 1976). These schemes can be described as stocks of knowledge that actors draw upon to understand their own and others' actions. With this they produce structures of signification, which mean they produce and reproduce structures of meaning. Communication involves the use of interpretative schemes. Power is utilized in interaction when actors are drawing upon facilities and resources. This creates, reinforces and changes structures of domination. Human actors sanction their actions, which mean that they draw on norms or standards of morality. In that way structures of legitimation are maintained or modified (Walsham 1993).

As we see in Figure 1, social action can reproduce existing social structures and at the same time also produce new structures.

Structuration theory and information systems

Walsham (1993) and Orlikowski (1992) draw upon structuration theory to understand the role of technology in organizations. Walsham presents a practical framework for analysis in "Organizational change: Context and process" (Walsham 1993). The framework is concerned with the process of change and its links with intraorganizational and broader context. He claims that ISs are deeply involved in the modalities that link social process and social context together.

Walsham (1993) has developed a framework for understanding organisational change, including four main components:

- The *content* can involve changes to products, processes and systems, such as technology.
- Web models are used to identify the *social context* (section 2.1).
- A cultural and political view on the organizational change is considered to help understand the *social process.*
- The structuration theory applied as a linkage between social context and social process.

Social context and social process are linked by modalities in which the ISs are involved:

> *"Computer-based IS embody interpretative schemes, provide co-ordination and control facilities, and encapsulate norms. They are drawn on in the social processes which take place in organizations, and in doing social structures are reinforced or changed."*
>
> Walsham (1993, p. 162)

Orlikowski (1992) builds on Giddens' structuration theory to examine the effect of information technology in organizations. She presents a model including human agents, technology and institutional properties, where structuration is understood as a dynamic process that is embedded historically and contextually in the organisation. The relationships in the model are considered stable, but their range, content and relative power will vary and change over time.

2.2 Systems development and strategy

There are several different strategies and developing models to choose from on how to go about to develop and implement a new IS. This section starts with presenting some strategies for use, before a number of frameworks are outlined.

2.2.1 Strategies for development

Cultivation, participatory design and prototyping are all commonly used strategies when performing systems development in context sensitive fields. The Scandinavian approach is known for involving the users in the development process, where participatory design and prototyping are the main ingredients.

Cultivation

Braa (1997) uses the notion *cultivation* as an important framework when performing systems development in a multileveled and sensitive context. Cultivation aims at taking the local resources into use, and the IS is viewed as a social system (ref. section 2.1.1). Commitment and ownership at local level is vital in order to make a sustainable IS. One strategy for creating such an ownership is to use a participatory process, based on a slow bottom-up approach.

Dahlbom & Janlert (1996) refer to cultivation as an approach of building on what already exist in the process of change. Instead of designing a product, you are cultivating a process (Dahlbom & Mathiassen 1995).

Participatory design

> *"In terms of the actual work the system is intended to support, the users are the experts".*
>
> (Braa, K. 1995)

Participatory design underlines the importance of the user and the improvement in their work lives. The users, or user groups, are given equal opportunity to determine system requirements and in approving system

design. It is quite common that the system developers work as advisers for the users (Hoffer *et al.* 1999).

There are usually given three motives for user participation (e.g. Bjørn-Andersen & Hedberg 1977):

- To improve the knowledge upon which systems are built.
- To enable people to develop realistic expectations, and reduce resistance to change.
- To increase workplace democracy by giving the members of an organization the right to participate in decisions that is likely to affect their work.

The idea of the first two motives is that the system will fit the work with help of users' knowledge. The third motive is concerned with cultural and political issues. Bjerknes & Bratteteig (1995) emphasize the importance of taking other strategies that aim at relevant areas of influence into account when using user participation techniques. As an example, global strategies should provide a framework for local action, and local strategies should include several interest groups, not only one (ibid.).

Heeks *et al.* (1999) argue that participative approaches in developing health care ISs, is a fundamental reason for reducing reality gaps, i.e. the gap between the system designed and the reality.

The idea of having several people or groups working together based on an equivalent collaboration, may be difficult in some contexts.

Prototyping

Prototyping is an activity and a method within evolutionary system development, which is utilized when there is uncertainty concerning what technology to use and what the customer's requirements are (Mathiassen et al. 2000). Sommerville (2000) describes a prototype as an initial version of a software system that is used to demonstrate concepts and try out design options.

Prototyping implies producing early versions of future applications, services and solutions, and in that way create a basis for discussions among groups involved in the development process. The prototype thus gives the users an early feeling about the future system, and misunderstandings can be solved at an early point in the process (Buddhe 1992).

Formal and well-established user groups turned out to be a problem when developing a HIS in South Africa. Because of the political and administrative structure, the methodology was based on improvisation; a

more informal approach was adopted, where the users had full access to the development team (Braa & Hedberg 2000).

The Scandinavian approach

The Scandinavian approach builds on a democratic work life, and is known for its strong focus on participatory design, e.g. to create local ownership. Because of its politically significant, interdisciplinary, and action-oriented research on resources and control in the processes of use and design, it often labelled as the Scandinavian approach. Ehn (1993) calls this approach a work-oriented approach, and uses the UTOPIA project as an example. The UTOPIA project emphasized mutual learning, understanding and communication during the design process, observations and other prototyping design artefacts (ibid.). Lyytinen *et al.* (1998) characterise the Scandinavian approach as a "grass root" approach because it tend to focus on small scale development of individual application systems, instead of the total IS.

Although the Scandinavian context is quite different from the ones presented in the third world, it can provide useful means to the development process.

2.2.2 Development models

There are different models to software development, and this section outlines some of them. These are quite different frameworks, and usually more than one approach is used in systems development projects.

The waterfall model

The waterfall model describes a development method that is linear and sequential. It is a stepwise process, and once a phase of development is completed, the development proceeds to the next phase. The requirements are detailed and complete, and every phase results in a document. The process is divided into separate phases, which begins with a definition of the requirements and ends in operation and maintenance. Possible risks are pushed forward in the phase. The waterfall model is suitable when the requirements are clear and user participation is minimal (Sommerville 2000).

Evolutionary model

As a reaction to the problems associated with the waterfall model, the evolutionary model was developed. The basic idea of evolutionary development is to develop an initial implementation, and based on feedback from the users, the system is improved until a satisfactory version is in place. The specification and development process consists of cyclical stages in order to understand the requirements. The evolutionary model is suitable

for the development of small systems where the complexity is low and the uncertainty is high (Sommerville 2000).

Spiral model

Few projects make use of only one development model. Several models are often used in one project, something Sommerville (2000) refers to as hybrid development. One of the hybrid models is the spiral model. The process is represented as a spiral, where each cycle symbolizes a phase of the software process:

1. Objective setting: Specific goal for this phase is defined.

2. Risk assessment and reduction: The key risk is identified and analyzed.

3. Development and validation: A suitable model is chosen based on the risk evaluation.

4. Planning: The project is evaluated and plans are made if it is necessary to continue the process.

The spiral model is iterative the four phases are repeated until the user are satisfied with the system. The major focus on risk handling is an important difference between the spiral model and other software process models (Sommerville 2000).

Incremental development

Incremental development combines the advantages of the waterfall model and the evolutionary model. Mills *et al.* (1980) proposed the incremental approach with the aim of reducing rework in the development process, while being able to delay requirements until customers had some experience with the system. Different processes can be applied in each increment, and the most important services are completed first and put into use. Incremental development has several advantages:

- Users gain value from the first increment.

- The first increment results in a prototype, which makes it easier to define further requirements.

- The risk of overall project failure is reduced. Since there are several increments, problems are solved as they are discovered.

- As the most important requirements are delivered in the first increments and later increments are integrated with them, the most important system services receive the most testing.

The limitations of incremental development are that increments should be rather small and each increment needs to deliver some system functionality (Sommerville 2000).

2.3 Summary

I have in this chapter described several theoretical considerations relevant for my research. These represent quite different approaches, and although one cannot relate to the entire view, parts of them can be useful in most areas. In order to understand large ISs, several scholars have developed frameworks that take the larger context into account. Walsham *et al.* (1990) build on Kling & Scacchis (1982) web models, and argue that large IS are best understood as social systems.

Social systems are resistant to change, and to understand how the process of change is linked with the broader context, Walsham (1993) draws upon Giddens' structuration theory. Giddens' theory has been used by several IS scholars and is concerned with how human actions are produced and reproduced through social structures.

When developing systems in a context sensitive field, the content of the context must be taken into account, which includes the existing web of ISs, and the installed base (Hanseth 2000). Taking the overall complexity into account, we see that changes must be incremental and piecemeal. During the design process, several approaches stress the need for user participation, as the users are the experts.

3 Health Information Systems in Developing Countries

This chapter introduces HIS in developing countries, describing the challenges and opportunities within the domain of IT and health systems in developing countries.

Software packages for health centres in developing countries cannot be bought off the shelf, and using a foreign application is impossible without major adjustments. The requirements are miles apart, consequently ISs Development (ISD) methods and education must be adjusted to fit the socio-economic, organizational and technological context in question. Primary healthcare is one of the most problematic areas, and although a foreign package can be used as a starting point for adaptation (Heeks 1999), the appropriate software packages and IS must be adapted locally (Soriyan 2001).

3.1 Globalization and marginalization

Not all groups benefit from the IT revolution, and this is especially the case in India where 70% of the population live in rural areas.

During the 1990s, the term 'globalization' has become a widespread phenomena. Globalization exists in all kinds of processes that contribute in making distance irrelevant, both in time and space. During the recent years, globalization has been referred to in different fields, like economic or cultural aspects of globalization, human rights or globalization and IT (Eriksen 2000).

Globalization is not necessarily a positive matter for all involved, as it often stands out as flowing from rich to poor developing country. Globalization usually goes together with marginalization, and as a result of this one-way flow, the processes of marginalization are often not considered.

> "*Globalization is treated as a process that is "out-there" rather than "in-here", and this tends to ignore what it means for individuals to live in a global world."*
>
> (Sahay 2000, p.4)

Castells (1996) argues that many regions and sectors have been excluded from the globalization in the past because of historical and geographical reasons. The inability of these areas to access new ICTs, with its knowledge and expertise, raises the odds for being systematically excluded in the future.

Orlikowski & Iacono (2001) points out the importance of taking the essentially heterogeneous character of networks including people, legislation, organizational routines *and* artefacts. Braa *et al.* (2002a) use the metaphor *"networks of action" that are being shaped within the context of "counter networks",* what Castells (1996) labels "counter-networks" *and "networks of networks"* referring to the issue of heterogeneity. Networks of action refer to the nature of organizing efforts that are required at any given level of the system. Counter networks highlight the challenging conditions that characterise the development of both ISs and health systems in developing countries, which possesses marginalized and "un-networked" conditions.

Technology transfer vs. technology learning

A major problem related to technology transfer from the Western world to developing countries has several times turned out to be caused by the cultural differences. The computer systems have been developed for and within a Western context, without considering the context of the computer systems usage (Heeks et al. 1999, Walsham 2002, Kaasbøll & Nhampossa 2002, Braa 1997).

Heeks et al. (1999) state that one of the reasons why health care ISs fail is the reality gap between the system design and the reality. A typical explanation is when health care ISs derived from one country are transferred to another country, especially from an industrial to a developing country. Transfer of information technology from the west, which fit western conditions and belief, may not be compatible with the new cultural environment the south presents (Walsham 2001). Walsham reminds us of the importance of sensitivity to cultural differences when working in a cross-cultural context, and points out understanding and empathy for norms and values of others as key issues.

While several research projects have concentrated on the north-south transfer, Kaasbøll & Nhampossa (2002) have studied a case of south-south transfer. A HIS had been transferred from one country in Africa to a neighbouring country, and despite several similarities, like required functionality, infrastructure, and domain of the IS, problems arose. The installation and adaptation required a great amount of effort of computer professionals, which is a scarce and costly resource not only in developing countries.

According to Braa *et al.* (1995) the concept of technological "transfer" assumes that a piece of technology may be regarded as an isolated machinery. They stress that technology has to be learnt and mastered rather than transferred. Traditionally, learning about IT in the North has been performed in sectors sheltered from international competition, and Braa *et al.* (1995) suggest the same with regard to learning in developing countries. When transferring technology, ensuring technological learning is crucial. The context-sensitivity of technology is not an exception, but more of a rule.

3.2 Challenges for health systems in developing countries

The health facility is the entry point for all data, and the quality of data at this level can be crucial for all information at all levels. Data gathering has low priority, is unreliable and routinely performed. It strongly affects the information circulation in the health system. Many think that it is costly to collect good data, but the expenses only moves upward if good data collection is not prioritized. I will focus on ISs for primary health care, which is the area I have been engaged in and where HISP is working.

International organizations and countries often provide financial support to adopt data collection systems. Independent ISs are thus developed for different health activity or program, and this leads to a lack in coordination, both with national HISs and between the different systems (Ibrahim 1987). Braa *et al.* (2002a) use examples of pilot projects initiated through donor funding to address scale and sustainability as inter-connected problems, crucial both for practice and research. The limited scale projects do often not produce anything useful for managers, who will typically need full data coverage from their area of responsibility, and not only for a limited area. Limited scale projects will thus often not involve the overall complexity and main problems of the area in consideration. As a result, when there is no real output produced and the financial support ends, efforts remain largely unsustainable (Braa et al. 2002a).

Different health programs have different organizations, budgets etc., which results in "vertical" provision of health services. When a mother needs to walk several miles one day for antenatal care and the next day come back with her child for immunization, rather than to receive both services the same day, it is clear that the health care does not serve its population in the best possible way. There has not been given sufficient concern to create functional units in which health services are integrated and at the same time coordinated with the activities of other sectors (Tarimo & Fowkes 1989). Braa, Heywood & Shung King (1997) found in their work of establishing a district-based health and management IS in two towns in South Africa, that data was not available at one central place in the district. The reason for this was the fragmented nature of the services delivery. Fragmentation means

that many services are located in the same geographical area, but do not share information (Heywood 1994).

Another problem with international agencies and donor agencies has been the unrealistic expectations in presenting improvements in health within a short time after initiating projects. This results in short cuts in implementing the programs and minimum attention to local cultural factors (Tarimo & Fowkes 1989).

Those who want to use the information can seldom specify exactly what it is they want, so helping administrators to identify their needs is a major challenge for professionals who work with HISs (Abrantes 1987).

Having stated the importance of participation in systems development in section 2.2.1, it is of interest to note that WHO is emphasising participation in developing primary health care services; The International Conference on Primary Health Care need stated in 1978 the Alma-Ata declaration after expressing the need for urgent action by all governments, all health and development workers, and the world community to protect and promote the health of all the people of the world. No. 5 VII, state that Primary health care:

> *"requires and promotes maximum community and individual self- reliance and participation in the planning, organization, operation and control of primary health care, making fullest use of local, national and other available resources; and to this end develops through appropriate education the ability of communities to participate;"*
>
> (Alma-Ata 1978)

3.3 Health information systems

This section will concentrate on the type of ISs I have been involved in during the fieldwork in India. Although issues presented most likely regard other kind of IS, I have focused on the use within the primary health care context.

Boerma (1991, p.126) defines a HIS *"..as a combination of people, equipment and procedures organized to provide health information to health workers (and others) in a way that enables them to make informed decisions."*

The main purpose of any HIS is the well being of the population it serves (Opit 1987), though this is unfortunately often not the case. Data collection and data processing are a major part of health workers job, but HIS are widely considered low priority in developing countries (Ibrahim 1987, Hull 1994).

Bentley states that health workers in most countries are overwhelmed with forms that they are expected to fill in even though their purpose may be far from clear. The workers are allocated little time to collect, collate and analyze data and interpret them for improving health service to the local communities (Bentley 1987).

Braa & Hedberg (2000) found that the health sector in South Africa had no comprehensive national standards. Each program and province had their own standards, which were not integrated. These local health units are part of a larger health system, thus they need to interact through standards of data.

3.3.1 Action led vs. data led HIS

Approaches to reform HISs can be divided into 'data-led' and 'action-led'. Data led means that all data is useful in itself, even data that concerns problems that cannot be dealt with, or are not used at all (Sandiford et al. 1992). Data is collected because of requests from higher levels (Heywood 1994). Hence a data led approach is designed for 'others' and supports bureaucrats and control, by among others, keeping information at the top. According to Heywood *et al.* (1994) it has a tendency of wasting time and resources, and a typical way of improving an IS is by expanding the data set, redesigning the forms and revising the data collection procedures.

In an action led approach on the other hand, one only collects the data that is needed for appropriate management and appropriate decisionmaking (Sandiford et al. 1992). This approach contributes to improved health in the way that it supports improvement in management by middle level workers (Heywood *et al.* 1994).

> *"Action-led health information systems can be developed only after carefully considering the areas where decisions can be taken which potentially affect the equity, efficiency or effectiveness of the health system. This requires a clear understanding of how human and material resources are translated into health generating activities, and of the ways that decisions are made which influence this process. "*
>
> (Sandiford *et al.* 1992, p.1084)

In contrast to data led, an action led approach collects minimal data and is locally relevant. It encourages sharing of information, which subsequently results in improvement of data collection, increased decentralization and sharing of responsibility, resources and power. The only way efficiency, coverage and quality of health services will improve are by decentralizing the authority and knowledge by empowering middle level workers. While a data led approach maintains the status quo, the action led approach focuses on change and encourages sharing of information (Heywood *et al.* 1994). Sandiford *et al.* (1992) conclude by saying that for HIS to gain value of the information collected, an action-led approach, which values relevance in

information, is required. According to Braa *et al.* (1997b) primary health care management need an action-led approach in order to use the information to influence action.

3.3.2 Common problems with HIS

The primary health centres are at the most peripheral level of the health system, and where the data is collected before aggregated and reported upwards. A computer is only a tool used for processing of information, and

> *"Under no circumstances can a computer improve the output of a health information system or a monitoring and evaluation system if the initial data collection is poor. If garbage is entered, then garbage will come out, even though the format may be changed and the presentation looks good."*
>
> (Boerma 1991, p.148)

This section presents common challenges HIS are faced with.

Top down or bottom up

According to Sabbatini (1987), the authorities in a country that builds up a hierarchical primary health care system, impose a rigid, top-down controlling system because they want to optimize the allocation of resources, adjust them to demand, budget adequately, and so on. Another problem with top-down approaches is when governments wish to disguise uncomfortable facts and thus manipulate health statistics (Sabbatini 1987). Unreliable data may result from incompetence and inefficiency in highly centralized systems. A delegation of decision-making and the local management of health care data are effective ways to avoid misinformation.

According to Bentley (1987), the information-gathering system is designed at the highest level of bureaucracy by people who often have little or no understanding of the work, responsibilities and limitations of peripheral health staff. The users are usually quite remote from those who carry out the analysis and design of the system, both physically and functionally (Opit 1987).

> *"The planners expect to be obeyed rather than understood and no one appears interested in the problems faced by primary care workers who are rarely visited or supervised; their reports are rarely commented on and they have to guess at what will satisfy the form-users*."
>
> (Bentley 1987, p. 423)

A bottom-up approach is the sensible way in order to examine why information is required and its use (Opit 1987).

Lack of decentralisation

Decentralisation means a change of the existing power relations, and the power and responsibility for decision-making needs to be located at local level (Sandiford 1992).

> *"Decentralisation is a process of devolution of power from the former top-down authoritarian system to a bottom-up approach."*
>
> (DHIS 2002)

Excessive centralisation is often a hindrance for managers to supervise efficiency of health services. Decentralisation should be planned and carried out within the local context to avoid chaos in the system. Often existing systems and national standards are not taken into consideration (Sandiford 1992). Braa (1997) found after working with two cases of health sector reform, that the obstacle to change towards a decentralised HIS was the vertical, fragmented and centralised structures.

Decentralisation violates the existing power structures, and transferring decision power to the local level, *delegation*, means reduced power on the higher levels (DHIS 2002). Using Giddens' structuration theory (sub-section 2.1.4) and Walsham's view of IS as social systems (section 2.1), can help to understand why it is so difficult to change organisations. These aspects will be discussed in Chapter 9.

Poor quality of data

Too much data is collected, but the quantity of useful information produced from it is minimal, thus it is not related to relevant problems (Braa *et al.* 1997b, Sandiford *et al.* 1992). Guidelines for collection, analysis and self-assessment of data are absent (Heywood *et al.* 1994). The forms and records used during collection are often confusing in terminology and not user friendly. There are too many forms to fill in, and often they contain the same data elements. Forms might even be redundant, and there seem to be a resistance to introducing new forms and to scrapping old ones. Different structures and health programmes results in different, but partly overlapping forms. Data have poor quality and are duplicated, but still it has gaps. Overall the data collection is very time consuming but produces minimal results (Heywood *et al.* 1994).

Braa *et al.* (1997b) state that information is not compiled or analyzed locally, but reported in raw form. There are no local indicators of progress towards targets, or local use of data at all. If indicators and targets are set, it is often by people 'on top' which often have no idea (Opit 1987). Feedback

are usually non-existent or very weak, and if there is any it is often inappropriate and too late (Braa *et al.* 1997b).

There are also problems with HIS concerning human resources. Supervisors and mid level managers are not adequately trained in collating and analyzing data and may not be able to provide the support and stimulation needed. This results in that the information collected is of little value to decision-makers at individual or community level (Opit 1987, Heywood *et al.* 1994). By educating health workers it is clear that HIS can be strengthened. Health workers are taught record keeping and statistics, but reasons why they collect information and how it can be used are often not discussed (Hull 1994).

Aggregation of data

A common problem with HIS is that the data is too aggregated; subsequently health staff can not see how their district performs and compare their data with others. An essential part of the design of data feedback is therefore to customise the aggregation of the data to client needs. Different users need different outputs (Sauerborn 2000).

Opit (1987) argue that aggregating or averaging data over large groups destroys information and can help to disguise failures or inadequacies in health care systems. If a country has an average infant mortality rate of 25 per 1000 live births, there might be areas where the rate is much higher. Through delaying methods and the control of the process of aggregation, this information is relatively easy to hide in top-down systems. It is a known fact that data at the local level is occasionally manipulated to show that they meet their targets, even if this not actually is the case. Even governments manipulate or prevent the publication of health data that may reflect badly on them (ibid.).

Limited usage of data

Health care ISs are meant to support the population they serve, but this is often not the case. Instead they serve as ways of maintaining bureaucratic or organizational power (Opit 1987). Information is highly valued, and information use symbolises a commitment to rational choice (Feldman & March 1981). Most ISs collect information that is, or will, never be used for any purpose. The situation can be presented as what is known as 'Finagle's law' (Opit 1987, p. 410):

"Finagle's Law"

The information you ***have*** is ***not what you want;***
The information you ***want*** is ***not what you need;***
The information you ***need*** is ***not what you can get;***

The information you ***can get*** costs ***more than you want to pay!***

Information is hard to define, but it is something that provides knowledge. Data are a formalized representation of information, which make it possible to process that information. Though the difficult part of systems development are to make knowledge explicit and turn information into data (Dahlbom & Mathiassen 1995).

"If the computer is the solution, then information is the problem."

(ibid., intro)

Organizations use a lot of resources, both time and money, on information (Dahlbom & Mathiassen 1995). A common problem is that large amounts of data is being collected and reported from the local levels of the health services, without being used or passed on to anybody that might use it. Old data collection forms continued to be used despite having been scrapped; the same data is collected several times by different authorities, and so forth. There are often no systematic relations between the time of receiving the information and the time of making a decision, the collected information may even be forgotten (Feldman & March 1981, Dahlbom & Mathiassen 1995, Opit 1987, Heywood 1994). Case studies have shown that there were no obvious consistent relation between the identification of available information and the decisions actually made. Information was collected, requested and considered, but the link between decisions and information was week (Feldman & March 1981). In many cases the information is gathered even after the decision has been made (Dahlbom & Mathiassen 1995).

Most organizations and individuals often collect more information than they use or can reasonably expect to use in the making of decisions. At the same time, they appear to be constantly needing or requesting more information, or complaining about inadequacies in information. Reasons for this might be 1) that organizations may be unable, because of organizational or human limitations, to process the information they have, or 2) that the information available to organizations is systematically the wrong kind of information (Feldman & March 1981). If organizations use information in an irrational manner, they will also be irrational in their use of computer technology. A good IS captures the multiple roles played by information in organizations (Dahlbom & Mathiassen 1995).

A major problem facing system development in the context described here is that not only is the aim to develop a sound IS with good routines for information handling and management, also the way information is used in the organisation is being addressed. This will involve organisational change

down to the local health managers and workers, which again emphasise the importance of context in systems development.

Lack of standards

Different levels in the health sector have different needs for data. The lower levels in the health sector, like primary health care, need more detailed data in order to perform their daily community work. The higher levels, on the other hand, need data in order to support their coordination and overall management. There is clearly a need for balancing national need for standards and innovation and local need for flexibility. Each level may define their local data set and interact and communicate with the entire system through the standards of the level above. Braa & Hedberg (2000) describe this system of health and management data standards as a hierarchy of (local) universalities, where the different levels are universalities (Figure 2). Developing a hierarchy of standards, enable the different levels to pursue their own information needs and data sets within an overall framework (i.e. hierarchy) of standard. Such a framework helped settling disagreements about what should be the shared standards between the different provinces during the standardisation process in South Africa (ibid.). Within this framework, each level of the hierarchy is "allowed" to define their own extended datasets as long as they adhere to the (essential) standards of the level above.

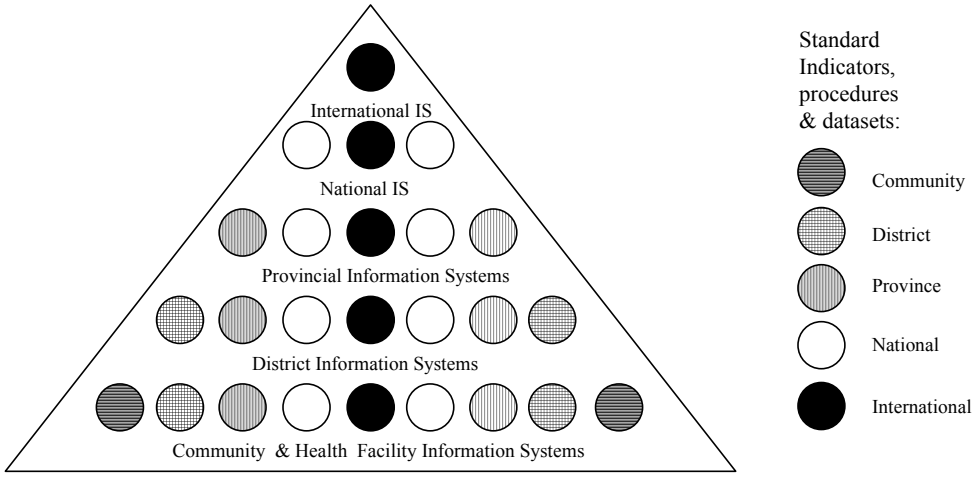

Figure 2: The information pyramid

Minimum data set

One of the principles underlying a good HIS, is to have focus on the relevant data (Boerma 1991, Braa 1997 and Heywood *et al*.1994). Only the minimum required data that can be analyzed and used to monitor progress towards targets should be collected. A minimal essential data set should be

established for each level, defining exactly what data should be collected and by whom. Information that is not necessary to know in order to monitor and evaluate local primary health care programs should be left out of the purpose of not distracting health workers from their essential work (Heywood *et al.* 1994).

3.3.3 Analyzing data

The objectives and targets at health centres are not clear, and HIS are not based on goals, targets and indicators.

> "*Goals or objectives play an essential part in the formulation of rationales for implementing health policies, programmes and services. Indicators are the basic tools for monitoring progress towards these goals. They reflect the current understanding of achievements and the future directions programmes should take. Monitoring progress is essentially a process of comparison of indicators, over time and across populations.*"
>
> (WHO)

The use of indicators is an approach used to convert raw data into useful information and to enable comparison between different facilities. Data is turned into information in form of indicators, which relate the data to e.g. target population groups (e.g. children for immunisation), or other collected data items. Only when this analysis has been made, can data from different sized units be meaningfully compared. Indicators are calculated to communicate how numbers compare based on i.e. the same size of population or staff or population. One calculates numbers e.g. of patients served per *1000 population* or *per type of client.* These indicators can be compared across any different facility size or population. An indicator is made up of a numerator and a denominator,

$$\text{Indicator} = \frac{\text{Numerator}}{\text{Denominator}}$$

and should be easily accessible and available for calculation for all health workers. Making all health workers, and not just the managers, able to perform calculation of routine indicators, is important. In that way the essential activity and knowledge is not in the hands of a few selected people, but rather distributed among several (Heywood 1994).

3.4 Summary

This chapter has outlined common challenges and problems for HISs. Although the focus has been on developing countries, several of the issues yield implications for rich countries as well. There are several obstacles for health systems development in poor countries, such as politics, poor

infrastructure and lack of human and financial resources. There quality of data is poor, and use of data is limited, especially in the local levels. Health services and systems are typically not integrated and there is a lack of standards. The highly bureaucratic structures and centralisation of decision-making processes are main problems, as it excludes the health workers at the "bottom" who are the ones that most actively and continuously interact with the community.

4 Research Approach

During the study that resulted in this thesis, I have seen it necessary to use several, quite different research methods. This chapter presents research approaches generally used in ISs together with my choice and justification of research approach.

4.1 Research methods

This section starts with an introduction to qualitative and quantitative methods before I give a thorough explanation of action research in general. Further, action research and case studies used in IS context is outlined. Techniques such as interviews, observations, surveys and experiences can be used in all types of research approaches described below (e.g. Braa & Vidgen 1996).

Qualitative and quantitative methods

A qualitative method aims at understanding social phenomena on the background of rich data about persons and situations. The process is based upon collection methods such as interview, observation, analysis of documents and pictures (Thagaard 1988). While the quantitative method searches for a deeper and contextual insight into the area of investigation, quantitative methods focus on quantifiable objects. Properties and incidences are considered independent phenomena in relation to the greater totality (Hellevik 1999).

4.1.1 Action research

> *"AR is social research carried out by a team encompassing a professional action researcher and members of an organization or community seeking to improve their situation. AR promotes broad participation in the research process and supports action leading to a more just or satisfying situation for the stakeholders."*
>
> (Greenwood & Levin 1998)

The basic idea is that the researcher and the stakeholders interact and work closely together to define and solve the problems. During the process they learn and execute social research techniques, take action, and interpret the results of actions based on what they have learned. In the action research approach, social problems are not only studied, they are actually attempted

to be resolved. One thought in action research is that all people accumulate and use complex knowledge in everyday life. An example of this is that in any action research project, the first thing the involved actors do, being researcher or stakeholders, is defining a problem to be solved. In this process, they combine their knowledge, and this close interaction and collaboration democratizes the relationship between the professional researcher and the local parties involved (Greenwood & Levin 1998).

In order to be identified as action research, there are three elements that must be present, namely research, action and participation. By research it is proposed that action research is one of the most powerful ways to generate new knowledge. Participation promotes democracy, which means that it enables the communities or organizations to mobilize their diverse and complex internal resources to the fullest. Stakeholders are involved in the decision making process, which gives them the opportunity to take charge over their own situation. Action research is a participatory process in that trained social researchers function as facilitators for the stakeholders (members of local communities or organizations), and together they establish the action research agenda, generate the knowledge necessary to transform the situation and put the result to work. In this way everyone involved take some responsibility. Action research is also participatory in that it aims to alter the initial situation of the group or organization in the direction of a more self-managing, liberated state, where the practitioners function as democratic reformers. Hence, action is a sensible way to generate and test new knowledge. As Greenwood and Levin say:

> *"..AR is a form of research that generates knowledge claims for the express purpose of taking action to promote social change and social analysis."*
>
> (Ibid, p. 6)

The social change implies that the involved members increase their ability to be in charge and manage their own future. Action research does not share the traditional view of social research that thought and action is separated. (Greenwood & Levin 1998) state that even if projects fail in reaching desired action, they still produce rich learning opportunities. Learning is an important aspect in action research, and the mutual learning situation that takes place between researchers and local group members affects both the research and actions (ibid.).

Action research can be both qualitative and quantitative research; in fact there are no restrictions for what methods to use as long as the participants find it meaningful. Different contexts and situations call for different methods. Action research is not a discipline, but involves members from both academic and non-academic practices, among others anthropology, engineering and psychology (Greenwood & Levin 1998).

There are several thoughts and practices of action research in IS. One of them is stated by Brown (1993), who considers the geographical location of the action research site, and distinguishes between the 'Northern' and 'Southern' tradition, in participatory action research:

> *"The 'Southern' tradition is committed to community transformation through empowering disenfranchised groups; the 'Northern' tradition is concerned with reforming organizations through problem solving"*
>
> (Brown 1993, p.249)

Conventional social scientists criticize action research in being unsystematic and atheoretical, but action research is usually involved in more complex problems than the conventional social sciences. Action research is context sensitive/bound and addresses real-life problems, focusing on experience, with its complexity, historicity and dynamism. The problems are solved through a democratic inquiry where participants and researchers cogenerate knowledge through collaborative communicative processes. In this process action research specifically engages in systems-informed, pragmatic social science. The diversity of experiences and capacities amongst the local group is considered as valuable in the research-action process, and there are no separation between theory and action. The inquiry process creates meanings, and the meanings lead to social action. New meanings can again be produced from the reflections on action. The credibility-validity of action research knowledge is measured according its workability, which is whether or not the solution resolved the initial problem (Greenwood & Levin 1998).

4.1.2 Research methods within the IS field

This section outlines to commonly used research methods within IS in the organizational laboratory; action research and case studies.

Action research in the IS field

Action research has been characterized as a way to build theory and knowledge by engagement with the world in the context of practice itself (Braa & Vidgen 1996). Braa & Hedberg (2000) employ action research in order to involve the wider social system in the design and development of ISs.

Braa *et al.* (2002a) base their study on "networks" on action research:

> *"..action research interventions need to be conceptualized and approached as but one element in a larger "network" of action in order to meet the grave challenges of making localized action scale (i.e. spread) and be sustainable (i.e. persist over time, also after the researchers leave)."*
>
> (ibid.)

As outlined in section 3.2, pilot projects, which usually are initiated through donor funding, focus on issues in a limited scale. That is, they concentrate on one health program or health model, without taking the overall complexity into account. The other problem concerns keeping the initiatives sustainable, that is when the researchers leave or the funding has stopped. Engelstad & Gustavsen (1993) states that the challenge for action research is to shift focus from "*single organizations and workplaces ... to networks*".

Braa *et al.* (2002a) address the problems with scale and sustainability focusing on the aspects of control and institutionalization. Control, or management is important for large-scale action research e.g. in order to align with the existing political, institutional and technical networks. Sustainability has several different meanings in the context of action research, e.g. from the life of the systems and processes developed as interventions, and to the question of how the research and practical efforts co-exist over time. Taking all the different issues into account, Braa *et al.* (2002a) focuses on the role of learning in supporting these processes.

Case studies

Kitchenham *et al.* (1995) label case studies as "research in the typical". Case studies offer a possibility of an in-depth understanding of one particular case or development project. Braa & Vidgen (1996) also find that although the researcher acts only as an observer, without intervening in the situation being observed, the researcher will affect the situation. Organizational actors may change their behaviour if they know that they are observed.

4.2 My choice of research approach

In this section I present the research approaches I used, along with the HISP India team.

Action research

During the fieldwork I was part of the HISP team, which applies action research approaches in their attempt to develop a IS, which may eventually improve health services to the poor and marginalized. HISP seems to fall into the 'Southern' tradition of action research (ref. section 4.1.1), although it is difficult to categorize HISP as it expands to different countries with different contexts and different levels of participants.

The action research approach relates to e.g. the participatory design of Minimum dataset, prototyping and different on-site training methods. We had the health workers enter health data into the system, which we then analysed and presented to the Department of Family Welfare. The

information need was defined through interacting with the users in workshops and meetings.

The HISP India team

The HISP team in India during my stay existed of Trude Larssæther, Jørgen Darre and Maria Røhnebæk, my co-students at University of Oslo (UiO), Zubeeda Quraishy, an Indian anthropologist, Usha Srinath, an Indian medical doctor and Jørn Braa (Norwegian) and Sundeep Sahay (Indian), ISs professionals at UiO. The team was towards the end of my stay supplied with two more students from UiO and one Indian informatics professional. Both professionals from UiO have several years of experience in implementing and studying the use of ISs in various global contexts, especially with a focus on health. The medical doctor was responsible for medical related issues, like the minimum data set and the data dictionary. The anthropologist is the program coordinator of HISP India, while Braa is the project coordinator of HISP international. Trude and my role were to get involved as much as possible in the HISP project, mostly by conducting training and helping with initial implementation of the system. Flanked by this involvement, we naturally acted as researches as well. As we had knowledge of DHIS we acted as professionals and advisors, but worked closely with the stakeholders involved in the project.

As part of the HISP team I took part in all actions involved in developing the HIS Project. I participated in meetings and discussions with different stakeholders, and within the team, more informal meetings and talks. Working in a team gave me several advantages, like access to meeting reports, letters and summaries. The fieldwork implied a great amount of travelling around to the different health facilities and stakeholders. After leaving the fieldwork, I still conducted meetings and discussions with the HISP team through mail and meetings in Norway.

Most of the people I met were excited about the fact that we were foreigners and came all the way to India to work on the project. They were eager to talk with us, but we had sometimes problems concerning the language. The project was situated in a small town in a rural area, where most people did not have much education, and had poor knowledge of English.

The training process

Referring to action research, the researchers and the stakeholders interact and work closely together to define and solve the problems. We were part of the second training program attended by the health staff. HISP hired a computer education centre to support the training. Before the training program started, the hired staff attended several days of training by the HISP team.

In addition to the classroom training, many on-site training sessions were performed. Having a background in informatics and not health, it was necessary for us to learn the meaning of the data elements and how they were intended to be used. The team consisted of a doctor who knew the terminology, but the actual use and understanding of the data elements had to be taught to us by the health workers. This mutual learning was important in levelling out the "differences" between us, the researchers, and the local users, with whom we aimed at collaborating with on "equal" terms. This training took place during workshops, in the primary health centres or wherever we met the Multipurpose Health Worker (female), or field worker, which I have labelled them, who collected data.

Data collection

When the computers had been in use for some weeks, we made the health workers enter health data, which they had collected for the previous year into the computer. I finished my field work before the data entering was finished, but another student working in the HISP team brought home a CD with the data, which we have analyzed together in Chapter 8. We have used both a quantitative and qualitative method. Examples of qualitative aspects was to go back to the primary health centres, present the data, and together with the staff try to understand the result of the data analysis. The analysis is based upon numbers, but we also try to understand the outcome in relation to the social and institutional context.

Observations

Going around to the different health centres and observing the health workers was very useful. The HISP team paid frequently visits to the primary health centres, usually unannounced. This gave us the opportunity to check whether the computers were in use, and by whom. Most important, I got to see how the health workers used the computer, and the progress in learning how to use it. Observing the trainers was also useful in order to see how they performed the training. We were also allowed study data registration forms and reports at primary health centres.

Interviews

I conducted a number of informal and semi-structured interviews of health workers and some more formal and more structured interviews of the HISP team members in India and other participants of HISP international. These interviews enlightened issues that were unclear, both concerning the work of HISP, but also matters of the team itself. Considering that several of the members had worked with health in developing countries for numerous years, the interviews provided us with highly valuable information. Interviewing health workers was done in an informal manner, often when they dropped by the health centres in between their fieldwork. The language was a hindrance, which sometimes resulted in short and limited answers.

Our presence, knowing that we were part of HISP, seemed to influence the answers they gave. Indians are known for respecting higher authorities, and the fear of insulting someone might have affected the answers the health workers gave. Having informal conversations felt more natural and valuable than performing interviews.
Number of interviews; field workers: 16, HISP members: 5, Officials: 4

Questionnaires

During the period I spent in Kuppam, we carried out two surveys by means of questionnaires. The first was an evaluation of the three day training program, which the health staff had attended. This was handed out at the end of the training and included questions regarding the training, the software and how they felt about the computerization of the primary health centres. English is the secondary language in India, but many of the health workers do not speak or read it very well, or not at all. The participants were therefore given a choice of answering in English or their local language, Telegu.

The second questionnaire contained open-ended questions and was handed out after the system had been in use for a month. This was not only meant as a follow-up, but as an opportunity to also reach the health workers who did not attend the training program, but still used the software. I felt this was a good opportunity to receive feedback, since the health workers were mostly on fieldwork, and not present at the primary health centres. The trainers stayed there the whole day, and the staff dropped in occasionally during their fieldwork. If I would interview the users myself, I would have to stay at one primary health centre the whole day, and maybe be able to perform one or two interviews. Being eight primary health centres, and health workers dropping in at unscheduled times; this would take too much time to carry out since the process took place for approximately one month.

Literature and other sources

We worked in the rural area, Kuppam, and access to facilities, like libraries, computers and Internet, was poor. Most of the information we got hold of was in paper form that we only could borrow and copy. There were a few Internet cafes in the town, but using the Internet was a trial of patience. The site went down, you could not get it up in the first place, or the power was cut. Either way, Internet was the best way to communicate with the other HISP team members, because of the high frequency of travelling. It was also the only way of sharing experiences with other HISP members in the world. When implementing the software, we especially needed support from people situated in South Africa. Internet has also been helpful when writing the thesis. The Internet provides several informative sites on India, Andhra Pradesh and health information, i.e. the Indian census.

During this study, a rather extensive literature study has been performed. It has been absolutely necessary for our understanding of the context and to gain background knowledge. The literature consists mostly of academic books and articles, but also papers and folders that we got our hands on during the fieldwork. The topics of the literature range from HIS and developing countries to organizational change.

Possible misinterpretations of my own data

When interacting with other persons there are always possibilities for misunderstandings and misinterpretations. Working in a different cultural, social and political context, made me especially aware of these risks. I will say that the language was the most obvious obstacle; both because many of the health staff were poor in English, and concerning the answers in both questionnaires. My connection to the HISP may also have influenced their behaviour and answers. Responding on the evaluation of training at the very same day as the training program where we were present might have influenced the answers the participants gave. Although, that we were foreigners might also be an advantage; we are outsiders, which may have reduced any possible political and hierarchical constraints towards us.

5 Health Information Systems Programme - HISP

This chapter gives a background of the project I have worked within, the Health Information Systems Programme (HISP).

5.1 Background

South Africa inherited a health care system from Apartheid where 60% of the resources were used by the private sector, serving only 20% of the population. The new government launched a program to restructure the health sector. The aim was to support communities that had suffered under apartheid, and to transform the highly specialised and centralised health system to be based on a decentralized system of health districts. HISP grew out of this reconstruction program with its aim to develop a district health information system to support the emerging decentralized administrative structure (Braa & Hedberg 2000).

HISP international

HISP is a collaborative university-based project between the Indian Institute of Management (India), University of Oslo (Norway), Western Cape (South Africa) and Eduardo Mondlane (Mozambique) and the Departments of Health and provincial health authorities in South Africa and Mozambique and India. HISP started in three pilot districts in the Cape Metropole in 1994. In 1998 it was implemented in Western Cape, and the year after in the Eastern Cape. In 1999 the National Health Information System of South Africa (NHISSA) accepted it as the national system for primary health centre. At the same time a wide-scale implementation was launched in Mozambique and in 2001 it was initiated in Malawi. In December 2001 the project was introduced in Andhra Pradesh, India.

HISP is a global network across a number of developing countries, which goes horizontally and vertically across and within countries. Figure 3 shows a schematic overview of the HISP network where South Africa and Norway works as coordinators for the other countries. Dominican Republic and Angola are emerging out of independent (of Oslo) efforts of South Africa and Cuba.

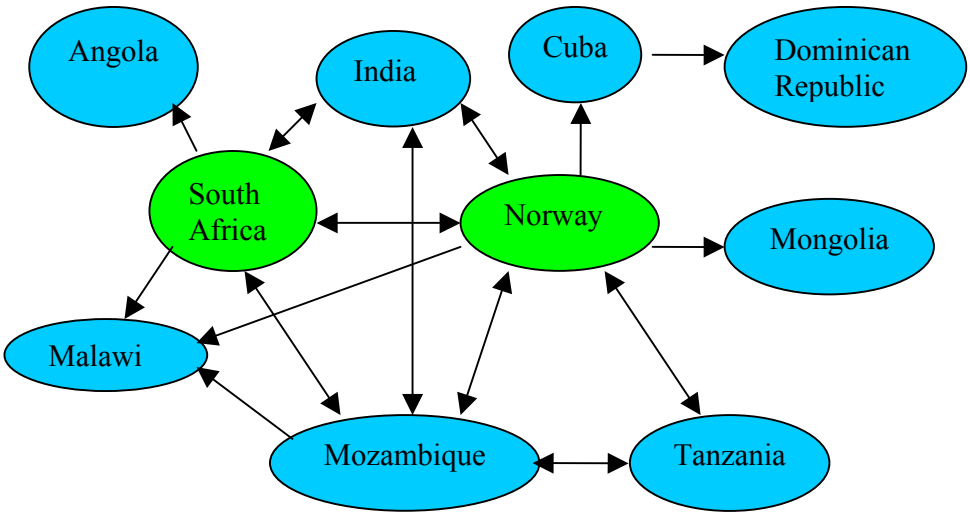

Figure 3: The HISP Network (Braa *et al.* 2002a)

HISP's life cycle can roughly be divided into three stages; adapting, implementing and using the software. South Africa and Malawi possess a countrywide implementation, Mozambique, Andhra Pradesh in India, Cuba and Mongolia are in the stage of partial implementation, while Tanzania and Ethiopia just recently have joined the network and have started testing and adapting the system.

HISP seeks to develop a district health information system, which aims at supporting local management and health care delivery. This again may help improve health services to the poor and marginalized. HISP was developed in South Africa, but is now spread out to several countries. According to HISP's software coordinator, they all have one thing in common; too much data is collected and not used for any particular purpose. When developing HISP the focus has been on flexibility. HISP can be seen as a toolkit, including software, methodologies for health information management, training programmes and health data standards. The system needs to be adapted to the local context, where the forms, data elements, database, reports, data dictionary and other contents have to be worked out locally.

According to HISP's software coordinator, people get hooked on HISP because of the software. The software is flexible and has a number of properties, which means that it can be adopted relatively "easily". The fundamental thing though, is that people actually get an approach. A bottom up approach, a political ideology of a HIS, which predominately is related to local data capture validation and use of information. Each level is supposed to be responsible for deciding what they need for their decision making and basically leaving all the other levels to decide what they need, which is related to the information pyramid presented in sub-section 2.4.3.

5.2 District health information system (DHIS)

Vision:

> "*To support the development of an excellent and sustainable health information system that enables all health workers to use their own information to improve coverage and quality of health care within our communities*"
>
> (HISP)

The DHIS is an IS that has been developed since 1996 in South Africa by HISP to support management at district level. It is a tool to support health management to make the best decisions possible and empower local health workers to plan and take informed action based on

- Progress towards local targets.
- Coverage and quality of services.
- Efficiency and effectiveness of interventions

In addition, the DHIS provides information on health status and health services.

The DHIS has a number of basic principles:

- Supports the district-based primary health centre approach.
- Collects essential data used to calculate indicators (see sub-section 3.3.3).
- Encourages decentralised use of information by health workers.
- Includes all service providers at all levels.
- Integrates with and supports other ISs (one of the challenges for HIS in developing countries as explained in section 3.2.)

The DHIS deals with aggregated, anonymous data on a per facility level. No individuals are identified in the reports, but age groups and gender information are used when appropriate to ensure that specific target groups are given appropriate services.

System overview

Figure 4 illustrates an overview of the DHIS software.

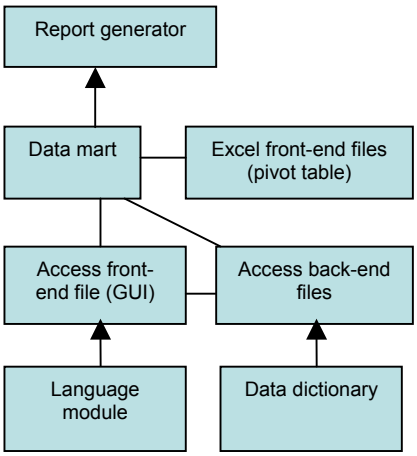

Figure 4: System overview of DHIS software

The software consists of a range of Access and Excel files, some registry settings files, a number of Windows system files and ActiveX control files. There is an Access database that stores the routinely collected data, and this is linked to Excel spreadsheets to facilitate aggregation, analysis and presentation of the data. The different modules are:

- Access front-end module for entry of monthly routine health data, which present the graphical user interface and can be used with different back-end files. This is the main module in the software, and it connects all tables.
- Access back-end files containing stored data for the different districts.
- Excel Front-end files for each Access back-end file. Excel pivot tables are used to present data as graphs, diagrams etc.
- The Data mart is a file with pre-processed data (buffer).
- Report Generator that generates predefined reports.
- The data dictionary contains medical definitions.
- The language module enables multi language support.

Below the DHIS main screen is displayed.

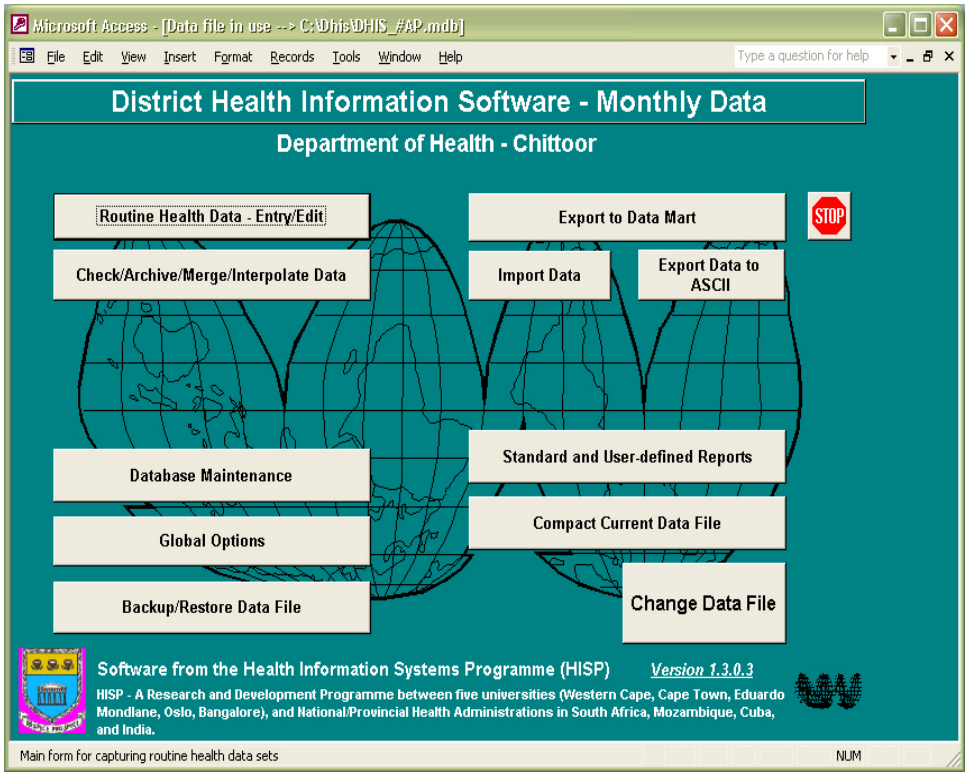

Figure 5: The main display of the DHIS in Chittoor, India.

The graphical user interface consists of icons so that users can "click their way through". This was a way to make the system as intuitive and user friendly as possible. This also eliminates some misunderstandings like wrong spelling. The data registration form consists of maximum and minimum range values for the reason of catching abnormal numbers. If an irregularity occurs, the reason must be typed.

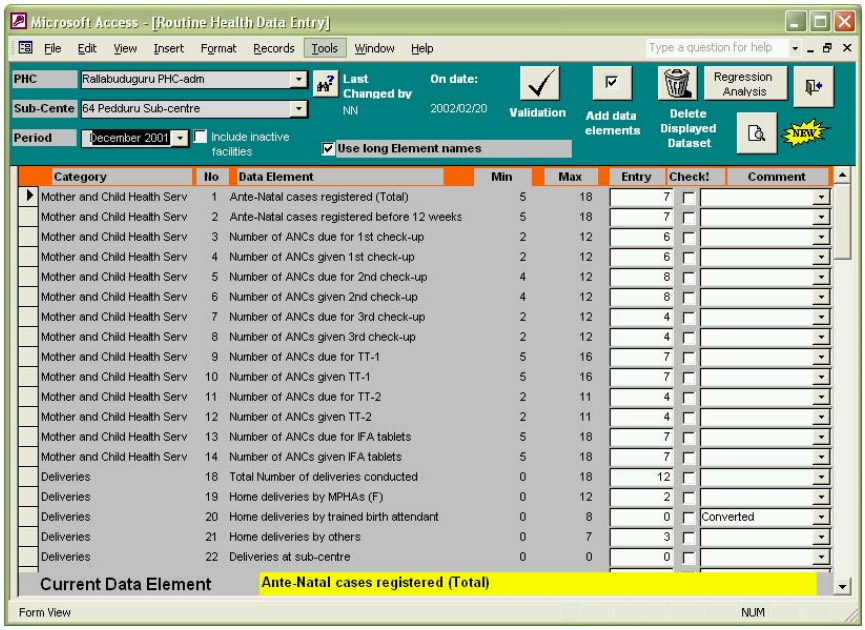

Figure 6: The DHIS monthly module.

The DHIS software is open source and free of charge, which implies that the source code and database structure potentially can be modified by anyone. The software is being further developed as collaboration between various global partners, and new upgrades will be distributed and shared free of charge through the global network of developers. This has made it easy to promote the software, since users take no financial risk in trying it out, and the fact that the software is very flexible. It was developed using Microsoft Access database management software, and the reason for this was the widespread use of this software in South Africa. One reason for using a front-/back-end solution in Access is that the software should be easy to use in new areas, which will allow users to tailor the geographic scope of their data sets to their needs. This is one of the principles, which are translated into concrete inscriptions.

The software development process is iterative and involves participation and cyclical prototyping. Users play an active role in testing and defining further enhancements, and initial specifications are quickly developed into a working model. One of HISP's philosophies is to enable end-users to provide a high degree of input and also promote shared ownership.

6 India, Healthcare and Andhra Pradesh

Figure 7: India

This chapter introduces the broader context within the pilot project is situated. First, an introduction to the context of the health systems in India is given, before IT initiatives in the state of Andhra Pradesh are outlined.

6.1 A brief background on India

India has with over a billion people the second largest population in the world, and every year it grows with 2% (census 2001). There are 15 official languages, the largest being Hindi (30%) and English. Despite India's many large cities, it is overwhelmingly rural. It is estimated that about 74% of the population lives in the countryside (Gov 2003).

The Republic of India has been the world largest democracy for the last 50 years, after the independence from Britain in 1947. The differences in people, language, customs and culture in the country are striking, and India is more a continent than a country with its enormous varieties and diversities. Change is inevitably taking place as modern technology is

woven into the fabric of society, yet essentially rural India remains much the same as it has been for thousands of years (Gov 2003).

India is known as one of the main contributors in the IT industry, especially in producing software services. The industry is concentrated in the big cities, and most of the production is exported. Students are drawn to the profession, but rural India does not take advantage of this development. The rural areas are not attractive places to work, and the salary in public sector settings is not considered to be equivalent to that of the big software companies (Heeks 1996).

The responsibility for education is shared by the state and union and is compulsory and free for all up to the age of 14, although many do not attend school regularly. Only half of the children in the 11 to 14 year group are enrolled and half of all students from rural areas drop out before completing school (Gov 2003). National literacy is 55%, and includes more men than females (census 2001).

The Indian Administrative Service (IAS) is the highest cadre of the civil services in India. People educated as IAS hold key positions in both the central and state governments where they are posted at sub-division and district level, or as State Secretariat or Head of Departments. People educated at IAS are moved from position to position on irregular basis, but are usually transferred within a 2-4 year period (Gov 2003).

Table 1 presents some key numbers for India and the state Andhra Pradesh.

	India	**Andhra Pradesh**
Total population	1,027,015,247	75,727,541
Rural population	741,660,293	55,223,944
Number of literates	566,714,995	40,364,765
Birth rate urban (SRS)*	21,6	20,5
Birth rate rural (SRS)*	28,9	23,1
Infant mortality rate urban (SRS)*	45	37
Infant mortality rate rural (SRS)*	77	70

Table 1: Demographic and health profile

Source: census 2001
*estimated rates for 1997

6.2 India's primary healthcare system

This section presents an overview of the health structure in rural areas. Topics described here will be explained in more detail in chapter 7.

India started its health care reform in 1952 after the independency from the British Empire, but it was first in 1983, after the Alma-Ata declaration in

1978 (WHO), that the country committed to primary health care and primary health centres. The main stress of this national policy is the provision of preventive and rehabilitative health services to the people, thus representing a change from medical care to health care.

Type of institution	Plain area	Hilly/ Tribal area	Avg. rural population served	Avg. number of villages served
Community Health Centre	120,000	80,000	214,000	200.07
Primary Health Centre	30,000	20,000	27,364	25.55
Sub-centre	5,000	3,000	4,579	4.27

Table 2: Statistical data of primary care institutions. The numbers in the first three columns are people served by the respective health centre.

The primary health care infrastructure in rural areas has been developed as a threetier system and is based on the population norms presented in Table 2. At the bottom level in the hierarchy, the sub-centre is the peripheral institution available to the rural population, theoretically serving between 3000 and 5000 persons. A sub-centre is according to the government run by one Multipurpose Health Assistant (male) and one field worker as well as one LHV who is in charge of supervising six sub-centres. The field worker core tasks are to capture data about ante natal cases, register births, and give BCG and Measles vaccine. She performs these tasks by going from village to village within her area, usually covering the area within one month (FW 2002).

The primary health centre is the first contact point between the village community and the Medical Officer. A primary health centre acts as a referral unit for six sub-centres, consists of one Medical Officer supported by 14 paramedical and other staff and usually contain between four and six beds for patients. The activities of the primary health centre involve curative, preventive and Family Welfare services in addition to simple daily-based services like vaccinations and blood testing.

From the state, numbers and indicators finally end up at the Department of Health and Family Welfare after being processed at different sub-institutions at the country level.

6.2.1 Andhra Pradesh health information flow

A study of the information flow in Andhra Pradesh performed by the HISP India team exposed a strict separation between the hospitals and the primary health centres. The structure of the health system in Andhra Pradesh is made up of isolated programs that perform vertical reporting, and can broadly be divided into three main areas (Braa *et al.* 2002b):

- **Primary health care:** This structure supports mother and child health programs under the Commissioner of Family Welfare. Collection of various programs is paper based, performed by health workers in the sub-centres, sent through primary health centre to the district and then to the state. All communication between levels is done by post/hand delivery. There is only one computer at the district medical and health office, and no computers in the district health service. Every month the Multipurpose Health Worker (f) fills out the paper forms at the sub-centre and delivers those to the person in charge at the primary health centre, usually the Medical Officer or the Supervisor. Data is then calculated and summarized on paper forms for the primary health centre, and brought to the monthly meeting for all primary health centres in the district. The primary health centre data is then computed manually at the district, and the result is typewritten before sent to the state. Hence, data is aggregated at primary health centres and district level before reaching the state.

- **Vertical programs:** Several different programs like Malaria, Tuberculosis, Leprosy and Family Planning, have independent structures. Data on these programs is collected by the program officers at the primary health centres and is reported in parallel to the state and district-level programme offices.

- **Andhra Pradesh Vaidya Vidhana Parishat (APVVP):** As part of World Bank project to strengthen the hospital infrastructure, APVVP was established. APVVP is an independent management and reporting structure that covers all district and area hospitals, and community health centres. Data from all hospitals in the district is entered at the district hospital and submitted electronically to the APVVP head office. Data from APVVP and data under the Commissioner of Family Welfare structure is not integrated, but the same personnel are reporting on the same events into both systems. The data elements are not following the same standards, i.e. while APVVP reports "number of deliveries", the other system is reporting "live births", "still births" and "deliveries".

The District Medical & Health Officer deals with the reporting at district level in the first two cases. At district level the Commissioner for Family Welfare or Director of Health is in charge. The APVVP structure is managed by the District Coordinator of Health Services at district level, while the Commissioner APVVP handles it at the state level (Braa *et al.* 2002b).

Looking at the information flows in Figure 8, the institutional structure of the health sector is identified. The mapping of the HISs is thus a reflection of the hierarchical structures of the health sector down to the lowest institutional level.

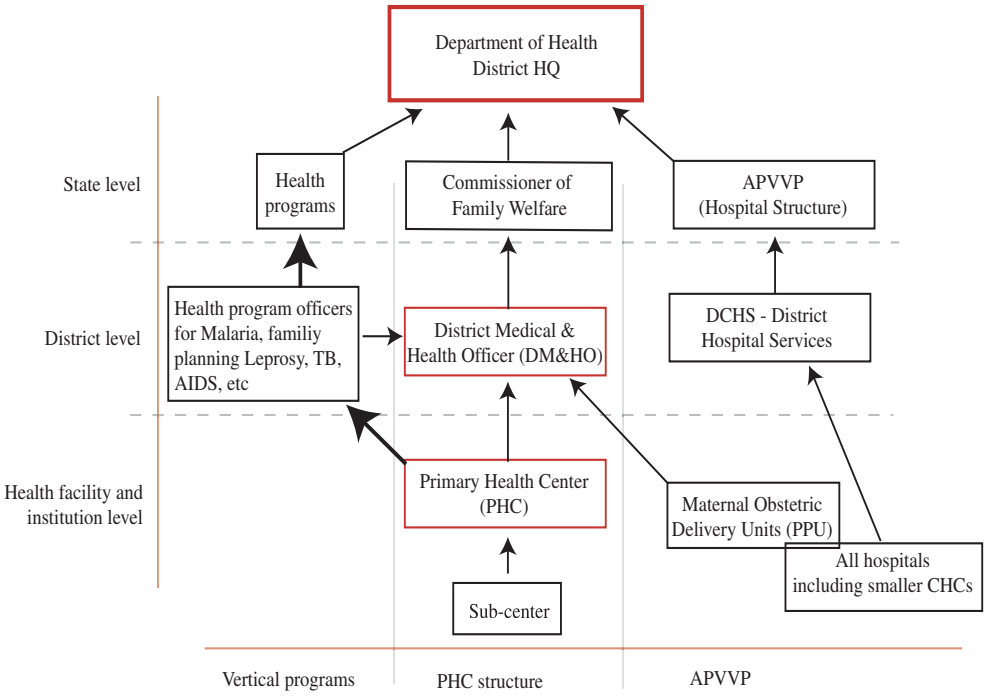

Figure 8: Structure and flow of information in the health system of Andhra Pradesh up to 2002.

There are several structural issues that make the information flow problematic. The health structure is an organizational hierarchy consisting of independent, vertical units, which complicates the overall picture in the health status. The most prominent challenges can be outlined as follows (Braa *et al.* 2002b):

- The fragmented information flows are not integrated, analysed or used at the district level.
- Systematically aggregation of data at each level upwards.
- Poor quality of data.
- Insufficient feedback of data and lack of use to support action.
- Primary health care and hospitals are separate reporting units.
- Data collection tasks consuming a lot of resources.

The above issues will be addressed later in this thesis.

6.3 IT in Andhra Pradesh

Andhra Pradesh is widely being more and more famous for its IT policy and is among the top cities in India besides Bangalore in building ICT infrastructure. The Government of Andhra Pradesh strongly believes in e-governance when it comes to IT. The government is engaged in providing good governance for the common citizen, and making a difference in the local communities. E-governance service includes online access to government records and easy bill payment that traditionally has required much time and money of low- income rural citizens.

The Government cherishes the vision of establishing a Simple, Moral, Accountable, Responsive and Transparent Government – SMART government. They see e-governance as one way of reaching the goal of SMART government. Several major projects have been implemented over the last five years, including:

- APSWAN: Connectivity is perceived to be the backbone of all efforts at e-governance. A 2Mbps optical fibre connection has been established between Hyderabad and all the District Headquarters.

- Video-conferencing facility: A video-conferencing facility between Hyderabad and 25 cities/towns has been operational from the end of 1999.

- CARD (Computer-aided Administration of Registration Department): Registration service of land deeds on a remote access basis.

- COMPACT (Computer-aided Administration of Commercial Taxes): Building a database of more than 350.000 registered dealers where data is analyzed and used for taking up investigations to detect evasion of sales tax.

- e-Seva, former known as TWINS (TWIN cities Network Services): A pilot project to provide one-stop services to the citizens. Includes payments of utility bills, issue of certificates, licenses and provision of information useful to the citizens.

- MPHS (Multi-Purpose Household Survey project): One of the largest IT projects undertaken by the Government, which aims to create the database of the socio-economic data of all the citizens of the state.

- APDMS: The Andhra Pradesh Development Monitoring System is a GIS-based system that has been launched in the beginning of 2000.

By these ICT initiatives the government aims at linking the villages and local people to global information networks. The State ICT policy emphasises application and use of ICTs, with less focus on the technology itself (Braa *et al.* 2002b). It is within this context of e-governance policy and implementation that the pilot project is situated.

7 Developing a Health Information System in a Pilot Area

This chapter gives a description of the fieldwork I conducted from January to March 2002. First, I describe Kuppam, before giving an introduction to HISP in India. Further, the political and social context is outlined. A description of the primary health centres is given to illustrate the context I have worked within. Furthermore, I present the systems development process. Finally, current status of HISP is outlined.

7.1 Kuppam

This section starts with introducing Kuppam, the town where the pilot project is situated. Some of the initiatives in the town are also outlined.

7.1.1 Kuppam electoral constituency

Kuppam, with a population of 320 000 people, is a rural community in the south-west end of the Chittoor district. The Chief Minister of Andhra Pradesh has chosen Kuppam as his electoral constituency, which means that he has to win the political election in this place, in order to rule as Chief Minister for the state. Kuppam has also been known during the past few years for being a key proponent in India for using technology and a people-centred approach to modernizing rural communities, more or less as a model village for the state. As a result of these innovations, Kuppam has become a test area for technology-based socio-economic development, and houses educational, agricultural, health care, and telecommunications pilot projects. A more detailed description of these projects will be given later.

Chittoor, with its population of about 3.75 million spread over an area of about 15152 square KM, is one of the poorer districts in Andhra Pradesh. The Chittoor district is divided into three divisions; Madanapalli, Chittoor and Tirupati, where Kuppam is situated within Chittoor division. The district has 84 primary health centres each theoretically supposed to cater to a population of about 30,000. Many of the important social and health indicators for the districts in the state have been found unsatisfactory and Chittoor scores badly on these indicators and targets compared to other districts in Andhra Pradesh. The data reported is to a large extent incomplete throughout the district. The maternal mortality rate for the state is officially estimated to be 1.54 pr 1000 live birth (SRS 1997), though it is believed to

be more around 4 pr 1000 live births. According to reports from the Department of Family Welfare, the maternal mortality rate for Chittoor is 1.18 pr 1000 live birth. Infant mortality rate is officially estimated to be 66 pr 1000 live birth for the state (SRS 1999), and in Chittoor it is reported to be 12.12 pr 1000 live birth.

7.1.2 IT and initiatives in Kuppam

Kuppam hosts a wide range of IT initiatives ranging from wireless technology to basic computer studies. The two best-known projects are the initiatives run by World Corps and Hewlett Packard.

World Corps is an international non-governmental organization (NGO) which in collaboration with public, private and NGO partners in developing countries identify promising young leaders from rural areas (World Corps 2002). World Corps has opened Community Information Centres in the five major towns and villages in Chittoor, one of them being Kuppam. The purpose of these Community Information Centres is to bring resources available to the rural and poor through the use of the Internet and human resources. The plan is to expand with ten more Community Information Centres in collaboration with Hewlett Packard. Such kiosks as these would also be able to make use of the states e-Seva initiative (6.3).

HP i-Community is an alliance between Hewlett Packard and the state government of Andhra Pradesh and is intended to accelerate socio-economic development in the rural areas by using information and communication technology to increase income opportunities and access to new markets. The ultimate goal is to improve literacy, job creation, income, access to government services, education and healthcare in the constituency over a three year period.

Other technologies are e.g. corDECT, who aims at connecting Kuppam through wireless technology as one of the first rural towns in the world. The introduction of broadband technology (1 Mbit) is also under progress in the town, something that would give a lift to the Community Information Centres and numerous Internet cafés in the area. In May 2002, Airtel and Tata, two of the major cellular companies in the country, introduced coverage and subscription. About 250 subscriptions are sold (December 2002), equally distributed between the two companies.

The Internet cafés offer, in addition to ordinary web browsing, services like gaming, fax, CD-burning and printing. The price for browsing is around 6 Nkr per hour, while gaming usually costs a bit less. The connection is fairly unstable and modems are usually shared across several computers, so browsing is usually slow.

There are also a few non-IT initiatives in Kuppam worth mentioning. The Large Scale Farm Advanced Project is a holistic approach to modernize

agricultural practices by involving agriculture and all related departments in the process of this technological up grade. It revolves around Israel cooperative model of agriculture. The Chief Minister has also initiated an Anti Child-Labour program, a program to help children from the surrounding 47 villages to come and study in Kuppam.

7.2 Introducing HISP in Andhra Pradesh, India

This section starts with an overview of HISP in Andhra Pradesh, India, from the initiation and up to my departure. Some of the material is gathered through interviews, mostly from the program coordinator in HISP India, the rest is based on my own experiences.

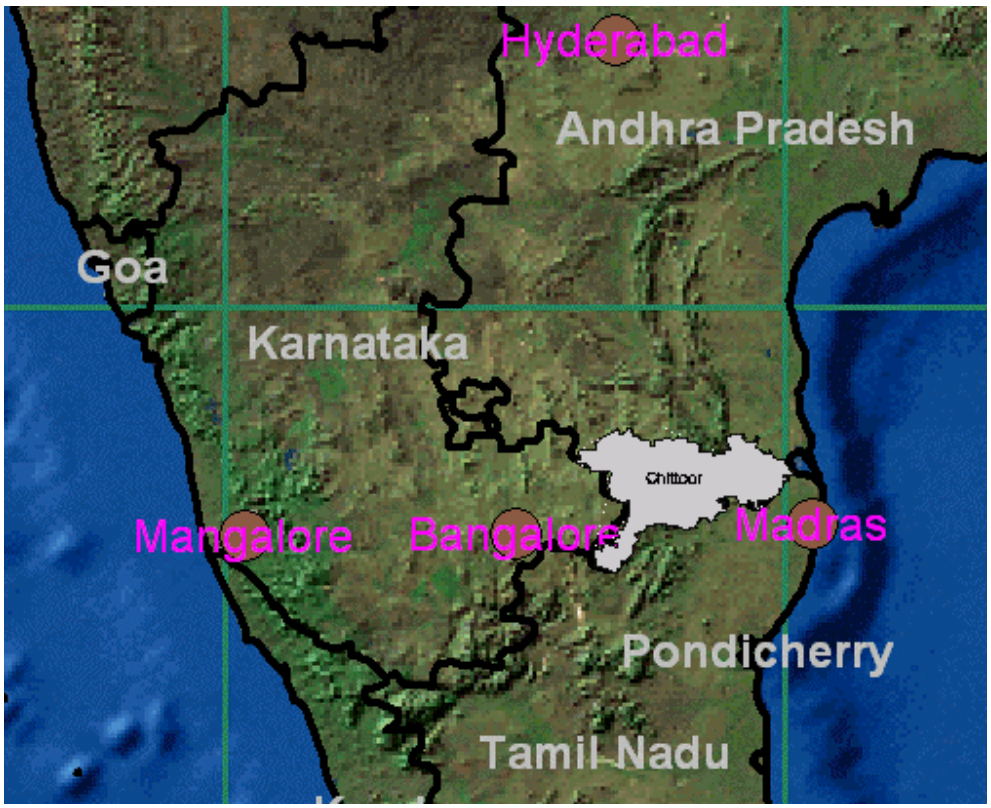

Figure 9: Map of Chittoor, Andhra Pradesh

The project is anchored at the Indian Institute of Management, Bangalore, and is part of the HISP. The collaboration partners so far (June 2002) in Andhra Pradesh include the Department of Health, the Special Secretary to Chief Minister and the District Health Management team and Collectors office in Chittoor.

Project aims

The HISP project in Andhra Pradesh has three key aims:

1. Develop a district-focused computer-based HIS appropriate for Andhra Pradesh.

2. Develop capacity for information management amongst staff at various levels of the health system.

3. Integrate the health system with other ongoing e-governance initiatives in the state.

The three aims can be summarized;

The first aim is related to adapting and developing the database software to the needs of the district including data on health, population, community and infrastructure. The database will keep data dis-aggregated at the PHC and sub-centre levels to ensure analysis at the local levels.

The second aim is to develop a unified set of "minimum data standards" that represent the minimum set of data items that need to be filled in on a monthly basis by the primary health centres and the sub-centres, along with procedures for information handling. HISP will also develop and run a training program on health information for health managers and workers at district, primary health centre and sub-centre levels.

The third aim focus on supporting the other ongoing initiatives in the state (presented in section 6.3). The indicator-based analysis of the HISP database can help to compare the State Health sector with other states and also other sectors in the state.

Getting started

HISP's initial stage began in December 2000 as a result of three main reasons, where two being India's liberalization policy and good relations between a member of the HISP team and influential persons in the government of Andhra Pradesh. Further, the states Karnataka and Andhra Pradesh both have strong IT policies, and especially Andhra Pradesh' IT policy on e-governance and networking of the villages is in line with the HISP approach.

After presenting HISP and its objectives in Hyderabad, the capital of Andhra Pradesh, and several meetings with the Special Secretary to Chief Minister, HISP started looking for a pilot area. Two districts, Chittoor and Medak, were of interest, and surveys were conducted in both districts to reveal which district was best suited as a pilot area. In consultation with the states authorities, Chittoor was selected based on several reasons. Chittoor is

situated close to Bangalore and The Indian Institute of Management, Bangalore (IIMB), a well reputed business institute were the project was anchored. Chittoor is also a pilot district for the interventions and IS development.

Situational analysis

In January 2001 the HISP team started to do their research at the different primary health centres and some of the main 24 hour women health centres in the Chittoor district. During their visits, they interacted with health workers, primary health centre staff and Medical Officers. The HISP team collected reports, data and information to get an insight into the organization. The first nine months were spent on standardising the system of data collecting and creating the "Minimum Dataset", (ref. sub-section 3.3.3), that could be used in all the health facilities.

The District Medical and Health Officer wanted to place the computers in a few primary health centres in the different areas of Chittoor. Coincidently, a health sectorial meeting was held when HISP visited another division in Chittoor, and several representatives from the health sector were present. The HISP team got this unique opportunity to present the project to almost everybody that would be involved. At this meeting, which regularly takes place the last working day of every month, all primary health centres in the district deliver their reports. Those who have done a good job get applause and credit, while poor performance usually results in Medical Officers being reprimanded.

After attending several meetings, a common apprehension amongst the health workers were that HISP would bring computers. Some health workers believed that the computers at the primary health centre would replace the Lower Division Computer, a person that computes the data. In fact, this person would be valuable in being responsible for the computers. By interacting and talking with the health workers, misunderstandings were sorted out and it seemed as they started to like the idea.

Formalising the pilot project

HISP had to meet with several instances in order to formalise issues concerning the pilot project. In June HISP went to Hyderabad to meet with Special Secretary to Chief Minister and a number of other officers. Then they went to Chittoor to meet the District Collector and the Joint Collector. The District Collector is in control of all administrative units in the district, just like the Chief Minister is for the state. The Joint Collector is one level below the District Collector basically doing the same tasks as the District Collector. The HISP team also had to meet with the District Medical and Health Officer again regarding the data elements, because a major part of the elements were reported several times in different reports. Again HISP

visited more primary health centres to collect information about the existing staff pattern and the work routines performed by the health workers.

In August 2001 the HISP team went to Hyderabad to meet the Commissioner of Family Welfare. They also met with the Chief Demographer to discuss the modified Minimum Dataset, which then was presented to the Commissioner of Family Welfare for the sake of being used at the primary health centres in Chittoor district. There were some problems getting the Commissioner of Family Welfare's approval as she found out that HISP was doing work largely involving data fields and indicators that the Department of Family Welfare was responsible for maintaining. In addition to the existing paper based reporting system in Andhra Pradesh, there was a name-based computerized health care reporting system (CMC) recently implemented in another district in Andhra Pradesh, which would change the existing reporting system. Introducing HISP would result in too many changes to the reporting system and too many reporting systems to handle. HISP did not get her approval, but the Commissioner of Family Welfare provided them with one computer. She said that if HISP had their own funds, they could continue, but still she wrote a letter to the District Medical and Health Officer giving the order not to change the patterns in the present reporting system. The CMC project was in fact initiated by the Family and Welfare Commissioner, and I got the impression that she strongly favoured that project. Also, HISP's entrance through the political structures might have made the bureaucracy feel they were left out, hence their unenthusiastic attitude.

Moving to Kuppam

In February 2001, a presentation was held in Hyderabad mainly for the Chief Minister. The Chief Minister was positive and suggested HISP to tie up with the public or private sector during the roll out in the state. Without the formal permission from the Commissioner of Family Welfare it was difficult to get the cooperation from the District Medical and Health Officer, both in implementing the Minimum Dataset and in doing the pilot study, so the Special Secretary, Chief Minister and other senior officials suggested the pilot study to move to Kuppam. There were also other reasons for this:

- It was the electoral constituency of the Chief Minister of Andhra Pradesh.
- Having a pilot phase in a smaller area usually gives better support.
- Infrastructural facilities will be available and it only has nine primary health centres distributed in five mandal/tax zones.
- It was closer to Bangalore and the Indian Institute of Management.

- The Special Officer of Kuppam was very cooperative.

In mid-September a preliminary survey was conducted in all the primary health centres of Kuppam. The HISP team collected different forms used for collecting and collating data, and also information about the information flow and organizational structure. The first master student from UiO came to Kuppam and started to work on the software and the data fields, while the team started interacting with the officials at different levels. During HISP's visits to the different primary health centres, and based on the interactions with the health workers, a few primary health centres were identified to attend a preliminary training of HISP.

Collaborating with a local computer education centre

The Special Officer initiated the collaboration with a computer institute where HISP could use lab facilities for conducting the training free of cost. Aptech training centre is situated in a small facility in Kuppam town, and possess about 10 computers. In addition to eight trainers, including five girls, Aptech consisted of three managers and one secretary. The computer centre taught development in Visual Basic and Oracle, in addition to Microsoft Office tools. Aptech was hired by HISP to perform training of the health workers, both during training programs and later at primary health centres to follow up the training.

Aptech is a computer education centre mainly teaching children, and from the results we saw, the students did very well. Although it did not seem to me that the teachers had much pedagogical training (ref. training program). Some of the trainers had a need to show their knowledge, and had some "attitude". Often when I asked questions, they nodded their head or said "yes, yes, ma'am". That happened also at times when I knew the opposite was the case. I do not know if they did it because we were girls, foreigners or if that is common behaviour. I clearly noticed the cultural differences when working with the trainers.

The trainers were experienced in MS Access and Oracle, but they were able to delete the database three times. They were inexperienced in database management, and the HISP team did not provide them with adequate knowledge. Working in deprived areas, there are usually not many training centres to choose from, and the education level is low. We needed somebody who was situated in Kuppam, spoke the local language and could work as support for the health staff after the training was over.

Preliminary training

Aptech gave HISP the opportunity to use one of their computers, and during four days representatives from four different primary health centres came for training. From each primary health centre 4-5 health workers were present, three fieldworkers, one Multipurpose Health Supervisor and the

Medical Officer. This was their first experience with use of a computer, and nobody had any idea of the capability and possibilities it could provide them with. This one-day of "training" was meant to be an introduction to HISP and the DHIS software, and to make the health staff realize what the software could do for them. They were very enthusiastic about the demonstration, especially when they recognized the form they used for data entry.

HISP provided free software and training, and computers were provided by the Special Secretary. The Commissionaire of Family Welfare was after several meetings convinced about the project objectives and gave her formal permission to perform the case study in Kuppam using the Minimum Dataset. The District Medical and Health Officer was formally informed and told to give full support to the pilot project. The Joint Collector approved of the sanctioning of the computers and the Collectorate at Chittoor was informed by the state.

Workshop

After consultation with the Joint Collector and Special Officer, HISP organized a workshop in December 2001 for all the health workers in Kuppam. During this workshop Aptech introduced themselves and again HISP highlighted the importance of using information for local action, and the essentiality of attending computer training and learning to use the DHIS software. The workshop was very productive. Many doubts were clarified and it was decided to form a core group, something all participants agreed to. This core group would consist of Joint Collector, Special Officer, District Medical and Health Officer, additional District Medical and Health Officer, three Medical Officers, Statistical Officer, Multipurpose Health Supervisor, two field workers and the program coordinator of HISP, which would meet once a month or if any urgent issues, once a fortnight.

What is written here is not just the story about the initiation of HISP in India. The intention is also to demonstrate something about the power structures and how many rounds it was necessary to go before something is considered formal. The HISP pilot project was not fully formalised by the Commissioner of Family Welfare before October 2002.

7.3 Political and social context

This section presents experiences I had regarding the political and social context.

7.3.1 Political and bureaucratic issues

The Chief Minister is selected for a five year period, and during these years he or she usually wants to achieve something visible, in order to be re-

elected. Programs like HISP needs time to adapt, and do not bring in a lot of money to the area, in opposite to e.g. World Bank projects. If one political leader initiate or support a project, the successor might not want to continue, which result in that the projects left stranded.

After HISP's presentation of the project, the Chief Minister of Andhra Pradesh made the following remark:

> *"While I appreciate what you are trying to do, the systems are of no use till you give me information about all the 1200 primary health centres in the state, and how these link with the e-governance initiatives that we are initiating at the state level. Also, I want these systems to be implemented very quickly."*

HISP's aim of cultivation, in order to create something sustainable, will not be done very quickly, and this is an example of political and bureaucratic issues HISP is faced with.

Aptech computing centre also worked as a meeting place for the HISP team. One day the Joint Collector came and discussed issues of the project with the manager at Aptech. Aptech were hired by HISP, only to function as teachers and computer assistants. The Joint Collector wanted to have the DHIS name-based and he also called for specific plans for the project. Further, he wanted a detailed overview of all the expenses, the training, the responsible persons, milestones and a roll out strategy.

Having plans and knowing exactly what persons were in charge for, was important.

7.3.2 Caste, social status and hierarchy

Interacting with Indians at many social levels, I got to experience the caste phenomena and noticed how this effected their working situation. Higher caste members usually hold higher positions in professions, and are usually well respected by members of a lower cast and social status.

During the training program (see section 7.5.4) we received complaints from some of the medical doctors that they had to attend training with the field workers. The doctors took it for granted that they could use a computer all by themselves, which was not possible since we did not have that many computers. Medical officers are well respected, as education is highly valued in India. They are used to be treated differently, and some of them expected special treatment:

> *"Please train the medical officers separately instead of combining with paramedical staff."*
>
> - Medical Officer in evaluation of training program

When some of the medical doctors came to the training, fashionably late, they snubbed the nurses off the first row without even looking at them. Naturally the nurses jumped back on the second row, without anyone taking a notice. Some times we could or would not take the common behaviour into account, so the doctors' request for their own computer was politely rejected.

After the training program the Joint Collector wanted the Medical Officers to undergo the complete training of the DHIS, because they were the ones to take decisions regarding the primary health centre. Although the health staff still would get training in order to use the computer, he stressed the fact that the Medical Officers also should complete the training.

Local action group

When computers were installed in the primary health centres and the training started, we wanted to establish a "local action group" amongst the users. This group would consist of representatives from all levels at the primary health centres that could deal with difficulties regarding DHIS, share experiences and other issues concerning the project. It was especially emphasized that the field workers would be represented in the group.

The Special Officer did not like the idea of having field workers in the local action group, neither did the Medical Officers. Experiences from the workshops had also proved that the Medical Officers easily took charge of their groups, so to be sure the field workers would speak freely; we decided to establish two user groups. The reference group would exist only of Medical Officers that would meet once a month or every other month. This group was a symbolic group with the only intention to please the Special Officer and the paramedical staff.

A good relationship with the doctors was necessary because they were the ones who permit the field workers to spend time on training. The Medical Officers were in charge for the primary health centre, thus it was important that they had a positive attitude towards the project.

To sum up: the social hierarchy is very important in India and participation in systems development, training, support and other activities needs to be arranged in particular ways in order to be able to include the lower levels of the users.

7.4 Empirical work in the primary health centres

This section outlines some of my experiences from visiting the pilot primary health centres in Kuppam. First, the health centres is described. Then infrastructural issues and the health staffs are presented.

7.4.1 Description of the primary health centres

Figure 10: Mallanur primary health centre.

A total of nine primary health centres were chosen to be a part of the HISP pilot project. All primary health centres are approximately within one-hour drive from Kuppam town, most with frequent bus connections.

The primary health centres vary in size, from being moderately small to rather large in terms of both building and population coverage. The smallest primary health centre covers a population of about 8700 (census), has two sub-centres and no building. The largest primary health centre covers about 75,000 people, has 11 sub-centres and is an upgraded 24-hour primary health centre. The other primary health centres are spread between these two extremes, covering from 14 to 66 000 people. The AREA hospital is situated in Kuppam town and due to that many health workers live in Kuppam, registration of health data also takes place here.

7.4.2 Physical infrastructure and health staff

In order to place a computer in a health centre, you need a building. In order to use the computer, you need electricity. Due to different infrastructural constraints, we were only able to install computers in five of the nine primary health centres and two in AREA hospital. Table 3 presents an overview of the nine pilot primary health centres in Kuppam.

Primary health centre information	Mallanur	Gudupalle	Paipallem	Santhipuram	Rallabuduguru	Ramakuppam	Vijlapuram	Veernamalla	VKota
census population	37174	38376	66448	28049	24507	26865	14302	8714	74750
Population*	23486	30922	52560	22523	22421	24397	11300	6424	64000
Patients per day	100	150		120	120	250		50	
Building	Building under construction	Old small	Old	Good building	Good building	Good building	Poor facility	No building	Upgraded PHC
Opening hours		8am-6pm		9-13 & 16-18	9-13 & 16-18	24 hours			24 hours
No. of staff	6	17		14	6	16	10	7	38
No. of sub-centres	4	7	9	4	4	4	2	2	11
Sc facilities		1		1	0	1		0	
No. of villages		84		16					
Phone	No	No	Yes	No	Yes	No	No	No	Yes
Water	Yes	No		Yes	Yes	Yes	No	No	Yes
Power	7-11 & 13-17	No	6-12 & 12-6	6-12 & 12-6	Yes	24 hours	Yes	No	24 hours
Distance - Kuppam town	30 min by bus			20 min by bus	15 km, 30 min by bus	40 min by bus	60 min by bus	60 km	60 min by bus
Public transportation	Frequent buses	Frequent buses	Frequent buses	Frequent buses	Frequent buses	Frequent buses	1 bus daily	3 buses per day	Frequent buses

*Household population figures collected at primary health centres by HISP.

Table 3: Infrastructural profile for the primary health centres as of February 2002

In Chittoor district, only 15 of the 84 primary health centres have telephones that are working. The phones are mostly out of order due to unpaid bills by the District Medical and Health Officers office. In Kuppam, only three of the nine primary health centres have telephone lines, and none of them are connected to the Internet. If telephone lines are established, it will not be too difficult to get them "online". Most probably they will be connected to the Internet via modem in the first place, and maybe in the future an intranet can be established.

Since there is no network, exchange of data will be done by sending floppies to one of the primary health centres so that all the data could be collected in one central place. Only one of the primary health centres has a CD writer, so transferring large data files is a problem. As of February 2002 none of the primary health centres had a printer, but that was provided a few months later. Four printers were provided, and almost all have been out of use for several weeks. Different problems occurred; rat eating up printer, staff were not able to replace cartridge and power problems. Getting the necessary equipment is difficult when resources are scarce.

Electricity is highly treasured in rural areas. In Kuppam only two of the primary health centres have 24-hour electricity, and the other ones which have electricity, have switched power every alternating week. Almost every day there are up to four hours scheduled power cuts in rural areas, and very often there are unscheduled power cuts. This is a problem for those who register the data. Because of fieldwork, they might have specific times to do their work at the computer, and the timings may not match.

Health workers are not supported with any type of transportation, so they have to walk several kilometres every day. Only one primary health centre in Kuppam had an ambulance, and a few Medical Officers had a car they could use for home visits. Many of the health workers had a hard time coming to the training, due to transportation difficulties.

Because of different infrastructural problems, not all primary health centres could use the computer. At Veernamalla primary health centre there was no building, thus no computer. In Gudupalle and Mallanur, new buildings were under construction and the old facilities had no power. The computer designated to Mallanur primary health centre was placed in AREA hospital, where the staff received training. At Ramakuppam, VKota and Santhipuram primary health centres computers were installed and working fine. At Paipallem they could not use the computer for weeks, because they had to wait for a new system from the supplier. Meanwhile, the staff received training at AREA hospital. Three of the four fieldworkers at Rallabuduguru performed their data registration at Santhipuram primary health centre, while Medical Officer and Staff nurse were given training at Rallabuduguru.

During our visits to one primary health centre I was told that it was preferred to give birth at home in rural areas, usually at their mothers place.

At one primary health centre seven out of ten deliveries were complicated. Pregnant women came in at the last moment if they experienced difficulties during birth. I completely understood that the health staff thought having a brand new computer that hardly was in use strange (only two persons had received training so far), while they did not have an oxygen apparatus. Most primary health centres were simple and poorly equipped and had a great need for more medical equipment. Needles were apparently used several times, as I saw several needles in a glass for disinfection.

Getting a computer

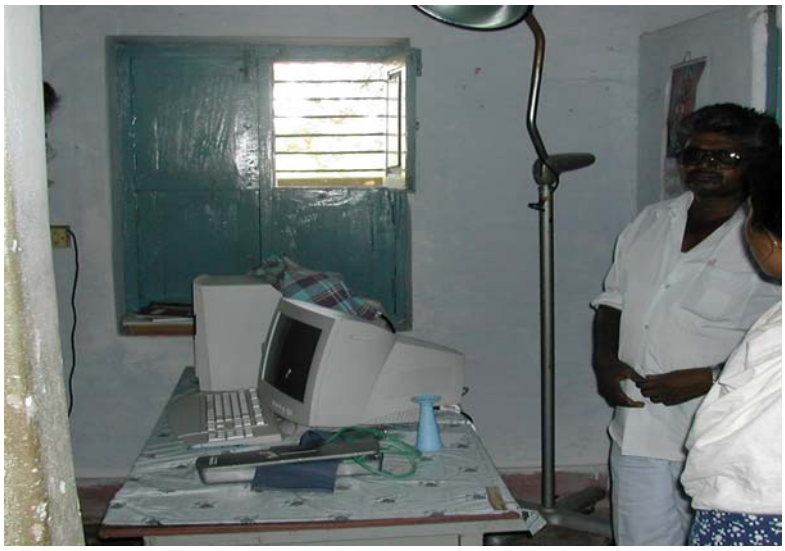

Figure 11: Computer in primary health centre

One of the primary health centres was under construction, and the old facility did not have electricity or any possibility to use the computer before the new building was ready. When a computer broke down in one of the functioning primary health centre, we wanted to exchange the computers temporarily, since it could not be used where it was. They were resistant to lend out the computer when they first had gotten it, hence there were two unused computers.

Several doctors wanted to have the computer placed in their office. None of them were able to use it, or really felt the need for using it; they mainly wanted it for prestige. One of the Medical Officers would not let the nurses use the computer in fear of getting blamed if something wrong happened with it.

Health staff

The number of health staff at the primary health centres vary according to their size, but usually it consist of a Medical Officer, Multipurpose Health Extension Officer (MPHEO), Auxiliary Nurse Midwife (OP ANM), a Pharmacist, a Lab attendant, a Multipurpose Health Assistant (male) and a

field worker. For all nine primary health centres there is a Community health officer.

The Multipurpose Health Workers (female) in India receives 2 years of training after leaving school, and most of them are very young, typically 18 years. The field worker belongs to one sub-centre that theoretically should cover about 5000 people, that means visiting 5 to 10 villages during a month. In practice, the population varies from four to eight thousand. Her main tasks are family welfare planning. Immunisations, ante natal care, family planning information, education activities and school health programs among others, are all basically done through the sub-centres. In addition to the community work, they also collect health data. The data collection takes a lot of time, and they use up to two hours a day outside working hours and one day every month at the primary health centre filling in different forms. The field workers have a busy day, and several we spoke to, expressed the time pressure.

The field worker is supposed to stay in one of the villages she works in, but this is not the case in many of the total 47 sub-centres covering the pilot area. A sub-centre is supposed to have a building; this is hardly the case in any of the centres. The field workers are given 60 Nkr extra in salary for using their own house as a sub-centre. The Multipurpose Health Assistant (male) is stationary at the sub-centre, mostly functioning as a janitor.

The supervisor for the primary health centre is supposed to check up the field workers job with spot tests, but this is rarely the case. The Multipurpose Health Extension Officer consolidates data collected at the primary health centre into one report. Last day of the month the Multipurpose Health Extension Officer attends a meeting at the head quarter in Chittoor, delivering the report.

Most of the Medical Officers are situated at the primary health centre, but at some primary health centres, doctors are not present every day. Two of the most common reasons are that the doctors live far away from the primary health centre, and additionally run their own private practice. Though the latter is not allowed, it is still done without too much being said and done about it. About 20% of the positions as a medical doctor at the primary health centres are at any time vacant, mostly because of the difficulties of keeping the doctors in a rural area.

7.5 Systems development in Kuppam

One of the aims of the project is to develop a district based health and management IS for collection, validation, analysis and use of information. In order to achieve this, interacting with the users and establishing routines are necessary. The design approach is evolutionary and incremental; the

application is constantly changed. The system development process in Kuppam consisted of several cyclical phases:

- Analyse existing data flows, routines and systems.
- Define information need.
- Develop and adjust the DHIS to the users.
- Adjust the training situation; both in classroom and context.

The following sub-sections will outline the process.

7.5.1 Analyse existing data flow, routines and systems

This section will describe how data is handled and reported in the health hierarchy in Chittoor. The health information flow in Andhra Pradesh was described in sub-section 6.2.1, so this section will focus on my findings in Kuppam.

The field worker fills out all her reports at the primary health centre. Last week of the month she gives it to the Multipurpose Health Extension Officer, which views and consolidates the data into one report. This job normally takes two days. Last day of the month the Multipurpose Health Extension Officer attends a meeting at the head quarter in Chittoor. The Statistical Officer gets the data before the meeting, and the Multipurpose Health Education Officer gets paid. The Statistical Officer consolidates the data for his district and sends it to the state (Hyderabad). The only feedback the health workers get is their salary or reprimands if they e.g. do not reach targets set (ref. section 8.1).

When HISP started in Kuppam, 30 – 40 existing data collection forms were in use. The goal was to reduce the number to one form at the sub-centre and one form at the primary health centres. The health worker would still carry a paper form in the field, and enter the data in the computer at the primary health centre.

During their survey in Kuppam, the HISP team had discovered several issues concerning the data handling:

- No analysis of data at sub-centre level.
- No analysis of data at primary health centre level except for immunization and tubectomy data.
- Analyzed data displayed as tables, no graphs used.

- No written feedback only verbal feedback in forms of "reprimands" at monthly sectorial meetings.

- Duplication of data. The same data are reported at the primary health centre and the sub-centre.

- Reporting forms have no standard format, which lead to handwritten reports.

- Lack of correlation between multiple reporting formats.

The pictures below illustrate one of the registration forms.

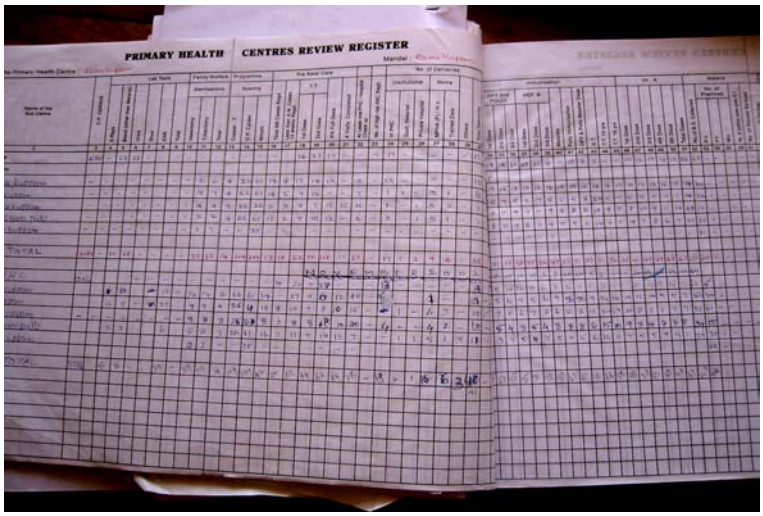

Figure 12: Primary health centres review register

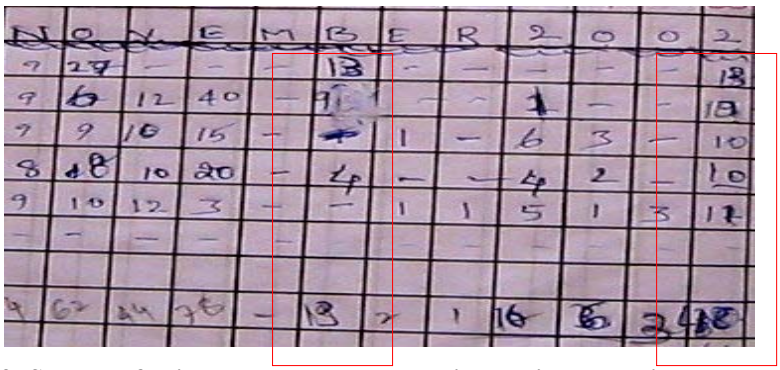

Figure 13: Sample of primary health centres review register showing erroneous and unreadable data. The number on the bottom line should be the sum of the column.

During our visits to the primary health centres we were allowed to study some of the data registration forms. I noticed several issues:

- Numbers were several times added wrong.

- Numbers had a habit of ending on zero, e.g. 10, 50, 60.

- Under-registration: fields in the form were left blank, without any explanation.

Just by looking at registration forms gave me an idea of the data handling.

Getting hold of population data

In addition to the census data, the field workers collect population data at the sub-centres, called the household register. We wanted to view the household data, but that was not an easy task. They were not kept in one central place, so we had to go around to the different primary health centres and get them ourselves. At the first primary health centre we visited the books and papers used for registration were kept in a closet, almost falling in your face when you opened the door. There was no system, and not even basic information was available. Only a few of the staff knew where different kind of information was, and simple data, e.g. population data, was not easily accessible. We were told that we had to wait for the field worker who was at work in a village, since she was the only one that possessed that kind of data. After several "she is coming tomorrow, come back then", we went to her house to collect the population figures. The figures were written on a piece of paper that she carried with her in the field. She could not quite understand our eagerness in getting it right away, but was very happy to invite us in for tea and cookies.

Challenges with the data registration

The over/under reporting is caused by several reasons, and one of them is migration. In the health care system in India all patients can jump levels and walk in patients are received without being referred from another level. Often women prefer to give birth at their mothers place. This information is not captured. Kuppam is situated close to two other states, Tamil Nadu and Karnataka. Rallabuduguru primary health centre is closely situated to Karnataka, and in serious cases, patients go to the hospital there. 10 of 40 pregnant women go to the hospital, and the rest prefer to give birth at home or at their mothers place. In the health system in India all patients can jump levels and walk in patients are received without a reference from another level. I was also told that it was common for people to go to a health centre in the town they were working in, which was often not the town they lived in. Some of the differences in number of patients across primary health centres are due to that some are very well equipped, and patients naturally prefer to go there. This will attract population belonging to other areas to the good primary health centres.

These findings show that there is need for improvement in the data handling and use. To investigate the quality of the health data collected further, I present a thorough analysis in chapter 8.

7.5.2 Define information need

One major problem was the lack of a cohesive joint collaboration between the different vertical health programs for registering health data. After working with the data elements, the HISP team introduced a Minimum dataset by early February 2001. A sample was given to the different primary health centres, making everybody aware of the redundancy problem and trying to find out how to gather the elements in one paper data collection form.

After several meetings with different instances there was still no coordination regarding the Minimum dataset, so HISP arranged a one-day workshop. The goal was to obtain feedback from the users in order to identify a Minimum dataset that was acceptable. The workshop was sponsored and founded by HISP and around 60 people participated. The participants consisted of Medical Officers, health supervisors, Community Health Officers and Multi Purpose Health Education Officers. The participants were divided into mixed groups to work out a Minimum dataset. Each group elected a moderator whom was requested not to be the doctor, but in all cases it was the doctor who took charge. The workshop was interactive and all groups presented their discussions and findings. The focus of the presentation was whether the terms on the Minimum dataset was easily understood, suggestions for alternative terms, whether there were any redundant terms, the format of the forms, whether targets were needed and finally if they had any other suggestions to contributing in making a better Minimum dataset. As a result of this workshop, the Minimum dataset started to take shape.

Indicators and reports had to be defined, and as a starting point the indicators for the Department of Family Welfare were entered into the DHIS software. Reports had not been defined because we were awaiting more information.

7.5.3 Develop and adjust the DHIS prototype to the users

When going to India in January 2002, we brought CDs received from South Africa containing the newest version of the DHIS. The software had to be adapted to fit the installed base (ref. sub-section 3.1.2). Some of the necessary changes were done by another student from UiO, which left India shortly before we arrived. In South Africa the hierarchy consists of facility, district, region, province and national level, while in India it is sub-centre, primary health centre, division, district, state and national level. The organizational units in the software had to be changed. Changing the names is easy, but the software is locked in that there are only five possible levels, and in India there are six. Placing sub-centres and primary health centres in the same units, calling it “PHC-adm” was done to solve this problem. Some users wanted an additional unit, village level, but that was not possible to do in that version of DHIS.

Although the DHIS software is made with the vision of being flexible, the "South African" context was, naturally, integrated in the software. The language was of course different. The software consists of a language module, but there are many embedded sentences and different names are used as system parameters.

Reports, data, forms and indicators had to be developed. First, the Minimum dataset was entered into the software and the prototype was immediately implemented. Indicators were initialised, and the health workers could start entering health data. Defining data elements, indicators and reports are still ongoing processes, which include multiple levels in the health sector.

7.5.4 The HISP training program

Figure 14: HISP training program

In order to make full use of the DHIS, the health workers need to receive training in using computers and data handling. The first HISP training program took place in the period January 16-18, 2002. Some of the health workers had barely been introduced to HISP and computers a few months earlier, but that was a brief session lasting only one day. The training program was arranged in Aptech computing centre, and approximately 40 health workers were invited, including a few health officers from Chittoor. The training program was arranged for the Pharmacists, field workers and Multi Purpose Health Education Officers. Four – five health workers were invited from each of the nine primary health centres. We also invited the Medical Officers so they would not feel inferior to the other health workers. The computers would predominately be used by the field workers and the Multi Purpose Health Education Officers, but the Medical Officers did not appreciate the idea of not taking part in the computer training. The training program had a tight schedule, which included a great number of different topics (Table 4).

No.	Date	Time	Session title	Speaker
1	16.01.02	10.00-10.30	Health Information Systems Project – Background, aims and objectives	Zubeeda
2	16.01.02	10.30-11.00	Health data, information and knowledge	Sundeep
3	16.01.02	11.30-12.00	Discussions and feedback	
4	16.01.02	12.00-13.00	Basics of computer hardware	Aptech
5	16.01.02	14.00-15.00	Practical exercise on hardware	Aptech
6	16.01.02	15.30-16.30	Basics of computer software – MS Office	Aptech
7	16.01.02	16.30-17.15	Discussions and feedback	Aptech
8	17.01.02	10.00-11.00	MS Word – Practical exercise	Aptech
9	17.01.02	11.15-12.15	MS Excel – Concepts	Aptech
10	17.01.02	12.15-13.15	MS Excel – Practical exercise	Aptech
11	17.01.02	14.15-15.15	MS Excel – Practical exercise	Aptech
12	17.01.02	15.30-16.00	Making graphs, tables and charts – tools	Aptech
13	17.01.02	16.15-17.15	Making graphs, tables and charts – practical exercises	Aptech
14	18.01.02	10.00-10.30	Health Information flows	Sundeep
15	18.01.02	10.30-11.30	HISP software – Overview	Aptech
16	18.01.02	12.00-13.00	Data Entry Module – Practical exercise	Aptech
17	18.01.02	14.00-14.30	How to add and delete an item – Practical Exercise.	Aptech
18	18.01.02	14.30-15.00	Data Dictionary – Practical Exercise	Zubeeda
19	18.01.02	15.30-16.00	Doing simple analysis	Aptech
20	18.01.02	16.00-17.00	Discussions, feedback, future plans	Zubeeda

Table 4: Training Program January 16-18, 2002

The first day of the training program started with an introduction to HISP, and its aims and objectives. Health data and collection in general were discussed, with the focus on how to turn information into data, and data into knowledge. All health workers seemed eager and interested, and problems were enlightened and discussed. Aptech used a long time introducing the computer and the health workers became inpatient. They wanted to start using the computer, not just hear about them. Some of the participants were eager and quickly sat down in front of the computers, while others were quite reserved and took place in the back. There were not enough computers for all, so two-three participants had to share one computer.

The second day of training was mostly dedicated to MS Office. In order to analyse data in DHIS, basic skills in MS Excel are required. The health staff wanted more practical training, so the theoretical lessons were kept at a minimum from this time. Using the mouse turned out to be a problematic gesture. Paintbrush was used to familiarize the operations and movements of the mouse. The participants were told to bring health data for a few months, which they would enter into the software the next day.

HISP and DHIS was the main topic the third and last day of the training program. The health workers entered the health data they had brought in a paper form into the software, which took quite some time. The paper form was in Telegu, while the computerized form was in English. Some of the health workers had problems reading the data elements in English. To make it easier to enter the data, the data elements in the DHIS software was in the

same order as the paper form they used when collecting data, and they got excited when they recognized it. The idea of having the participants working with their own data was to make them feel more familiar with the system.

Use of questionnaires

During my fieldwork we handed out two questionnaires to the health workers containing questions related to the DHIS and the training. First, both questionnaires are presented, and then related problems are outlined using quotations.

At the end of the training program we handed out a questionnaire for evaluating the training program to the participants (Table 5). They were given a choice of answering in English or their local language, Telegu.

Evaluation form for the three-day computer-training program conducted for medical officers and health workers from different PHCs at Kuppam, at Aptech from 16th January to 18th January 2001.
Name of participant Name of PHC 1. What are your views/attitudes about the three day training programme conducted at Aptech? 2. How did you feel before attending the training programme? 3. How did you feel after attending the training programme? 4. Do you think the training programme has given enough capacity to do your daily work on computers? 5. Suggestions/comments

Table 5: The evaluation form for the training program

About a month after the training program, we handed out a second questionnaire, which the trainers brought to the primary health centres. They handed it out to the health staff that came for training to capture those who actually used the computers and the DHIS software. The software had been in use for about a month, and the health workers had hopefully had a little time to digest some of the new changes and also reflect on the impact the computerization would have on their daily work routines. I felt this was a good opportunity to get as many as possible to give feedback, since the health workers were mostly on fieldwork, and not present at the primary health centres. The trainers stayed there the whole day, and the staff dropped in occasionally during their fieldwork to receive training.

Questionnaire for HISP PARTICIPANTS

This questionnaire is confidential, the names will be treated anonymously and only for HISP's use.

Name :
Age :
Gender :
Designation :
PHC / Sub-centre:

1. Did you participate in the three day training programme at Aptech?
2. What do you know about HISP?
3. How do you feel about using the system?
4. How has the training been so far?
5. What is your main difficulties?
6. In what way do you think this system will change your everyday work?
7. Do you feel you will benefit from using system?
8. If so, in what way?
9. Please, if you have any questions or comments let us know?

Table 6: Questionnaire for DHIS users

The first questionnaire (Table 5) gave us 29 answers, compared to 17 from the last one (Table 6). Seven persons attended both questionnaires, which mean that ten health workers who did not participate on the training program, but used the computer at the primary health centre, gave their answers. The first questionnaire had a good (85%) cover-up of the participants, since it was handed out and returned at the training. Some of the health workers could not attend all three days, and five were not present the last day. The officials who joined the training program did not take part of the evaluation.

Both questionnaires contained open-ended questions. This was done purposely in order to get as much feedback as possible.

Language problems

The trainers at Aptech who spoke Telegu translated the questionnaires while I entered the answers into the computer. While doing so I repeatedly had to ask if that was exactly what was written, because I saw three sentences on the sheet and only got "ok" as an answer. There were lots of "ok" and "good", common phrases that everybody knew, and I often felt that I missed the essence in the answers.

Some of the answers we received were hard to interpret, but at least this one is eager to learn:

"I am very eager to learn words"

- Field worker in evaluation of training program

Most of those who answered in English had a poor vocabulary, and another drawback was that that was also the case amongst the trainers. During the training program and in the evaluation we got complaints about the software being in English, e.g.:

> *"I am poor in English knowledge. I feel afraid to learn computers, but now I decided to learn computers."*
>
> - Field worker in evaluation of training program

It was clearly a problem amongst the users that the DHIS software was in English.

Motivation towards learning

A common feedback in the evaluation was that three days of training were not sufficient, and that they wanted more training. A majority regarded learning computers as very useful, though the reasons were not that clear. Although the schedule included too much to grasp in too short period, the feedback we got showed that we were able to reduce some of the fear of using the computer and motivate health workers in further use.

> *"Before I had a little touch with computers but I am afraid of working with mouse and have some fear to play with computers. Now I confidently working with computers and once again I got a chance to fresh up my previous knowledge."*
>
> - Field worker in evaluation of training program

> *"Before training programme, no idea about computers and no theoretical and practical knowledge. Not much interest in learning computers. After attending the training programme I felt very happy for attending the training programme because it was very interesting, encouraging and enthusiastic*."
>
> - Statistical officer at DM&HOs office, Chittoor in evaluation of training program

Having the health workers evaluate the program right after days of intensive training might have influenced some of the answers they gave:

> *"This 3 day training programme is very useful. Before this training programme I didn't know anything about computers. After this I know everything about computers."*
>
> - Field worker in evaluation of training program

"Before I didn't know computers. After completion of 3 days training I know very well about computers. I know how each part will work."

- Field worker in evaluation of training program

Most health workers came to the training without knowing anything about computers, but fortunately left with confidence:

"After training I got some confidence. If I continue to type and practice I can learn perfectly"

- Public Health Nurse in evaluation of training program

There was generally a high level of motivation amongst the participants. Several expressed that they wanted to spend more time using the computer, preferably on one each.

Many of the health workers had a hard time coming to the training, due to transportation difficulties. This is an issue that makes arranging training sessions difficult.

Evaluation of the training

Figure 15: Health workers evaluating the training program.

My experience was that the training program was too intensive, in that it covered too many topics in a limited period of time to fully comprehend the material, considering that most participants never had used a computer before. Aptech was a training centre educated in Microsoft tools, and the

trainers spent too much time on the "wonderful" benefits of Microsoft and taking about hardware and its history. The focus should have been mostly on DHIS and use of information. The health workers have busy days at work so getting permission to attend training for three days was a lot to ask. The budget year in India ends March 31, thus the months ahead are busy, containing several programs to attend. We had to match the timings the health staff could come with timings we could use the training centre. In sub-section 9.1.4 I will outline some suggestions for further training strategy.

7.5.5 Training at primary health centres

After the training program, Aptech trainers were placed in the health facilities to give training. Due to different problems, like power cuts, power generators not working and technical issues, only four primary health centres and AREA hospital had working systems. Health workers who belonged to a health centre without computer, received training in the neighbouring health centres or AREA hospital. The training was planned by the HISP team. First, to get familiar with using the mouse, the health workers practised Paint and typewriting for a few days. We wanted the health workers to start entering health data for the previous year, and this work were supposed to start after 1-2 weeks.

We went around observing the training, and it turned out to be necessary for us to supervise the training. After telling the trainers to concentrate on the software several times, some of the trainers still continued with MS Word or Paint. Our aim was that the health workers only would concentrate on the DHIS, in order to learn it well while the trainers were placed in the health centres to assist. We also noticed that the trainers entered the data while the health workers sat next to them and told them what to enter. Some of the health workers were eager to come for training, while others refused coming. At one primary health centre, health data for one year was entered in one day, while others used several weeks on this task.

Difficulties

The first obvious problem regarding the training was the limited power and the unscheduled power cuts. Health workers dropped in between field work, and could not use the computers. When the power was out, power generators were used, but only for a few hours at a time. At some health centres the computer was locked in. Our intention was that the computers would be accessible for all health staff all day, but some managers were afraid of theft and damages of the computer and locked it in. Some of the nurses refused to come for training, and from the feedback the trainers gave; the reason was fear of the computer. Some trainers also insinuated that the Medical Officer would not let the field workers go for training. We hoped that one effect of the training would be that we were able to identify

interested and skilled people to work as "IT people" at the health centre, that is to be in charge of the technical issues and maintenance of the computer.

Due to the difficulties above it is hard to know who answered the questionnaire and who did not; I do not know if it was only those who were interested in training, or a random sample of all health workers who were supposed to use the system. In the questionnaire we asked the health staff what their main difficulties were. Five of the 17 answers we got said "nothing", where four of the five health workers had attended the training program. Eight health workers said that due to little time because of their duty, learning computers was difficult. One said that her main difficulty was using the mouse and the keyboard, and they were all happy with the training.

DHIS benefit

16 persons thought they would benefit from using the system and the last one gave no answer. Various reasons were given, like planning, analyzing and monitoring of data. Creating reports, timesaving and correctly entering of data were other reasons for how they would benefit.

A field worker telling how she will benefit from using the system in the questionnaire:

> *"If we want any information we can switch on the computer and we can know about it"*
>
> - Field worker in questionnaire

Other reasons given:

> *"Time save, if I am not there also our seniors can see our monthly reports and there is no necessary in waiting for me. We can give the monthly reports when ever we want. We can enter the data correctly."*
>
> - Field worker in questionnaire

A Medical Officer telling how he will benefit from using the system in the questionnaire:

> *"I can monitor the work of the health workers more easily. Information can be available easily and paperwork will be reduced. Communication will be faster."*
>
> - Medical Officer in questionnaire

The last two reasons indicate that monitoring is one of the most valuable effects of the system. One of HISP's principles is that information should be

available for all health workers (access to information), the idea of monitoring health workers is evidently appreciated by some.

HISP knowledge

We also asked what the health workers knew about HISP in the questionnaire:

> *"This is very useful for us by introducing this. From this lot of writing work has been reduced. I feel happy to see this kind of system"*
>
> - Field worker in questionnaire

> *"1. To put the data, 2. Easy way, 3. Time saving"*
>
> - Field worker in questionnaire

> *"Due to this HISP for me easy to prepare PHC reports and all, second one is collection of reports from staff (MPHAs) is very easy."*
>
> - Public Health Nurse in questionnaire

> *"It is easy that every thing is in a single HISP programme. All programmes will be in a single sheet so that it will not be confused and we can know what are all going in PHC's."*
>
> - MHPS (m) in questionnaire

> *"HISP means Health Information System Programme, it is using the Information Technology and provide better and improved healthcare to the rural population. Also to reduce the paperwork of health workers and health supervisors."*
>
> - Medical Officer in questionnaire

All health workers filled in the questionnaire at training, so they had all been exposed to the software. From the feedback we got it seemed most had an idea about HISP objectives, other than just entering data into the computer.

During our visits to one of the primary health centres, we discovered that three of the four sub-centres actually reported their data to a different primary health centre, because it was closer to their home. The Medical Officer and Staff Nurse were the only ones receiving training, and there was not much to do for the trainer from Aptech. A more thorough analysis of number of health staff situated at the primary health centre should have been done before placing trainers at the health centres.

7.6 Current status of HISP in India

Status of HISP in India as of February 2003 – a summary:

- In October 2002, HISP and the government of Andhra Pradesh, Department of Health, came to a Memorandum of Understanding (MOU). The scope of the proposed MOU covers the following two projects components:

    1. The stabilization and institutionalization of Kuppam systems.

    2. The extension of the Kuppam systems to Madanapalle division in Chittoor district.

- Six of the nine primary health centres in Kuppam have a computer, the rest report at the other primary health centres.

- The graphical user interface of the DHIS software is now being translated into Telegu.

- The collaboration with the Indian Institute of Management Bangalore did not work out and ended in late 2002. HISP has now tied up with the Administrative Staff College of India (ASCI), a college situated in Hyderabad.

- All routine reports are generated from the software in four primary health centres, and the sub-centre and primary health centre use one form each.

- The HISP India team has extended to 11 persons.

- Eight field workers had in January 2003 a presentation in Hyderabad presenting their own analysis of the health data.

- Medical Officers have started to ask for training in the DHIS.

The above issues clearly indicate a progress in Kuppam and Andhra Pradesh.

7.7 Summary

This chapter has described my empirical work within HISP in Andhra Pradesh. I experienced that systems development is a complex task in the Indian health sector. Poor infrastructure slowed down both the installation of the computers and the training process in various ways. The political and

social structures influenced the process of systems development. Several aspects of the data handling indicated a need for improvements in the management of data.

The process of adapting and implementing the DHIS in Kuppam, the site for the research, has been outlined, and in the following section I will study the quality of the health data collected.

8 Analysis of Health Data from the Pilot Area using the DHIS

This chapter will highlight some of the findings and problems discussed in the previous chapter. The first data from the pilot area has been entered into the DHIS software and this chapter presents a quantitative analysis in combination with observations and interviews. This analysis has made it possible to assess the "official" against the reality on the ground. The analysis is part of a report prepared in collaboration with another student of the HISP India team.

8.1 Analysis of health data from Kuppam

The health data is mainly collected from the nine primary health centres and their respective sub-centres. Census data, and in some cases household data, from 2001 is used to calculate indicators.

The section is divided into two areas. First, we look at some important performance indicators used by the Department of Family Welfare. Second, a grass-root level analysis is done of the data collected. In this way we try to develop implications for understanding health data quality in Kuppam. Suggestions for required actions for improvement of health data reporting in Kuppam and Chittoor will be given in Chapter 9.

As described in section 6.2.1, most of the primary health care data is collected at the lowest level in the health hierarchy, the sub-centres. At this level, data is not stored, maintained or analyzed in any systematic way. Data is aggregated at each level and cannot be traced systematically back to its origin. This is a general problem and we will focus on how data can be disaggregated by using an IS like DHIS.

Population figures

We also emphasize problems with the population figures. There are three different sources that can be used when calculating indicators in Chittoor:

- The census: official census for India, updated every 10 years through surveys.

- The household register: population data collected by health workers at the sub-centres. Collected by the HISP team at the primary health centres for the purpose of this analysis.

- The Multipurpose Household Survey register: a population database conducted by revenue officials.

The census data reports a population about 15% higher than the other two. All of the three sources report different figures, and the census is regarded as the most accurate source. The household register is used to set targets; the larger population, the greater workload. The Multipurpose Household Survey population is used for allocating funding to the different revenue zones; the larger population, the more funding. The Multipurpose Household Survey also includes people that have emigrated and want to remain in the jurisdiction in order to maintain their right to vote. The health workers only count those who actually live there. These issues are undoubtedly influencing the population figures, and the quality control of the population figures must improve. We have tried to find several sources on the Internet, but there is almost only data for state level available.

Targets

There are two different targets used in Chittoor:

- Objective targets: targets set according to population, e.g. children up for immunization; the target for "fully immunized infants" is set based on number of live births.

- "Work-harder" targets: targets originally set by the Department of Family Welfare for the district (Chittoor). The District Collector distributes the targets to the primary health centres and raises the targets to make sure they are reached. Sometimes the Joint Collector and Medical Officers also raise the targets. When the sub-centres finally get these targets they are often too high to reach.

8.1.1 Indicators

Below we present the two types of reporting used for measuring the health status in Chittoor; one representing the Family and Welfare Indicators, the other is called the HMIS (Health Management Information System) indicators. Family and Welfare targets are estimated based on surveys and previous year's registration. These indicators represent what the institutions (sub-centres, primary health centres, districts etc) are supposed to achieve according to the population in the designated area. HMIS indicators are performance driven, and set administratively by state and district officials. These targets embody the "work-harder" targets described above.

Family Welfare indicators

In Table 7 we have filled in the actual numbers for Kuppam pilot area (average for all nine primary health centres from January 2001 to December 2001) and compared them with the parameters for preparing micro level action plans (targets) set by the Department of Family Welfare in Hyderabad.

SI. No	Indicator name	Actual	Target
1	No of village level ANC/Immunizations clinics		As pr local sub-centre requirements
2	a) Ante Natal Cases registered (Total)	17.68	25 AN Cases /1000 Pop
	b) Ante Natal Cases registered less than 12 weeks	8.37	25 AN Cases /1000 Pop
	c) Total no of high risk pregnant women treated		3.75 AN Cases /1000 Pop
3	a) No of pregnant women who had 3 check-ups	25.11	25 AN Cases /1000 Pop
	b) No of pregnant women counselled for nutrition		25 AN Cases /1000 Pop
	c) No of pregnant women given 2 doses of TT	16.26	25 AN Cases /1000 Pop
	d) No of pregnant women given 100 IFA tablets	15.11	25 AN Cases /1000 Pop
4	Total no of deliveries	16.63	22.5 Deliveries /1000 Pop
	a) Deliveries at primary health centres	[1]2.51	3 Deliveries / 1000 Pop
	b) Deliveries at other Govt hospitals	2.63	6 Deliveries / 1000 Pop
	c) Deliveries at private clinics	1.02	5 Deliveries / 1000 Pop
5	a) No of women who had 3 post-natal check-ups	19.71	22.5 PN Women / 1000 Pop
	b) Number of RTI/STI cases treated/referred among women	11.87	3.17 cases / 1000 Pop
6	Maternal Deaths recorded	[2] 7.07	1.54 / 1000 live births
7	No of live births (total)	93.33	95%-97% of the deliveries
8	a) No of high risk new born treated	0.52	10% of the new born
	b) No of parents counselled for low births weight babies		37.7% of the parents of the new born
9	Children given immunization (below 1 year - Full immunization)	16.45	20 Infants / 1000 Pop
10	a) Measles cases treated	1.20	(blank)
	b) ARI cases treated		31% of the 0-5 yrs. Children
	c) Diarrhoea cases treated	2.69	25% of the 0-5 yrs. Children
11	a) Child deaths recorded infants	2.62	66/1000 live births
	b) Child deaths recorded - children (1-5 years)	1.21	21/1000 live births
12	a) Number of marriages recorded	2.74	8 / 1000 Pop
	b) Marriages where age of wife is above 18 years	0.58	3 / 1000 Pop
13	a) No of sterilization	9.56	12 / 1000 Pop

[1] Data for both sub-center and PHC

[2] High number because of outliers and possible typing errors. Eliminating outliers indicates Maternal Deaths recorded to 1.44 pr thousand live births

	b) No of male sterilization	0.03	2 / 1000 Pop
14	a) IUD insertions	6.12	4.62 / 1000 Pop
	b) Oral pills users	[3] 3.42	3.96 / 1000 Pop
	c) Nirodh users	[4] 8.89	9.25 / 1000 Pop
15	No of high risk maternal cases referred to FRUs		3.75 / 1000 Pop
16	No of high risk children referred to FRUs		2 / 1000 Pop
17	High risk pregnant women	5.99	15% of the AN Cases
18	Institutional deliveries (Targets)	37.03	60% of the total deliveries
19	Deliveries at primary health centres	[5] 40.71	21% of the institutional deliveries
20	Deliveries at other Govt Hospitals	42.75	42% of the institutional deliveries
21	Deliveries at private clinics	16.54	37% of the institutional deliveries
22	Live Births	[93.33]	95% to 97% of the Deliveries
23	Still births	1.85	3%-5% of Deliveries
24	High Risk New Born		10% of the New Born
25	Low birth weight babies	8.10	37.7% of the New Born
26	Marriages where age of wife is under 18 years (Target)	[6] 21.23	60% of total marriages
27	Maternal Cases referred to FRUs		15% of the AN cases (High risk cases)
28	Children treated at FRUs		10% of the live births (High risk New Born)
29	0 - 3 years children	7.04	8% of the population
30	0 - 5 years children	11.44	13% of the population

Table 7: Family Welfare indicators, January 2001 to December 2002

Generally, referring to Table 7, the actual calculated indicators are lower than the targets set, and when comparing across the indicators other there are several contradictions. E.g. comparing 'total numbers of deliveries' (16.63 pr.1000/pop) with 'number of women who had three check-ups' (25.11 pr. 1000/pop), we see that total numbers of deliveries are much lower than women who had three check-ups. If this were the actual case, there must have been a large amount of abortions or unregistered births. Another contradiction appears when adding live births (93.33) with still births (1.85). Almost 5% of the births are unaccounted for; in this case 256 births are unregistered. In order to examine these contradictions and indicators further, one need to be able to disaggregate data to a grass-root facility level. In sub-s-section 8.1.2 we provide such an analysis.

Two more comments to Table 7:

- The indicators 4a, b and c have the same names as indicator 19, 20 and 21. Although the former displays in pr 1000 and the latter in

[3] Assuming one cycle every month, so number is divided with 12
[4] Same as footnote 3
[5] Data for both sub-center and PHC
[6] Original indicator name is 'Marriages where age of wife is **over** 18 year'. Only available data element was '**under'**

percentage, it can cause confusion.

- In the cases where the actual number is blank, we were not able to find data elements to calculate indicators in DHIS. Either the HISP team has not been aware of these indicators, or they are obsolete and were left out when defining the Minimum dataset.

HMIS indicators

An approach used to evaluate the health service in Chittoor, is grading the primary health centres according to targets set. The grading system is binary, and as long as the figures are above the targets, they receive 10 points, if not they get 0. The numbers are then summarised, and if the sum is above a certain number, they get the best grade (A). The other grades given are B and C. The results are presented in public, through the District Collector's monthly review meting where all the Medical Officers of the district are present in front of the District Collector. The "good" primary health centres are praised, while the "bad" ones are reprimanded. The raw data for the HMIS indicators are registered and calculated on a weekly basis. They are monitored by the District Collector every week who then again present the data to the Chief Minister every 15th day through videoconference meetings.

Table 8 presents the HMIS indicators for eight of the nine primary health centres in Kuppam.

Name of The Sector Kuppam Sector Reporting for the Month nov-2002

Sl.No	Name of the PHC	OP census	Lab Test	Sterilisations	Deliveries	AN Registration	Fully Immunisations	BS Collection	No of B.S Positives	No. Of Deaths due To Malaria	T.B Sputum Collection	TB Under Treatment	TB cured	No. Of GE Deaths	Catract Cases	Score	Grade
	Target	1800	540	40	25	73	200	240	15	0	45	40	4	0	30		
1	Gudupalle	160	0	8	11	15	9	30			0				16	20	C
2	Mallanur	75	0	7	11	8	10	25			0					20	C
3	Veernamalla	148	0	11	26	18	16	50			0					30	C
4	Paipalem	502	45	37	76	75	50	531			0				10	50	B
5	Rallabuduguru	2833	546	21	43	30	45	340			0				49	70	B
6	Ramakuppam	5067	281	31	27	7	25	297			0	9			41	60	B
7	Santhipuram	92407	590	23	46	45	49	335			28					60	B
8	V Kota	7574	0	64	108	112	52	359			13	21	1		42	80	B

Table 8: HMIS indicators

The targets are the same for all primary health centres. Workload, size of population etc. are not taken into account when setting the targets; so how are the targets set? They are, as said, set by health officials and bureaucrats, but on what premises? It is our understanding that only health officials and the local administration in the district follow up sterilization achievements for the HMIS indicators. There is a need, we believe, for these targets to be analyzed closely in relation to the local achievements. More realistic targets can thus be calculated through a participatory process involving local staff. In this way, the targets would be seen as achievable, and serve as a point of motivation. Currently, the general feeling at the facilities towards these targets is that they "are merely numbers that can never be achieved anyway".

The data is not converted into indicators and are therefore not comparable, since the size of population varies significantly across health facilities. The data cannot systematically be traced down to sub-centre level to find out where there is need for improvement in the health status. Grading might to some extent improve performance for the primary health centres and sub-centres by forcing health staff to work harder, but it might as well lead to manipulation of numbers. However, grading does not help us understand the problems at grass-root level.

8.1.2 Data analysis

This section will describe the analysis done for health data collected for the year of 2001 for the Kuppam pilot area. This data was collected using "Form 6" (Family Welfare form for collecting mother and child health data), the field workers' diary and broadsheets at the primary health centre level. Computer professionals and field workers in collaboration did the data entry part from April to July 2002. The objectives of this analysis are to show how it is possible to improve the health standard by using indicators that are drilled down to the sub-centre level.

The analysis is dived into five key areas: Lab tests, fully immunized, ante natal care, maternal and infant mortality rate, and life cycle events. These are important indicators in the area and are used extensively in family welfare planning. Almost all of the health facilities show either discrepancies among the data collected or data that does not match with reality. At this point we are only able to indicate possible questions regarding the issues we present. These questions need to be systematically investigated and addressed to improve the health in the district.

Lab tests vs. patients seen

Name of primary health centre	All lab test other than Malaria test	Malaria blood smear collected	Total headcount (OP, ANC, IMM, etc)	Population data	Total headcount/ Population data
Mallanur			38,731	37,174	1.042
Paipalem			26,570	66,448	0.400
Rallabuduguru		820	15,896	24,507	0.649
Ramakuppam	0		51,211	26,865	1.906
Santhipuram	922	1,086	30,869	50,885	0.607
V Kota	3,900		87,190	74,750	1.166
Veernamalla			6,925	8,714	0.795
Vijlapuram			27,804	14,302	1.944
Gudupalle	1,408		26,156	38,376	0.682

Table 9: Comparison of outpatients – lab tests – Malaria blood smear collected

There should be some correlation between number of lab tests carried out and number of patients seen by the doctor (total headcount). As we can see, there is no correlation and lots of missing data. We cannot make a conclusion with such a small sample of data, other than that the registration needs to improve dramatically!

Not being able to say anything about these correlations, we looked at the population data to compare with the Total Headcount. The last column clearly point towards a lack of correlation. The huge differences can be caused by immigration of people and through erroneous reporting. The idea is that all primary health centres should have the same standard and provide the same services, but this is not the case amongst the primary health centres in Kuppam. Good quality primary health centres are naturally used more than poor ones, but the registration procedures are not able to capture this. The workload will therefore vary heavily on the different primary health centres, and that should be kept in mind when allocating resources.

The last column in Table 9 indicates the number of visits pr capita pr year at the primary health centre. We see that the ratio is quite low; and average of about one visit pr year pr person. We also noted the quite large difference in the ratio between the primary health centres, varying between 0.4 and 2.

Fully immunized

An infant (from birth to one year) is categorized as “fully immunized” as soon as she or he has received the vaccines BCG, OPV1-3, DPT1-3 and measles. ‘Infants given vitamin A’ is newly introduced, and cannot be taken into account, since data is lacking. BCG is given right after birth, OPV1-3 and DPT1-3 the following months and finally the measles vaccine is given at ninth month of age (Table 10).

AGE	VACCINATION		
Birth	BCG OPV 0	Tuberculosis Oral Polio Vaccine (Zero dose)	
6 weeks	OPV 1 DPT 1	Oral Polio Vaccine (1st dose) Diphtheria Whooping Cough Tetanus	1st combined dose
10 weeks	OPV 2 DPT 2	Oral Polio Vaccine (2nd dose) Diphtheria Whooping Cough Tetanus	2nd combined dose
14 weeks	OPV 3 DPT 3	Oral Polio Vaccine (3rd dose) Diphtheria Whooping Cough Tetanus	3rd combined dose
9 months	Measles		

Table 10: Immunization schedule for infants (WHO)

This should give a few logical facts:

1. The number of 'live births' conducted and 'BCG vaccine given' should have roughly the same numbers.

2. OPV1 and DPT1 are generally given at the same time and we should therefore theoretically see a correlation between these numbers (the same is of course the case with OPV2, DPT2, OPV3 and DPT3).

3. Measles vaccine should be lower than all the other vaccines given, because of child deaths.

4. When a child gets the last vaccine, measles, it is considered to be fully immunized. Common practice among most of the health assistants is to tick of 'fully immunized' at the same time as the last vaccine (measles) is given. This does not follow the logic naturally, as the infant can receive the measles vaccine and not any of the other vaccines, and thus not be fully immunized according to the definition.

Finally, the overall picture should result in a small decrease along the time span the vaccines are given. Infants given full immunization (and measles) should have the lowest number on the graph.

Figure 16 demonstrates that the logical path described above does not match with the registered data. In more detail, 'Number of live births' is the lowest number on the graph, while at the same time, registered BCG vaccines are almost a thousand more than the number of live births. DPT1 and OPV1 do not correlate at all, and from OPV-1 to fully immunized, the numbers actually increase. We also see quite clearly that the numbers do not match

the estimates and targets calculated using census data from 2001. The actual numbers vary from 15 to 28 percentages below the estimated targets.

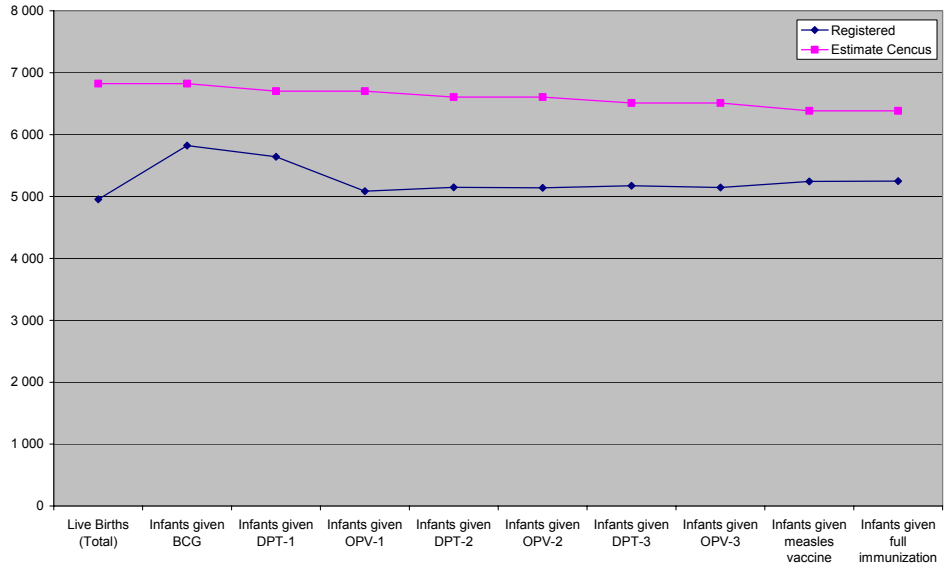

Figure 16: All immunization vaccines for infants, leading to fully immunized infants. The estimates are calculated using the census 2001 and the targets given in Table 7.

Furthermore, comparing number of infants from the 2001 census with BCG vaccines given, we get BCG coverage of 98% (except Gudupalle). This is a good coverage, which might indicate that BCG is a prioritized vaccine among both health workers and mothers. Calculated by using live births as denominator we get BCG coverage of 118%. This indicates that women that give birth are not reached by the health workers. BCG is, besides reflecting the proportion of children who are protected against the severe forms of tuberculosis during the first year of life also an indicator of access to health services (WHO). Could BCG be over-reported to show that health service access is available at the particular sub-centre?

Using the census, we see who receive health services, and in this case only 70% of the live births are registered. Thus, we see that 30% are not reached by the health service. These data are also reflected in the other figures.

Data regarding the path to full immunization can also indicate that the registered data are wrong due to under-reporting, or estimates and targets are simply set to high by the health department. The reason may also be that the health workers are not doing their job properly, or lack of DPT and OPV vaccine. BCG and measles are rarely out of stock.

Comparing the numbers of registered births for the whole year with estimated infants in the area from the 2001 census, should give a pinpoint on the immunization coverage in Kuppam. The percentage, using census data, is calculated with the formula given in Equation 1. To compare the census' 'infants less then 1 year' data with what the health workers actually register, we use 'live births' as a denominator. Though one cannot compare

these directly (because it is nine months between live births and fully immunized) it still gives an idea on the difference of using two population sources (if one assumes an equal flow of live births over the years). The graph does not give a totally correct picture of the coverage, for that one would need a complex name-based system to follow each individual infant. But it does give an overview of the situation, and that is what we want in the first run.

$$\%\,\text{coverage} = \frac{\sum(\text{Registered fully immunised})}{\sum(\text{Infants less then 1 year from census})} \times 100$$

Equation 1: Calculation of immunization coverage

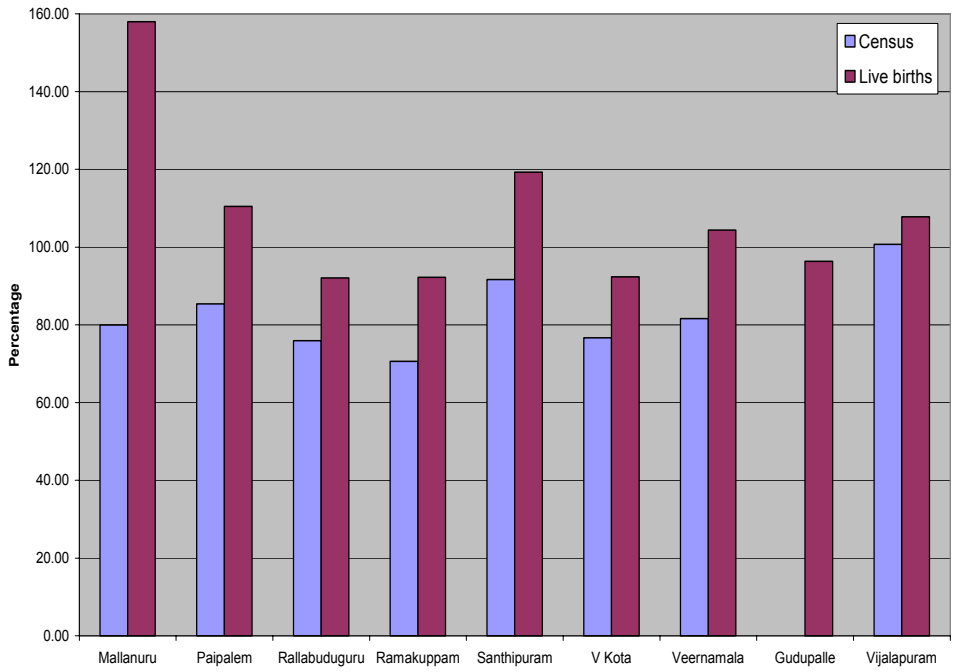

Figure 17: Immunization coverage at primary health centres, no census data available for Gudupalle

Figure 17 illustrates the immunization coverage across the nine primary health centres in the Kuppam area. We have used two different sources as a denominator, the census data and live births. Calculated for all primary health centres, using the census data, the coverage is average 83%, which is fractionally below the 85% WHO recommends. Paipalem, Santhipuram and Vijlapuram have coverage above 85% (using census data), while the other five are well below the recommended coverage.

The difference between using census and registered live births are clearly demonstrated. Every primary health centre is well above 90% coverage when using 'live births', for one year, as denominator. Some of the primary health centres are also well above 100%, e.g. Mallanur, indicating either over-reporting of fully immunized infants or live births not registered. The

last indication (live births not registered) would be most likely when we compare with the coverage calculated using the census data.

Again it comes down to what numbers that are used as denominators. We have seen how much difference it makes by using two sources, census data and registration done by the field workers (service given). The census data is known for being the most reliable source, and what we use to calculate the health service coverage, but one cannot simply rule out other sources. Besides, census data have not been used until recently for comparison and making indicators within primary health care, which demonstrate the irregularity in the numbers available at local level.

Ante natal care – check-ups

Pregnant women are registered and are offered the possibility to go to check-ups during the pregnancy, to make sure they are in good health etc. We looked at the number of women given 1st, 2nd and 3rd check-up, TT-1, TT-2 and numbers of deliveries conducted. TT-1 (Tetanus toxoid) should correspond to the 1st check-up and TT-2 to the 2nd check-up, since the vaccines habitually are given at the same visit to the health centre.

First, we looked at data for the whole pilot area (Figure 18). The number of ante natal care (i.e. pregnant women) check-up, increases for each check-up, even though one are not supposed to receive the 2nd check-up without having the 1st check-up. In the case of ante natal care check-ups, there is an increase of 35% from the 1st check-up to the 3rd for the whole pilot district. This can indicate that the data is wrong, or that 4th, 5th and so forth are registered as the 2nd and 3rd check-up, indicating a misunderstanding amongst some of the health workers in using the data-elements.

In Figure 19 we look at all the primary health centres individually. There are huge discrepancies between the different data elements, and we easily see that it is particularly one primary health centre that stands out, both in correspondence across the two check-ups, but also the increase in the ante natal care check-up cases.

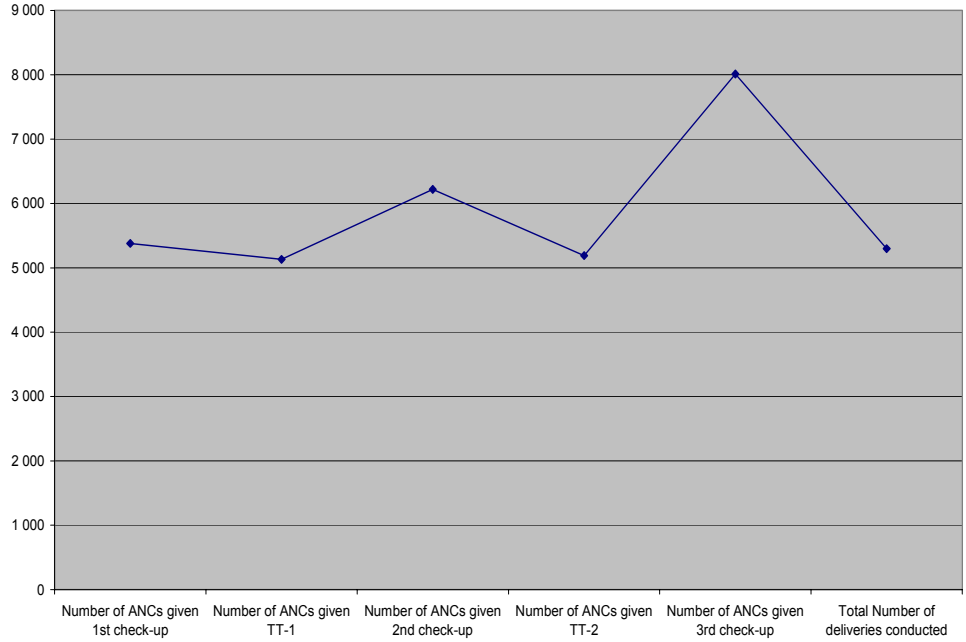

Figure 18: Total for all nine primary health centres

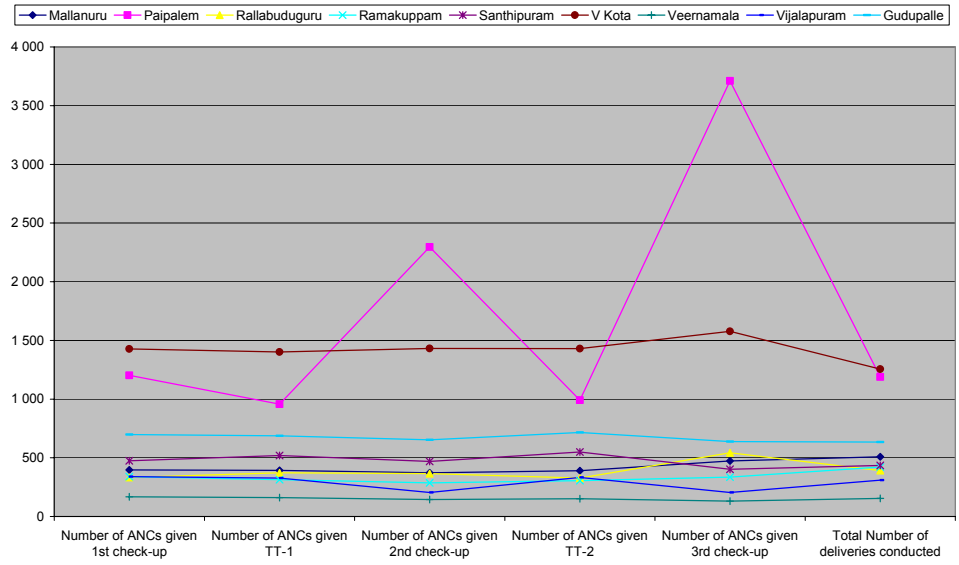

Figure 19: Primary health centre vice view of ante natal care 1st to 3rd check-up with TT and total deliveries for all nine primary health centres in the pilot area.

Paipalem primary health centre's numbers for the 3rd check-up is 68% higher than the 1st check-up! Why is it like this, and why is it only Paipalem that has such abnormal data? One reason might be that field workers are giving ante natal care check-up, while TT is given at the primary health centre. The numbers should normally correlate with each other, but having data from two different sources, it is more likely that errors will show up. Another reason might be that ante natal care check-up is not done three times by the field worker, but several times depending on the primary health

centre. If the reason is because of misunderstanding the data-elements, field workers at Paipalem primary health centre, need to be informed.

The paper-based collection are forwarded up in the health system and aggregated at each level. The ability to detect or follow up localized anomalies is lost as aggregation obscures such discrepancies. Using an IS like DHIS that can perform analysis at a disaggregated level, can help to easily locate such abnormal data.

We need to check these abnormalities further to find out where the discrepancies are, so we looked at the lowest level, the sub-centres of Paipalem. Figure 20 reveal that it is especially Kuppam West and Cheelapalle that causes the abnormalities. If we know in which sub-centres the abnormal data is collected, it is easy to find which field worker has collected the data and what might be the problem. Looking at the data in this way, anyone who uses the system are able to see where the discrepancies are and know where to take required action.

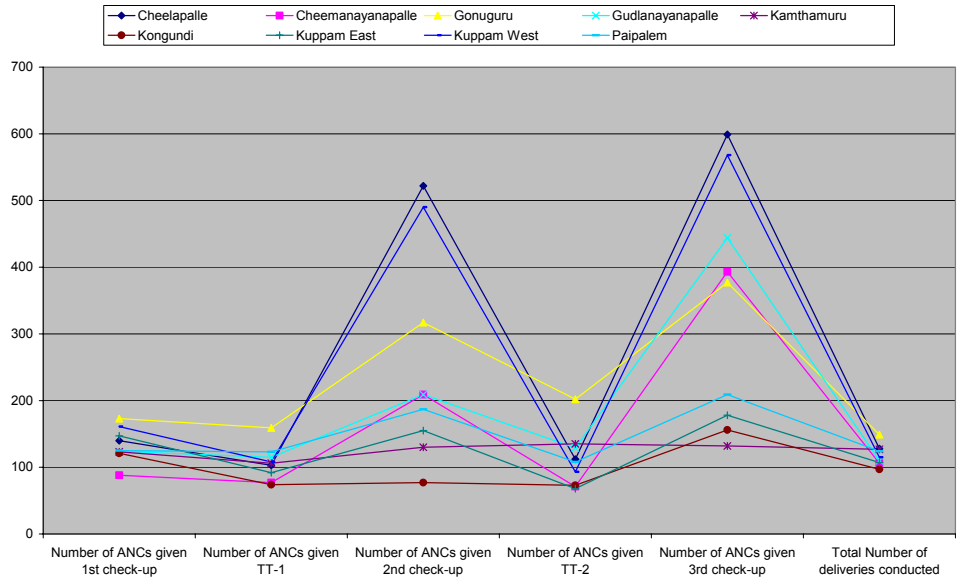

Figure 20: Ante natal care check-up cases for Paipalem sub-centres.

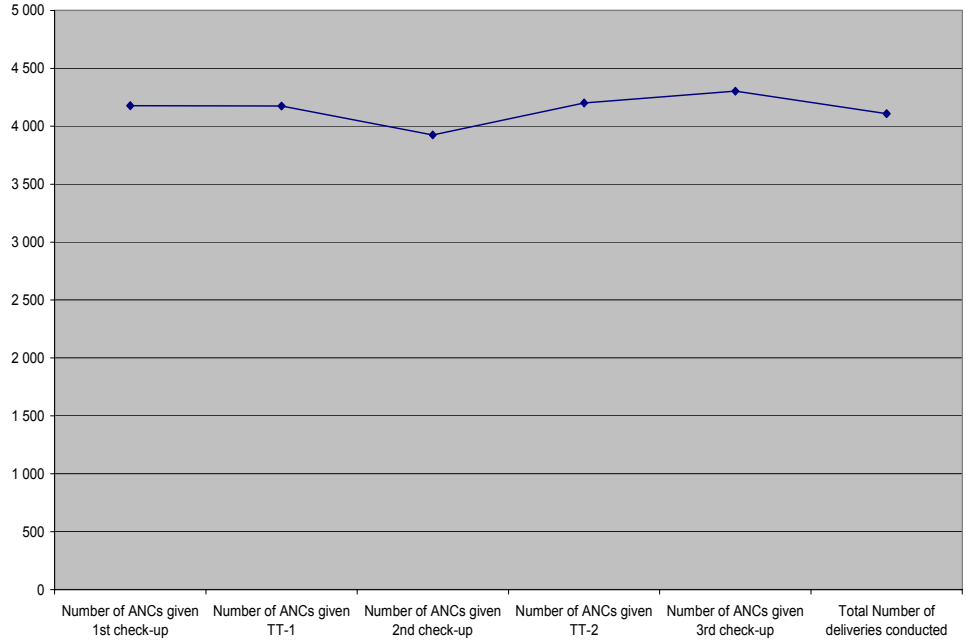

Figure 21: Ante natal care check-up (ANC) cases of all primary health centres except Paipalem.

Leaving out Paipalem (Figure 21) the diagram turns out much more probable!

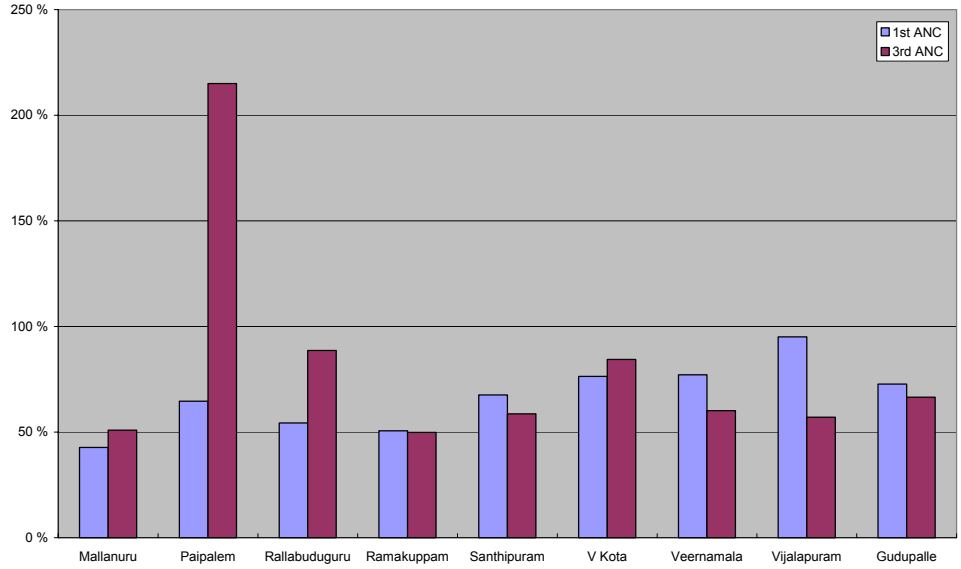

Figure 22: Ante natal coverage for all primary health centres.

Figure 22 illustrates the ante natal coverage for the primary health centres in Kuppam. The state of Andhra Pradesh struggle for a high coverage, as it affects the infant and maternal mortality. The high percentage for Paipalem is already described. Generally, the coverage in the area is low.

Maternal and infant mortality rate - institutional vs. home deliveries

One of the goals is to minimize number of home deliveries and correspondingly increase number of institutional deliveries. The high rates of maternal and infant mortality influence these performance indicators. If the indicators show that maternal mortality and infant mortality rates are low in the area, then institutional deliveries should have a high percentage, and vice versa. If institutional deliveries are low we should see a high maternal and infant mortality rate. However, this is not the case in Kuppam. Maternal and infant mortality rates for Kuppam give an impression of being low, but this is because of poor registration. We found that out of the 47 sub-centres, only 19 have registered anything. For rural areas in Andhra Pradesh, the infant mortality rate was 70 in 1997 (census 2001). Figure 23 illustrates that home deliveries are reported to be 64% of all deliveries, a percentage that indicates a higher maternal and infant mortality rate than what is reported. The reason for the high home delivery percentage might also be that some of the institutional deliveries (at private clinics) are not reported. Note here that only 70% of all live births are registered, as pointed out above.

Why are maternal and infant mortality deaths not reported? The reason is that the primary health centre and sub-centres are put in "a bad light" if they report high maternal and infant deaths. At monthly district meetings, medical doctors are under pressure to keep these rates down to put the district in the sunshine, so to speak.

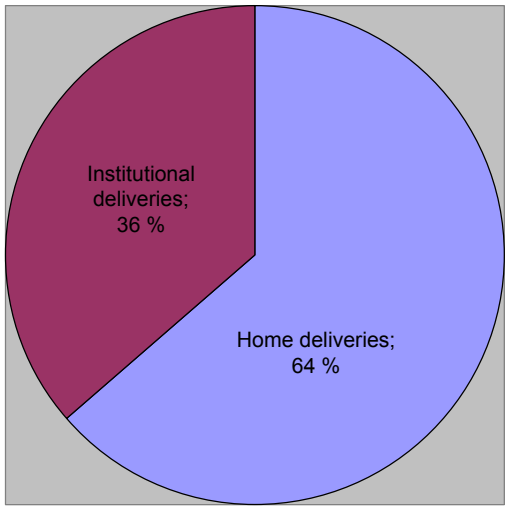

Figure 23: Institutional deliveries vs. home deliveries

Correlation in life cycle events

In this final section, we would like to illustrate variations across important life cycle events. The cycle uses four data-elements that all register infants

less than one year. The elements and a short description of them are given below.

- *Ante natal cases registered (total)*: This is the total number of pregnant women registered in the area. It should be the highest number compared to the other data-elements described below.

- *Total number of deliveries*: This is the total number of registered deliveries conducted, including live and still births.

- *Number of infants given BCG*: This is the number of infants given the BCG vaccine. The vaccine is given just after births, and therefore it also serves at a proxy for the number of infants having access to the health facility. The number should then naturally be equal to 'live births'.

- *Number of infants given Measles*: Measles is given as the last and final vaccine (for the child to achieve full immunization status) in the 9th month. This serves as a proxy for health facility access after nine months.

The four following figures below present these data-elements. First a total and estimate of all the primary health centres in the pilot area. Then a down-scale of the total showing all the primary health centres separately are done. Finally, to drill it down to grass-root level, we present the data for some sub-centres. The estimates in Figure 24 are calculated using census data, household and the targets given in Table 8.

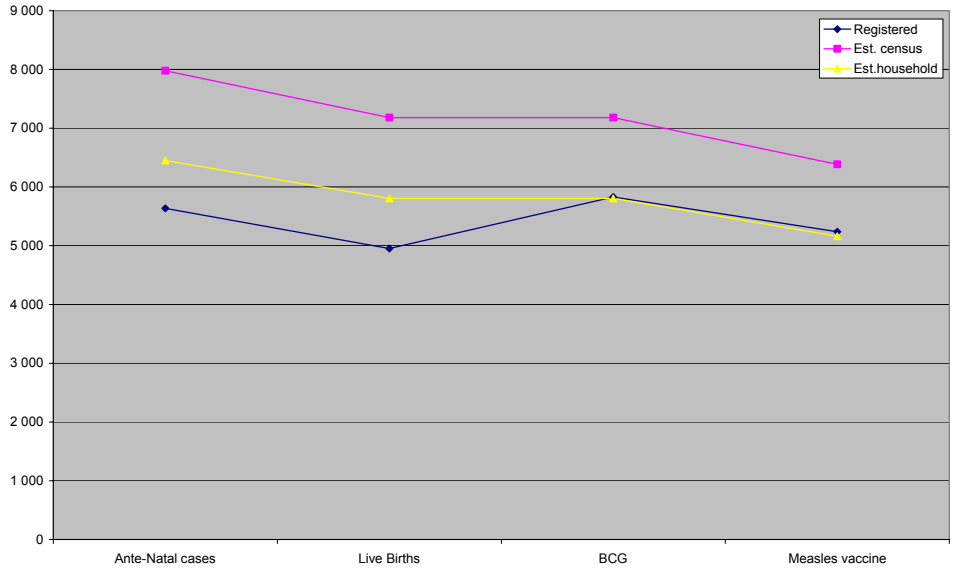

Figure 24: Variations in registered cases of life cycle events, total for all nine primary health centres. The estimates are calculated using the targets given in Table 7.

Figure 24 demonstrates that the difference between registered and estimated vary between 20 and 30 percent for all the four elements. There is only coverage of 70 to 80 percent compared to the estimated numbers. This discrepancy can be explained in different ways:

- 20 - 30% are not reached by the health service. There can be several reasons for this; the health workers may not be doing their job properly or their workload is too high. It can also be lack of resources available to do the required job, or that the community do not see the importance of receiving health services.

- The population numbers are incorrect. As already mentioned, the census data is expected to be the most reliable source, it is the official numbers reported throughout India and is done independent of district and state officials. The population numbers reported by the health workers themselves (household register) are much lower than the census data. The main argument against using the household register is that it can be biased. The higher number the health worker reports, the more work she has to do because indicators and especially targets are set higher. Naturally household numbers match much better with the actual reported number because they come from the same source.

Finally, it might be a combination of the above or other reasons that we are not aware of. Another interesting point is the symmetrical linear drop from "Ante natal cases" to "Live births", then the asymmetry from "Live Births" to "BCG" and finally a symmetric line in the drop from "BCG" to "Measles". The symmetries are a sign of not given health services, and the asymmetric line from "live births" to BCG indicates the importance and awareness of the BCG vaccine. Another reason for the asymmetry between live births and BCG is over reporting of the two vaccines due to poor reporting procedures (e.g. one infant given two BCG injections, for some reason, are reported as two infants given the vaccine).

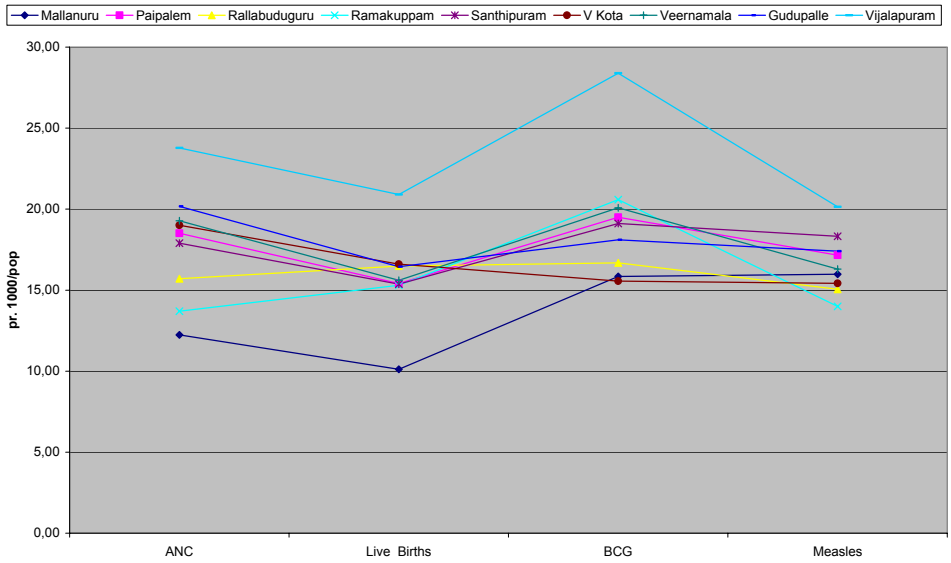

Figure 25: Variations in registered cases of life cycle events for all nine primary health centres, normalized related to population in area

The two figures demonstrate the ability to investigate data at grass-root level. Figure 25 shows the overall picture for the pilot area, but it is hard to use this data in order to achieve action for improvement. Figure 25, however, illustrates the ability to confront the primary health centres and then the sub-centres with the data they themselves have registered.

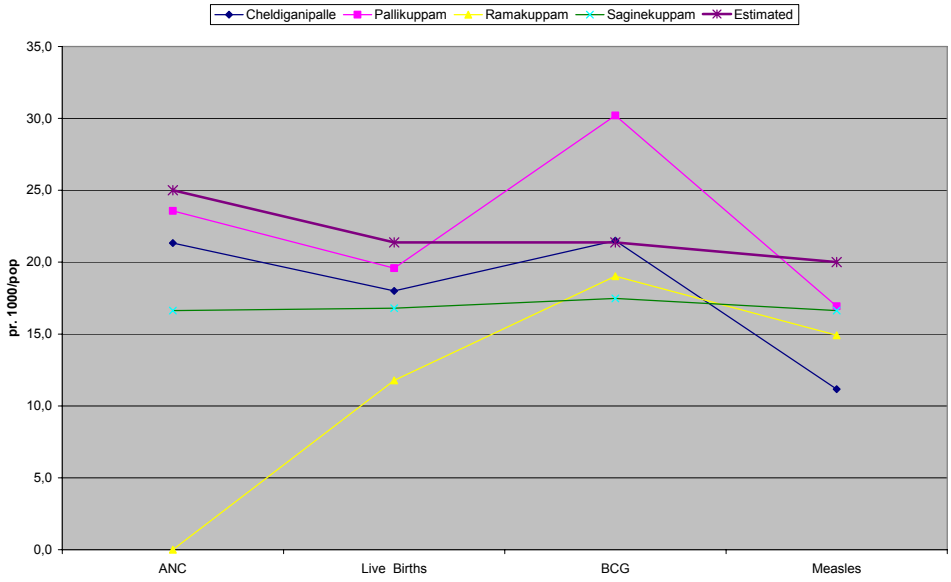

Figure 26: Variations in registered cases of life cycle events for some sub-centres for Ramakuppam primary health centre, normalized with population figures.

Figure 26 shows quite clearly that some of the sub-centres vary greatly in registered cases of life cycle events (ante natal care, live births, BCG and measles). Now it is possible to confront and discuss with the field workers

who register the data what can be done about the situation reflected through the graph.

8.2 Summary

The data analysis points at several important issues. Only 70% of the live births are registered, thus 30% of the pregnant women do not receive the health service they are entitled to. One reason might also be under-registration, but we know that women in Kuppam prefer to give birth at home, and the health workers might not be aware about the delivery.

Using indicators, we have found that vital data are not available in some cases (ref. maternal and infant mortality rate). There needs to be a greater emphasis on data capture rather than data reporting, i.e. the collection of high quality data. Further analysis and discussion will be given in the two next chapters.

Two field workers were confronted with the issue of data elements and targets. They had no problem understanding the elements in English. Targets, they felt, were set too high, and they almost found it humorous that the targets varied based on who set them. They gave an example of the target for sterilization; it is calculated to five per month, but the Medical Officer would raise it to ten, and then the Statistical Officer would raise it to 12. These targets were impossible to achieve on the ground.

Parts of this analysis made the basis for a first draft that the HISP team presented to the Department of Family Welfare in Andhra Pradesh in December 2002.

9 Discussion

This chapter presents a discussion of my empirical findings and is divided into two main parts. First, the adaptation phase of the pilot project is outlined. Subsequently, I will discuss the potential for the new HIS to make a difference and ultimately help to improve the health situation in Kuppam.

Giddens' deals directly with social action and structure at multiple levels, and I will use his structuration theory in an attempt to understand how social practices develop and change. Walsham *et al.* (1990) state that large IS are best understood as social systems. The notion of being part of the social context, and not just the computer, can be used to understand the difficulties of changing the IS and the health system.

9.1 Systems development; adaptation of HISP software, processes and models

Applying Hanseths' (1996) information infrastructures to Walsham *et al.* (1990) views of ISs being social systems, Braa & Nermunkh (1997) found that the installed base is made up of a web of social systems. Systems development has proved to be a complex task, due to diffused and intertwined connections. The health sector in India consists of people, social and political structures, data handling, different health programs and information systems; several issues that must be taken into account when developing a new HIS.

The systems development process in India consisted of several stages as explained in section 7.5.

Moving software from South Africa to India

HISP was initially developed for South Africa. The project in Kuppam thus represents the movement of software from one context in Africa, to a very different context in India. Much is written about this problem and discussed under the label "technology transfer" (ref. section 3.1). According to HISP's software coordinator, the term technology transfer is not adequate because it is not technology that is predominantly being transferred. He sees it as a situation where practically all countries have basic similarities and challenges with regard to public health information and health care management information, thus this has been a basis for the cross-country adaptation. According to Braa (1997), the traditional notion of technology

transfer is not addressing the challenges HISP encounter, since there are limited 'solutions' to transfer. In fact, 70% of HISP's resources have been used on training and mainly human resource development, not technical development.

HISP had been working to establish itself in India for about two years before computers were placed in selected health centres. The database application had to be developed; a minimum dataset, a data dictionary, indicators and reports had to be developed locally, and training had to be provided. The transfer from South Africa to India does not refer to the typical "north – south" transfer as described in section 3.1, but a "south – south and west – east" transfer. While the term technology transfer focuses mainly on the technological constraints and drawbacks, I will focus on the possibilities and opportunities that DHIS offers:

- Introducing an IS containing a full "package" of software, training material, concrete process-approaches, experience and expertise is usually easier than coming as " empty-handed" researchers with minimal funding and only a plan.

- The DHIS is free of charge, thus there are no great financial risks for the users. They can explore the software, and make tests without obligations.

- The DHIS is open source, which means that everyone potentially can modify the code.

- Professionals with years of experience in adapting the system work free of charge and aim at making a sustainable system by taking local resources into use and integrating it with other ongoing initiatives.

Although, the DHIS is used as a starting point for adaptation, which Heeks (1999) argues is necessary for all "foreign" software applications, Soriyan (2001) goes one step further and argues that such systems need to be customised locally. The following section outlines the process of adapting HISP to the local context in Kuppam.

9.1.1 Design approach

The design approach used in HISP is evolutionary and incremental; the application is constantly changing. The systems development in Kuppam consists of several cyclical phases (ref. section 7.5), which are still ongoing processes. Therefore, having a developing team that consists of professionals from both informatics and the health sector, and a high degree of user participation, is necessary. I will further discuss some key aspects of these processes.

Evolutionary approach

Using the waterfall model (ref. sub-section 2.2.2) was not an option in HISP's case; the requirements and problems were not known before developing the system. We were dealing with inexperienced users, and before they had experienced the system, they did not have any idea of the systems functionality and use. Looking at heterogeneous systems and "networks of networks" (infrastructures) (ref. sub-section 2.1.3), it becomes clear that the implications for the different systems will not be visible before we start implementing the sub-systems. Hence, the possibilities are not obvious to the users or the developers before the system is implemented. An incremental evolutionary approach, as explained in sub-section 2.2.2; with a focus on learning, is therefore used in India. After the first initial Minimum dataset was developed, it was immediately defined into the prototype and put into use. The software is continuously modified and adjusted to user needs; indicators, reports and data elements are added or removed.

Cultivation

Cultivation, as descried in sub-section 2.2.1 aims at taking local resources and knowledge into use; HISP collaborates with a local university and a local computer centre, and use local resources to integrating the health system with other ongoing e-governance initiatives in the state. The field workers possess a great amount of knowledge about the people they serve; they know detailed information about almost everybody in the village, and we need to find ways to tap that knowledge. HISP operates on different levels, and do also cooperate with the government of Andhra Pradesh.

One of HISP's principles is to involve the users; hence we have favoured a participatory process. Ownership is the key issue, which is also comparable with the Scandinavian approach (ref. sub-section 2.2.1). Although the Scandinavian tradition builds on a democratic work environment, some of its principles and ideas, e.g. mutual learning, understanding and communication, are valuable means in the design process in the Indian context.

Participatory design

During the adaptation process, it was important and necessary to make the health staff engage in a participatory prototyping of a Minimum dataset. Arranging workshops and establishing a local user group involved health workers at the lowest level, and they seemed to appreciate this kind of democratic forum.

User participation, as explained in sub-section 2.2.1, has been difficult in India due to the highly bureaucratic and hierarchical system. Decision-making at lower levels was not always appreciated by higher officials (ref.

sub-section 7.3.2). Even with a bottom up approach, decisions had to be finally ratified and often modified at central levels. But still, a bottom up approach is useful for fostering a sense of ownership (ref. section 2.2).

The hierarchy is strongly present in the culture, and the hierarchy in the primary health centre reflects the social context in India. Local innovations had to be facilitated in a top-down manner by creating conditions and procedures, like making two decision groups; a local action group consisting of the health workers at the lowest level, and one reference group consisting of the Medical Officers. The managers, e.g. the Medical Officers and the health workers, were not always comfortable together. In some cases the Medical Officers did not want to interact with the members of the other health staff, so by creating two user groups the field workers would thereby be enabled to influence the further systems development (ref. sub-section 7.3.2).

The prototyping process in South Africa was based more on informal user groups (Braa & Hedberg 2000), while in India, establishing formal user groups turned out to be necessary. The problem though, was facilitating equal interaction within the groups.

These design approaches can be linked to Giddens' dimension of *meaning*; making health workers part of the design strategy will most likely create awareness of current practices and procedures of data handling. The DHIS aims at changing the purpose of data handling for the health workers in Kuppam. The data collection is no longer object only for reporting to higher instances, but for local use as well. It is the health workers and managers *meaning* of data that we want to change, hence the IS function represents an *interpretative scheme* to help in cultivating meaning. Structures are only maintained through action, and when the meaning of data handling changes, structures enable change.

9.1.2 Data set development

There were several different forms in use, which included the same data elements, and duplication of data elements occurred constantly. Collecting and reporting a great amount of data is not only costly and time consuming, but takes the focus of the essential data. Keeping the focus on only the vital data is thus important. Therefore, the number of forms and data elements should be reduced to a minimum.

Too much time was spent on data collection; two hours each day were used on data related issues and three days a month was used for consolidating reports. This time should be spent interacting with the community and help providing better health care. One suggestion is to establish norms where only data on those items will be collected that contribute to the calculation of 1-2 indicators. This will help to focus on the relevant data, improve

quality of data collection, and help to link data collection with local action (ref. sub-section 3.3.3).

The data set development can be linked to Giddens' dimension of domination; the data handling consumes a major part of the health workers job, only to satisfy the needs of central management. The IS works as a *facility* where the *power* only is in the hands of the higher authorities. The top-down social structures of *domination* where thereby produced and reproduced through their actions.

Hierarchy of standards

The data needs are different at the sub-centre, primary health centre, district and state level. At the lowest level, detailed information like household data is what is wanted, and at the highest level they need to get an overview of the health status of the concerned regions. Developing a hierarchy of standards is essential (ref. Figure 2), which also regards the forms that are used for data collection and reporting. They need to be consistent at the different levels.

9.1.3 Implementation of pilot project

HISP "fits all"?

According to (Braa *et al.* 2002b) there are two main reasons why HISP's cross-country adaptation is possible despite the major cultural and structural differences. First, the work of international agencies has established standard definitions of data elements and health services and procedures, like standard indicators for data reporting and HISs. Second, the IS design and development strategy is general in that it aims at the simple and achievable within the given context.

According to HISP's software coordinator, the main reasons why HISP is suitable for the developing countries it has been introduced to so far, is that fundamentally they are struggling with similar problems:

- All countries have some kind of health sector reform going on, a central part of which is decentralization. All countries are struggling with similar questions, e.g. who decides on the budget and who decides on the service delivery. A lot of people in Malawi complained about the top brass decentralizing the problems, but not the resources. This is archetypical, but still something all countries are grappling with. There has been a broad push from the WHO and most of these governments want to decentralize some how. Hence, there is a basic policy environment that is similar to some extent.

- All countries have been collecting huge amounts of data in the past, which generally is hardly ever used locally or centrally. Centrally

data typically has been used for pure descriptive and statistical purposes. Health workers regard reporting primarily as one way of showing that they are doing their work.

On the other hand, what is not similar is e.g. the different degrees of the drive towards decentralization. There are also problems, which are more technical in nature, arising from different administrative structures.

The Indian context is bureaucratic and hierarchical and the democratic and political ideology HISP presents was not always understood and appreciated by all participants. We had some challenges related to the social, cultural and political context (ref. section 7.3), and working with HISP in India has really proved the importance of a context sensitive approach.

Poor infrastructure

In Kuppam there were several problems because of infrastructural issues; buildings were too poor to facilitate a computer, and the power cuts were a continuous problem. Lack of power slowed down the training process, as the field workers were not present at the primary health centres and could use the computer in between the power cuts. When the health workers finally had time to come, the power went down, and that did not motivate for further training. Poor infrastructure is a common problem in deprived areas, thus the need for computers only in a few primary health centres, is functional. Because of poor infrastructure in Kuppam, HISP could not scale, and their further strategy is to identify suitable primary health centres.

Starting to use computers - resistance to change

The resistance to organizational change amongst the Medical Officers can be cited in their refusal of letting the field workers use the computer and to attend training:

"Because of field work I am unable to learn about computers"

- Field worker in questionnaire

The field workers are generally low in social and caste hierarchy, and less educated than the other health staff at the primary health centre. The fact that they would get equal access to the computer along with the Medical Officers may be seen as violating existing social norms and provokes further discussions. Tasks that only have been reserved the Medical Officers will now also be performed by the field workers. These issues interfere with the dynamics of knowledge, which depends on whom for what kind of knowledge.

The Joint Collector pointed out the importance of Medical Officers receiving the most computer training, since they were in charge of the

primary health centre. Giddens' emphasis on the intended consequences of action can be used to represent the field workers getting more responsibility, while the unintended actions represent the relative disempowerment of Medical Officers.

Top down

The existing HIS in Kuppam, and the state generally, is of the top-down kind: people at the top with the power to make decisions, ask questions, while those at the bottom, health workers at the sub-centres and primary health centres, are persuaded to give answers. Some of the field workers said that they felt important doing their job when they reported to the District Medical and Health Officer, which is their supervisor. They did not appreciate the idea of reporting to someone with less authority.

I think this statement illustrates the focus of the previous data collection system; collecting data for the purpose of reporting to higher instances. In order to change the IS, regarding the IS as a social system provides a useful framework (ref. sub-section 2.1.2); relationship between people, work routines and perceptions will also need to change.

Targets

According to "Community Needs Assessment" targets should be set by health workers after doing surveys, to ascertain client needs. Looking at the targets set in the HMIS performance rating of primary health centres in sub-section 8.1.1, which are all the same for the different primary health centres, we have seen that this is not always the case. Workload, infrastructure, size of population etc. are not taken into account when setting the targets. Targets are set to show the intended level of accomplishment, and tell the health workers what they need to achieve, by when, and to what degree (ref. sub-section 3.3.3). Therefore, the targets need to be based on thoroughly investigation. They need to be set according to the size and needs of the population using a participatory process involving the local health staff.

Grading schemes

Another question concerns the grading scheme recently introduced (ref. Table 8), and whether it provides advice to those primary health centres being identified with poor grades. The grading scheme should not only serve as a mechanism to reprimand poor primary health centres but as a source of suggestion for future actions to help improvement. Used just as a form of reprimand, the grading scheme can lead to manipulation of data, so that the health workers avoid being shamed in public, rather than to an improvement in service. The grading is useless unless it provides some incentives for those with "poor" grades. Reprimands alone are not helpful in improving the health status; the reason for the poor (grades) results must be

examined. If the reason is that they do not understand the data elements, getting a bad grade will not lead to any improvement.

One solution could be to organize the health workers in groups to evaluate each others' performance. To be able to perform this kind of action, they would need guidance and assistance during the performance rating.

The grading schemes can also be linked to Giddens' dimension of domination. When the grading schemes works as a form of reprimand, the IS works as a facility where the top-down social structures are reproduced by upper management.

9.1.4 Training constraints

As I experienced in Kuppam, there is sufficient need for training of the health workers, not only in using computers and the DHIS, but also in use of information. Health information and its use are vital to health services, and the basic training of the health workers is not sufficient. Another problem was the unskilled trainers. This section outlines different aspects regarding the training.

Learning by doing

In my opinion some of the trainers were too eager to help, and did not give the health workers a chance to solve problems themselves. In some cases it seemed that the trainers wanted to "show off". Although the feedback we received from the participants concerning the trainers were positive, my observations was that instead of telling the students what to do, some of the trainers took charge of the mouse or the keyboard and fixed the problems. In my option, that is not positive and sends out the wrong signals to the participants, e.g. that they cannot handle the computers by themselves. During training, successful experiences in mastering tasks are important. That gives confidence and often increases the wish to learn.

Lack of shared understanding

A shared understanding amongst the health workers, the Medical Officers and the district and health administrative staff of the data elements collected, is important. Currently, we have found that this is not the case, and many examples can be cited in the data analysis in section 8.1.2, e.g. ante natal check-up cases. The numbers for the 1st, 2nd and 3rd check-up should correspond, but we found that the numbers for the 3rd check-up is 68% higher than the 1st check-up. It is possible that the 4th, 5th and so forth are registered as the 2nd and 3rd check-up, indicating a misunderstanding amongst some of the health workers in using the data-elements.

We also noticed that "due" and "given" are the same in most cases, which might indicate that due is used as a target. Due is the estimated figure, and

given is the actual figure, so these figures should not necessarily correspond. "Due" is accordingly the number gathered by the field workers of persons who should receive a service, while "given" is the actual number whom received the service. Health officers use this as a way of checking if the field workers perform their duties. But can they really? The health centre can e.g. be out of stocks or the patients might not come the next day. The figures may be the same because the field workers will show that they perform their duties (fulfilling quotas), or maybe they do not understand the meaning of the data elements. The "due" column has subsequently been removed.

Further topics concerning the training process will be addressed in the next chapter.

9.2 What is the potential for the new HIS to make a difference and ultimately improve health care delivery?

Problems and challenges of the existing HIS in the pilot area have been studied, and an analysis of the health data using the DHIS was performed. Based on these findings, we clearly see that the existing HIS needs improvement.

> *"The main purpose of a health information system should be to foster the well-being of the population it serves."*
>
> (Opit 1987, p.416)

Information for action

The over-collection of data was obvious when HISP was defining the minimum data set and eliminated more than hundred of data elements. A large number of numerator data elements were not converted into indicators at all, that is, they were not used for any type of analysis or decision-making. The *data led* approach, as explained in sub-section 3.3.1, is emphasised in current systems.

Ultimately, HISP measures success by decisions and actions made, not only of the quality and quantity of data produced, which is in line with the *action led* approach (ref. sub-section 3.3.1).

Create awareness

One important task supervisors have, is to motivate the field workers to collect accurate data. An easy and effective way is putting "fresh" (up to date) graphs and diagrams on the wall in every primary health centre, also

for providing a source of comparison with other primary health centres. In that way, the health status is visible to everybody. No matter how good the tools and methods are for analysing data, it is useless with wrong data. One important issue is to make the health workers and managers aware of the consequences of incorrect or manipulated data.

> *"If garbage is entered, then garbage will come out, even though the format may be changed and the presentation looks good."*
>
> (Boerma 1991, p.148)

"Good" numbers do not necessarily mean that there are good health services provided. As the performance rating has shown in section 8.1.1, reaching the targets is easy if the primary health centre has a large population in their jurisdiction. Again, this concerns the indicators, i.e. the grading system is irrespective to over-reporting. One needs to look beyond these figures to find out where the problem is and what can be done to improve the situation.

Experiences of HISP's software coordinator, is that when health staff starts analysing data, they will use the skills they have gained through working with the Minimum dataset to start looking for other decisions they need information for to handle. Combined with the information pyramid (ref. Figure 2), which gives people considerable freedom in defining information needs, people get engaged at a much deeper level and start to look at the whole situation; the resources they possess, the inputs, diseases, patients and people, and then come up with goals and objectives. Basically, by giving people responsibility and ownership, helps releasing the innovative and creative side of local management and staff.

Situational Awareness for Local Action

The only possible way to initiate action to improve the health situation is to be aware of the local situation. One needs to know who, where, why, when and how people get sick. The DHIS deals directly with these issues as the analysis focus on the level where data is actually collected.

Walsham *et al.* (1990)'s notion of IS as social systems is especially magnified in this case; the technology itself is not a goal, but the social factors linked to it; the people it serves, the health situation, data handling and work routines, to mention some of the factors.

I have in the previous chapter analysed data and highlighted errors and discrepancies in the health data collected. The focus has been on some of the most important indicators for that particular area. Discussions and questions concerning the data quality have started to take place in some of the health facilities, and health workers and managers are confronted with the collected data.

An important feature with the new HIS is the ability to locate where health services are provided and not. Based on the DHIS analysis, one can find out if there are groups of the target population that is not reached. Because of the existing lack of data quality, such analysis is currently limited.

Analyse Data → Create Awareness → Take Action → Improve Health

Figure 16 illustrates all immunization vaccines given to infants. There is a substantial gap of infants that do not receive vaccines. Only 70% of total live births are registered, thus 30% are not reached by the health service. The large gap of non-registered patients is also illustrated in the other figures as well. Looking at institutional deliveries (36%) vs. home deliveries (64%) (ref. Figure 24), only 80% of live births are counted, the rest is unknown.

Figure 17 demonstrates that five primary health centres have immunization coverage below the target of 85%. The average is 67% and several are below the required figures. The potential action is obvious; the health workers need to conduct awareness campaigns followed by immunization campaigns in the concerned primary health centre areas. Create awareness is important, because we know that many mothers - and grandmothers - are not aware, or convinced, about the importance of immunization.

Figure 26 shows that none were given ante natal care at Ramakuppam primary health centre. If the service was performed at the other sub-centres, their numbers should have been higher. Figure 22 shows ante natal coverage for all primary health centres. The chart shows where the coverage is low, e.g. three primary health centres have around 50% coverage. This means that approximately half of all pregnant women in these areas are not given ante natal check-ups by the field workers. The most important countermeasure against maternal mortality is ante natal care with at least three check-ups given. Here we have seen that 50% get none, and we know exactly where ante natal check-ups are not given.

Based on this analysis and after investigating the problem, efforts can be put in and action can be taken. In this particular case, the health workers need to find out how to identify and reach the pregnant women.

Firstly, the health workers must reach those in the target group who are not reached by the health services because they live far from the health facilities or are not aware of the benefits of ante natal check-ups or vaccinations. As an example to illustrate this; health workers we spoke to said that Kuppam is notorious for its early marriages. In Table 7 we see that in 21% of all marriages, the wife is below 18 years of age. The tradition among women in

the Kuppam area is to have the first delivery at their mothers place. This tradition constitutes an obstacle, especially when the women are that young, to achieve the primary objectives of the health services which are:

- To increase the number of institutional deliveries, and in particular get the very young women to deliver in a safe environment.
- To ensure that all pregnant women have at least three check-ups.
- To ensure that both the mother (who receive TT) and the newborn are appropriately vaccinated.

Secondly, in order to increase coverage of health services in these areas, it will be necessary for local health workers and managers at primary health centre and sub-centre levels to change their work practices somehow. They need to become more pro-active and out-reach, so that groups not normally reached may be identified. Furthermore, awareness campaigns may be strengthened.

The health workers know their community well, and they need to be more active in order to reach out to the pregnant women. However, we know that this kind of local initiative, awareness of information and action, will require changes in routines and in how ante natal care is normally carried out. We therefore see that the changed IS will require changes in work practices and in the organisation in order to have any effect. This topic I will discuss in the next section.

9.2.1 How can organizational changes be managed?

To bring about such changes at the local level in order to fully benefit from the new HIS, and to improve health care delivery, is what is addressed by authors like e.g. Walsham (1993), when they emphasise organizational changes as being intricate to IS development.

The process of introducing new technology normally involves significant changes to the organizations (ref. section 2.1.2). This affects the people who are part of that organization and how they perform their job and every day routines. Technology in itself will not change the health system. The IS, as the example of how ante natal care coverage shows, provides a framework for action. The existing health system works within relatively stable structures, but structures can be changed; structures are only maintained by social action.

> *"..the structural properties of social systems are both medium and outcome of the practices they* ***recursively*** *organise .. Structure is not to be equated with constraint but is always both constraining and enabling .."*

(Giddens 1984, p.14)

Giddens' structuration theory explains how social action is produced and reproduced (ref. sub-section 2.1.4). HISP aims at changing the information handling processes at local level in the health sector, which I take to include the wider social system at their levels. The health staff at the primary health centres will be able to use the data they have collected for local action. In order to obtain that, the health workers will need to change their work practices. Use of information and data analysis are all practices that will need to be changed in order to turn the vertical, upwards information flow to a "horizontal" use of information. Using the example of ante natal care, the field workers will need to be more out reach in order to get the pregnant women to come for ante natal care.

In order for these changes to take place, changes need to be made within each level of the system, from the sub-centres and up to the state level. Firstly, the health staff at the local PHC and sub-centre level must be able to perform this kind of action. They need to be empowered. Secondly, these initiatives must be accepted and promoted at the higher levels. Finally, the pregnant women also need to be aware of the importance of the health services provided.

Social action is constrained by structures; existing work methods, disempowerment and norms. These structures enable social action; being aware of the health situation at local level, the health workers methods and how ante natal care is performed, the pregnant women's conception of the importance will change.

The high number of population without access to health services may be caused by other factors, like poor infrastructure. Several primary health centres had lack of resources, employees and medical equipment. As a Medical Officer said, seven of ten deliveries were complicated, and an oxygen apparatus would have saved more lives. Sanitary installations and clean water are also issues that must be dealt with on the district level. The state level needs to delegate authority and resources in order for the local levels to take action.

10 Conclusion and Further Strategy

In this chapter I will summarise the essence of the discussion in the previous chapter and present the conclusions related to my research questions. Finally, based on the experiences from Kuppam and analysis of the health data, a suggestion for further strategy is outlined.

10.1 Conclusion

In order to address my research question, I have been part of an action research project during the implementation phase of the development of a new district HIS in a small, rural area in India. A particular emphasis has been on the importance of the context.

My first research question was:

> *What are the conditions and constraints for systems development at local levels within the health sector in India?*

In addition to the obvious conditions of poor infrastructure, lack of skilled people and financial resources, which may be rather common among developing countries, poor routines on data handling and limited information knowledge were constraining. The aspect of having a "political ideology" built into the new HIS, which is related to local data capture validation and use of information, implies several changes to the whole organization. The district health structure showed resistance on several levels due to different reasons; the scattered power allocation makes it hard to introduce the system and the bureaucracy makes it difficult to institutionalize the new way of handling information in the organization. The social structure created difficult working conditions, and local innovation had to be facilitated in a top-down manner in a relatively rigid top-down hierarchy.

Based on the experiences made and analysis of health data from the pilot area, the following question has been addressed:

> *What is the potential for the new HIS to make a difference and ultimately help to improve health care delivery?*

I found that there is obviously a need for an improved HIS, and the potential for the new HIS to improve health care delivery is considerable. However, improvements will only be achieved if the health sector starts using the collected data to do analysis and address problems on the local levels. In order to do that, the organization must change and the "information culture" needs to be changed and information must be valued more, in particularly on local levels. Health workers need to be empowered in order to change work routines and the people need to be made aware of the importance of health services provided. Higher levels need to establish a culture which emphasise local innovation supported by the use of collected and analysed data. The new HIS enables the creation of awareness of the health situation, but health workers and managers are the ones who need to take action within the organization.

10.2 Strategies for scaling up

HISP is faced with two key challenges; scale and sustainability. The HISP team started working in India in December 2000. During my stay in the beginning of year 2002, computers were installed and collecting health data from nine primary health centres. Only in the state, Andhra Pradesh, there are 1200 primary health centres and 7500 sub-centres. How will it be possible to roll out HISP in the state, considering the challenges we were faced with in Kuppam; poor infrastructure, poorly skilled trainers and the constraints in the existing health system? This section will provide some suggestions for the roll out phase within the current period of funding (2004). In order to be of any relevance, I will base the discussion on the Memorandum of Understanding (ref. sub-section 7.6) made between HISP and the state of Andhra Pradesh. This agreement is a huge step further for HISP, and address such as the problem of poor infrastructure in the expansion to the next division in Chittoor:

> *1. The State Government will be responsible for the establishment of all infrastructure required including buildings, computers, and network connectivity.*

10.2.1 Scaling up

Because of India's huge population number and different context, it will be very hard to get a standard yielding for the whole state, not to mention the country. After working in India for two years HISP is established in the pilot area and planning for further expansion. We clearly see that the roll out need to take place in a limited period of time. This is a problem as the HIS is a social system, which consists of a number of human and non-human components; e.g. people, software, routines, training programs and knowledge, which need to be adapted and cultivated into the local context in order to achieve sustainability.

Because of Kuppam being the constituency of the Chief Minister of Andhra Pradesh, the technological expansion is concentrated in this area (see sub-section 7.1.2). The state puts in heavy resources, while the surrounding towns do not experience the same growth. The rapid expansion puts Kuppam in a special situation; hence, it may be difficult to compare it to other rural areas, even neighbouring towns. Another aspect with having multiple developing projects situated in a small area makes it hard to see exactly what project has an impact and to be able to measure that impact.

An advantage of the multiple initiatives in the town, and the state (ref. section 6.3), is the skilled and educated people that runs in. That may again attract more skilled people, which there is a substantial need for. Several projects also create a healthy and visible environment.

HISP's principle of scale

According to HISP's software coordinator, HISP has never expected any pilot project in a new setting to be the same. However, a general problem has, as expected, proved to be lack of recourses. The process is not considered as replication, but as expansion and adoption. The only constant thing in HISP has been change. Because of this exceptional changes, HISP's software coordinator claims that one of the main reasons why most pilot projects fail is that they expect their roll out to be a replication. Experience has showed, that in every new area HISP is initiated, there has to be coped with different problems and challenges.

"Roll out" plan

A plan can have at least two different intentions; a plan for the sake of the bureaucracy, and a plan for the purpose of actual use and action. The Joint Collector wanted a specific plan for HISP's further expansion (ref. sub-section 7.3.1), but making an exact plan is difficult; in this setting, plans that are made for months ahead, often needs rapid changes due to sudden alterations. Although, taking all changes into account is impossible, HISP need to work out an estimate of the amount of resources needed.

When I arrived in India, the DHIS had been modified, but changes were not documented. As for HISP international, the software is constantly changing, and support, experience and modifications of the system is often sent over the Internet. That is an excellent way of communicating, but these statements deserve to be documented for future use. HISP could for instance publish "common questions" on their web site.

According to HISP's software coordinator, a problem related to roll out projects that have been put out on tender, is that you need to make tender specifications which normally have to be very exact. The actual roll out process never works like that. There are constantly new challenges. In most

cases the tender based contracts do not assume changes to happen. If changes are expected, that also means that they need to be dealt with. It might be problems with corruption and political issues, which make it difficult, so many prefer to go for the readymade nicely package where it is assumed that the problems are known on the forehand.

In the Memorandum of Understanding, there is written:

> *"The HISP team will submit a detailed project plan for HISP in accordance with the scope defined in this MOU."*

Although making an exact plan is difficult, HISP will need to make an overall project plan containing strategies, need of resources and milestones.

Visible impact

Because of political concerns, like the coming elections and further funding, producing visible results as quickly as possible is essential. I think it is important to show how DHIS can be used and what benefits they have using it. In the first place the managers and decision-makers are those whose support is needed in order to roll out the project. A good idea is to start with entering lots of data into the software, preferably sooner than we did in Kuppam, where it was done as part of the training strategy. We only need a small sample, and can use the Family Welfare indicators. Ten data elements covering the whole state can be entered into the computer with numbers from a few primary health centres in each district. Graphs, diagrams and a report can be produced so that they can see their own data and statistics. The analysis and presentation in Chapter 8 is such an example.

Political and bureaucratic possibilities

As long as HISP has support from higher authorities in the health hierarchy, the bureaucracy might be an advantage in the roll out phase; the roll out will probably happen quickly as dictations from the upper management has proved to be exercised and followed by health workers at lower levels.

As the Chief Minister in Andhra Pradesh said, he wanted the implementation to take place very quickly (ref. sub-section 7.3.1). The problem though, is that cultivating the project into the health system normally will take some time. HISP needs to find a balance between a rapid roll out and the cultivation process in order to create a sustainable HIS.

Decentralization

The distribution of power and decision making are inscribed in the health system. Introduction of the new HIS implies changes to the power structures. Health workers at lower levels will hopefully be given more responsibility and authority to make decisions, based on analysis of local conditions.

In the Memorandum of Understanding, HISP presents a "cluster methodology"; one of the primary health centres in every cluster, which consist of three to five primary health centres, is provided with a computer. Letting only some of the primary health centres have a computer can make it an instrument of power, taking the focus off the actual reasons for having it. As we discovered in Kuppam, some of the Medical Officers wanted to place the computer in their own office because of the status this would reflect.

Establish expert group on data issues

It would be of great value to establish an expert group on data issues that deals with everyday problems on the lowest level. This group should be given the responsibility of creating a hierarchy of minimum and essential data standards based on an active recognition of the fact that different levels of the health structure (sub-centre, primary health centre, sector, district and state) have different needs of data and analysis. Each level of the hierarchy needs to be given the flexibility of introducing and deleting data and reports as long as it does not change the structure of the levels above (ref. sub-section 3.3.2).

The group should also be entrusted with the responsibility of analyzing issues of data quality at different levels and ensuring that improvements are introduced on a systematic basis through processes involving active participation of health and computerization staff at different levels. The analysis of the health data in Chapter 8 provides a first step in understanding some of the issues of data quality, and asks potential questions that need to be explored further. This ground would need to actively interface with the HISP team currently involved in the computerization efforts such that suggestions emanating are actively and appropriately implemented in the software and related work practices of the health staff.

The three latter issues are only possible if the health workers are given the authority to do so. Setting targets and defining minimum essential datasets are related to health services in general, regardless of being an IS or not, and so is also the need for better quality control.

10.2.2 Training strategy

One of HISP's challenges is to engage more human resources in order to train the health workers.

Training programs

Training programs will probably contain a busy schedule because of the field workers hectic work. Thus, focusing on the main topics is important;

that is use of information and the DHIS. As we experienced in Kuppam, the health workers had a hard time coming to the training due to lack of transportation. There are several issues to keep in mind when arranging training programs.

I think HISP needs to dedicate more time to educate the trainers, both in pedagogic and in use of information. Informatics professionals might not be the most appropriate trainers. Training a group of health workers might be more fruitful, as they are the ones that have knowledge of the health data.

"DHIS for novice users"

A major part of the HISP training material developed in South Africa is heavy documents thoroughly explaining use of information. These are excellent documents, but in my opinion the first written meeting with HISP should be a small and simple presentation of the DHIS. This could be a folder or brochure, preferably in their local language, also containing the main aims and objectives of HISP.

Training on the "use of data"

The aim of HISP is to shift the focus of information handling to the local level, where the health workers are able to collect data that they think is relevant, and direct its use to address the everyday problems they are engaged in.

All health workers need to learn and understand how to use information for action and be aware of the importance of collecting the data. That is, they need to learn how to identify targets and indicators. All health workers should be able to calculate routine indicators – not just the managers. Otherwise this essential activity concentrates the power of knowledge in a few hands and ordinary health workers remain disempowered (Heywood *et al.* 1994). This adversely affects the overall quality of the health service being provided to the community.

Data dictionary

Keeping an updated data dictionary at every health facility will be a help towards a shared understanding of the data elements, and also work as a standard for those analyzing the data. Parts of the current erroneous data can be due to the misunderstanding of the data elements, and what has to be collected. Training of field workers in the meaning and interpretation of data items is essential in this regard. If data elements are added or removed, all health workers need to be informed. The need for this becomes especially magnified in the light of the ongoing computerization efforts where changes in one item need to be reflected in all the health centres. Only then can standardized reports be developed.

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Conference

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Appendix A

A1 Interview guide

HISPs software coordinator:

1. What makes HISP different from other NGOs?
2. Several projects in India have failed because of not being able to roll out systems beyond pilot projects. How do HISP cope with this?
3. How is it possible to transfer (Technology transfer) the system to India from SA, reason for fitting India (and other countries) and limitations?
4. How do you approach when introducing HISP to new countries?
5. What are the most common challenges when approaching new countries?
6. HISP want to empower the lowest levels. How is this idea accepted in hierarchic systems and what strategies do you have to make users decide?
7. Was HISP meant for scaling? (HISP wasn't initially meant for scaling, but is the flexibility in the system sufficient for scaling?)
8. What is the essence and difference of EDS/MDS
9. HISP is not just software, but implies great changes to the reporting system and the health workers job. Can they cope with these changes, or are they too big?
10. The causes and remedies of the illnesses may not be primarily medical but perhaps connected with low income, poverty and poor education. Is there any way HISP can catch this?
11. Does HISP have any strategies for ensuring supervision and data quality control?

A3 Evaluation of training

Evaluation form for the three day computer training program conducted for medical officers and health workers from different PHCs at Kuppam, at Aptech from 16th January to 18th January 2001.

18.01.02
Name of participant (left out)
Name of PHC (left out)
6. What are your views/attitudes about the three day training programme conducted at Aptech?
7. How did you feel before attending the training programme?
8. How did you feel after attending the training programme?
9. Do you think the training programme has given enough capacity to do your daily work on computers?
10. Suggestions/comments

1. The programme is very effective and the trainee and trainers are very friendly and encouraging.
2. Before I had a little touch with computers but I am afraid of working with mouse and have some fear to play with computers
3. Now I confidently working with computers and once again I got a chance to fresh up my previous knowledge.
4. Yes, it is very helpful and it made my work easy and also management of time.
5. As the subject is very vast, this 3 days is not enough to become perfect. So I wish to have it for one week the next time.

1. The training programme was good and gave some important knowledge in computers.
2. It is very difficult to display the computer.
3. It helps to get some knowledge on data applications.
4. Yes, I think.
5. Spent more time on training period. The training period should extend.

1. We were enjoyed a lot. This 3 day training is not sufficient. We want training for at least 2 months.
2. I thought that it is very helpful to Primary Health center to feed our data with ease.
3. It is an excellent programme.
4. No.
5. We want much more practice.

1. The programme very difficult method and interesting.
2. Before the programme I didt have any knowledge.
3. My interest increased very during the training programme.
4. Yes
5. No comments.

1. It is very essential for field staff. Because now so much of time is spending for written work and more ever repetition work is made to field staff. If we learn

computer the time will save and spent more time in field and can improve our targets.
2. I am very happy to hear this word. You are deputing to 3 days computer training programme at Aptech, Kuppam. But one doubt for me. I can learn completely or not. Completely means perfectly.
3. After training I got some confidence. If I continue to type and practice I can learn perfectly.
4. No, this learning programme is not sufficient to our daily work on computers.
5. This Aptech maintenance is very good, especially faculty staff. They are very very good. Their behavior is very humble. They got very good patience to teach.

1. I am having much interest at 3 days training programme. Here you masters behavior very happiness. But I could not satisfy with only 3 days training. I hope in future must more interesting to know fully.
2. I am really happy. But I learn simple.
3. I am very eager to learn words.
4. Yes, I learnt something from Aptech.
5. I want at features you masters give training to us really we know about very well. [She thinks she learnt very well]. I may be giving training to my subordinates.

1. Not able to catch the points as it is new to me. But this system is very useful in future. After three days training I improved a little.
2. I am very happy to attend to learn the system operation.
3. Now I know some thing about the system. After some time I may learn more and teach to some others too.
4. No. This training has not given enough knowledge. I want more time to learn.
5. This training is very useful. I know that the staff are very cooperative. Very helpful.

1. Training programme was very good. We learned something about computers. Coaching is good. Thankful to the faculty.
2. I am very much afraid about the computers. I don't know ABCD about computers.
3. Now I am feeling very happy that I know something about computers. It is really useful programme.
4. Yes. Some more training days should be there.
5. Some more training days should be there.

1. The time is not enough for medical people. At least 2 months will take the time to achieve our goal.
2. Number of time I thought that I want to get good chance (Aptech) I never got a good chance before this training.
3. After completion of my 3 days training course I am entering "LkG to Ist standard "(Aptech).
4. NO. The programme has given only ALPHABETICS training.
5. I want to get good training and fulfill my job functions. If time permits I may get good "job" (trainee) at Aptech. Any how it is a good opportunity for medical people.

1. It is very nice training programme, but duration is not sufficient. If the training programme is for more days it would have been good.
2. Before training programme, no idea about computers and no theoretical and practical knowledge. Not much interest in learning computers.

3. After attending the training programme I felt very happy for attending the training programme. Because it was very interesting, encouraging and enthusiastic.
4. I got some experience in using computers to do my daily work. Still I need lot of practice to become more efficient.
5. Duration would have been more. More pc's to be kept for practical. On the whole it was very good training programme.

1. Excellent training, use it for public health person.
2. Very eager to learn about computer operations.
3. I am very happy to learn something to operative computer system from Aptech.
4. No. I want more training to become skilled in computer system.
5. [No comment].

1. This 3 days programme is very useful and very good. I learnt how to operate computers and what is computer. I am interested to learn some more.
2. Before coming to computer training I don't know anything about computers.
3. I feel very happy after computer training. It is very useful for my work.
4. We need some more training.
5. This training is very nice. I learnt something about computers.

1. It's very nice.
2. Learning computers is very good.
3. It's very nice. If we learn more it will be very useful.
4. Yes.
5. Aptech team is very good and teachers are very cooperative.

1. Very good.
2. I am poor in English knowledge. I feel afraid to learn computers, but now I decided to learn computers.
3. What I learned is less. I come to know that I want to learn more. I'm feeling very happy to learn computers.
4. Yes.
5. I am very thankful to Aptech team and the faculty. They explain the programs very cooperative. Thank you very much.

1. Training programme was good. Faculties are very cooperative. But we feel that we didn't get the clear practice of the programme yet – of course we can able to understand the depth.
2. We don't have any idea regarding computer before the training. Now we got little bit of knowledge about the computer.
3. After 3 days of training interest regarding computer increased to a great extent.
4. No.
5. Please train the medical officers separately instead of combining with paramedical staff.

1. Very good.
2. Before coming to training I didn't know anything about computers. After completion of program I learned how to operate computers and I am very much interested to learn computer programs.
3. After completion of my training I came to know that it is very useful to us. We can save time.
4. We can reduce the daily burden of our work load.

5. Suggestions and Comments:
   We have to increase the programme days so that we can learn more things. We are very thankful for giving this opportunity and also like to thank the computer teachers and the team for giving us this training.

1. It is very good
   I have started to think about learning computers . It is very good and useful to learn computers.
1. It is very good and useful to learn computer courses.
2. Yes.
3. Suggestions/ Comments
   Aptech team and faculty are very good and very cooperative and that is one of the reason why I have become interested in undergoing the computer training.

1. Through this three day training programme I have learnt how to operate and use computers at least the fundamentals have become clear to me.
2. This programe is very nice but the duration of the programe is too short We need at least one or two more months of intensive training. This is my personal opinion.
6. Programme is good but the duration of the time is not sufficient and we need more time (2-3 months) to master the basic course and also HISP software.
1. Yes
2. Suggestions /Comments
   NIL

1. Before three days we did not know anything about the computers but now I am very much interested in learning about the computers.
2. Initially we thought we cannot learn within three days but after the three days training we have learnt to operate the computers at least the basics.
3. Your friendship and teaching is very good . I like it very much.
   Without any feelings and with good interest the faculty has given the training. For that we remain thankful to all of you.
4. If we are given the same intensive training without break we are sure to learn the basic courses of the computers.

5. Suggestions /Comments

Please continue to provide us the training with same vigor and intensity at the PHC too. I thank the faculty for their patience in teaching.

1. Very useful
2. It is very new
3. I feel very happy because it reduces the work.
4. Yes.
5. Writing work will be reduced. Thanks to Aptech people.

1. Very useful
2. It is very new.
3. I feel very happy, and three days training is very nice. Computers reduce the work.
4. Yes.
5. Writing work will bee reduced thank's too Aptech people.

1. Good. It's very nice
2. I don't know computers.
3. Now I know the computer. I feel very happy.
4. In this training I have decided to learn computers. I have confidence to learn computers.
5. In this training programme only three days it was extended to five days. During the month we learned the computers, but we can not cumulate it. Thanks to Aptech team.

1. I like the Aptech training programme.
2. The training days are very less. We want more days to train. Less days we can not train fully. I feel strange about the training programme, but I have very interest in learning computers after the training programme.
3. After finishing the training I am very eager to learn more about the computers.
4. My PHC work consolidate reports was made very easy.I feel very easy work with computers. I like it very much.
5. The PHC training is they were giving in our PHC so with this I can improve my Knowledge.

1. I don't know Aptech programme in these three days I know more details about this training and computers. I feel very happy.
2. I don't know Aptech programme.
3. After finishing the training I learned more details about work, time saving. Once feed the data we don't want to do same thing. This programme is more useful to me. I feel very happy.
4. The work, writing in work books is very difficult but computer feeding is very useful and easy.
5. Training will be very less days. I t extended to more days.

1. I don't have any idea of computers. In these three days programme I learned more details about computers.
2. Before these three days training programme I think learned the computers. I feel very strange about computers after three days of training programme I feel very easy to learn computers. Aptech teached us how to operate on computers.
3. This 3 days training programme should be extended to more days.
4. My daily work will be very useful with computer. Population counting, EC's, AN cases are made as records. It is very useful.
5. 3 days was not enough, we want one month training. I was not satisfied with only 3 days, because with more training we'll learn more.

1. It is very useful to our PHC to send all reports. It reduces writing work.
2. I didn't have any idea about computers. After this 3 days training programme I know about computers.
3. It will reduce the work.
4. Yes.
5. We are very thankful for conducting the training programme.

1. This 3 day training programme is very useful. Before this training programme I didn't know anything about computers. After this I know everything about computers.
2. At first I thought; why should we learn computers? After finishing this training I learnt more about computers.

3. After finishing this training I feel very happy. This training is very useful to PHC people to make the work easier. I believe this work is fast and accurate.
4. This training should be for more days.
5. The training is very good. I learnt something about computers.

1. Before I didn't know computers. After completion of 3 days training I know very well about computers. I know how each part will work.
2. I am fully satisfied with this training programme.
3. In this 3 months I will learn completely about computers and I can work for HISP project. I can enter data without any wrong.
4. We can enter all the details which we collect from the field in very less time. Whenever we need we can see the details very easily.
5. If you increase training for 1 more month it will be good for us.

1. Before I didn't know computers. After completion of 3 days training I know very well about computers.
2. Before 3 days training I didn't know anything about computers. I had fear in computer training.

A2 Questionnaire

This questionnaire is confidential, the names will be treated anonymously and only for HISP's use.

Name :
Age :
Gender :
Designation :
PHC / Subcenter :

Did you participate in the three day training programme at Aptech?
What do you know about HISP?
How do you feel about using the system?
How has the training been so far?
What is your main difficulties?
In what way do you think this system will change your everyday work?
Do you feel you will benefit from using system?
If so, in what way?
Please, if you have any questions or comments let us know?

Questionnaire for HISP PARTICIPANTS

Age : 31 years
Gender : Female
Designation : MPHA(R)
PHC / Subcenter : V.Kota, S.Bandapalli /Sc

Did you participate in the three day training programme at Aptech?
No.
What do you know about HISP?
We learnt about HISP programme well. We still want to learn about it well. We learnt how to enter the data, Close the data & to start it.
How do you feel about using the system?
It is very useful for us to use Computer. It is useful if there is lot of Work and especially it will be very useful in fieldwork. It is nice learning it.
How has the training been so far?
It's Very Nice, Still I want to learn about it.
What is your main difficulties?
Because of fieldwork i am unable to learn about computer.
In what way do you think this system will change your everyday work?
We can enter the fieldwork daily, which we have done on that day itself, There is no necessity of entering in book. We can spend a lot of time in Fieldwork.
Do you feel you will benefit from using system?
Yes.
If so, in what way?
Instead of maintaining the record this is very useful.
Please, if you have any Questions or Comments let us know?
Computer work is very nice.

Questionnaire for HISP PARTICIPANTS

Age : 31 years
Gender : Female
Designation : MPHA(F)
PHC / Subcenter : Paipalyam, Gonuguru /Sc

Did you participate in the three day training programme at Aptech?
Yes

What do you know about HISP?
We came to know how to start the system and how to do feed the data in computer.

How do you feel about using the system?
By using the computer it is easy to enter Sub Centers the information and easy to get the required information

How has the training been so far?
Very Nice.

What is your main difficulties?
Nothing.

In what way do you think this system will change your everyday work?
In field data will be entered in the notes and again we have to enter in the data, This is a difficult task, But after learning computer it is easy to enter the data.

Do you feel you will benefit from using system?
Yes

If so, in what way?
If we want any information we can switch on the computer and we can know about it.

Please, if you have any Questions or Comments let us know?
It's the easiest way and the workload is less.

Questionnaire for HISP PARTICIPANTS

Age : 28 Years
Gender : Female
Designation : MPHA(f)
PHC / Subcenter : Paipalyam, Kamathamur/ Sc

Did you participate in the three day training programme at Aptech?
Yes

What do you know about HISP?
Lot of work will be consumed and it is very useful to HISP.

How do you feel about using the system?
By using the computer it is easy to enter Sub Centers the information and easy to get the required information

How has the training been so far?
It's very nice.

What is your main difficulties?
Nothing

In what way do you think this system will change your everyday work?
In field data will be entered in the notes and again we have to enter in the data, This is a difficult task, But after learning computer it is easy to enter the data.

Do you feel you will benefit from using system?
Yes

If so, in what way?
We can get the data whenever it is necessary from computer.

Please, if you have any Questions or Comments let us know?
It is easy and less work.

Questionnaire for HISP PARTICIPANTS

Age : 25 Years
Gender : female
Designation : MPHA(F)
PHC / Subcenter : Paipalyam, kangundi/Sc

Did you participate in the three day training programme at Aptech?
yes

What do you know about HISP?
Health Information systems Programme

How do you feel about using the system?
About this System . I feel very happy. It's very useful for reporting and calculating.

How has the training been so far?
Some thing happy and useful

What is your main difficulties?
Nothing

In what way do you think this system will change your everyday work?
Suitable for modern days.

Do you feel you will benefit from using system?
Yes

If so, in what way?
Because, Analyzing and planing.

Please, if you have any Questions or Comments let us know

Questionnaire for HISP PARTICIPANTS

Age : 24 years
Gender : Female
Designation : MPHA(F)
PHC / Subcenter : Paipalyam, Kuppam East

Did you participate in the three day training programme at Aptech?
Yes

What do you know about HISP?
It is very useful to enter data and it consumes our work a lot.

How do you feel about using the system?
It easy to enter the data and to retrieve the data when ever we want in an easy way.

How has the training been so far?
It's very nice

What is your main difficulties?
Nothing.

In what way do you think this system will change your everyday work?
In this method it is useful to enter the fieldwork in a computer and it is easy to get the data which ever is necessary.

Do you feel you will benefit from using system?
Yes

If so, in what way?
If we are not in the field then if any officer comes to see our data then it will be useful for them to see the data with or without us.

Please, if you have any Questions or Comments let us know?
It is easy and useful.

Questionnaire for HISP PARTICIPANTS

Age : 44 Years
Gender : Female
Designation : MPHA(F)
PHC / Subcenter : Paipalyam, Kuppam West

Did you participate in the three day training programme at Aptech?
Yes
What do you know about HISP?
We learnt how to start the system and how to work with it. Manjunath is teaching us very well.
How do you feel about using the system?
It is very nice. We want to learn more about it.
How has the training been so far?
It's very nice.
What is your main difficulties?
If we didn't have any work it will easy and faster to learn the system.
In what way do you think this system will change your everyday work?
The system will notify me what work we should do and it will make me not to forget any thing.
Do you feel you will benefit from using system?
Yes
If so, in what way?
If you make us to learn the system for one month then it will be useful.
Please, if you have any Questions or Comments let us know?
It's very easy, lot of time will be saved and writing work is very less.

Questionnaire for HISP PARTICIPANTS
Age : 33 Years
Gender : Female
Designation : MPHA(F)
PHC / Subcenter : Paipalyam, Cheelapalli/Sc
Did you participate in the three day training programme at Aptech?
Only for One day.
What do you know about HISP?
Health Information systems Programme
How do you feel about using the system?
I learnt how to use computer and learnt very less now.
How has the training been so far?
It's O.k.
What is your main difficulties?
It's hard to learn after completing our duty.
In what way do you think this system will change your everyday work?
We can save a lot of time.
Do you feel you will benefit from using system?
Profit.
If so, in what way?
If you have been thought for 15days or one month it will be Very nice.
Please, if you have any Questions or Comments let us know?
Still I want to learn about it.

Questionnaire for HISP PARTICIPANTS
Age : 28 Years
Gender : Female
PHC / Subcenter : Pipalyam, Gundlanaidu Palli/Sc
Did you participate in the three day training programme at Aptech?
No
What do you know about HISP?

It is very useful in learning it work load will be very less. It will be very useful in the coming days to come.

How do you feel about using the system?

Very happy to Know about it.

How has the training been so far?

It's nice.

What is your main difficulties?

It's entirely new to us that's way its difficult.

In what way do you think this system will change your everyday work?

Instead of wasting time we can concentrate on our work a lot.

Do you feel you will benefit from using system?

Yes

If so, in what way?

It is useful to create reports.

Please, if you have any Questions or Comments let us know?

It is interesting. If we learn more it will be very useful.

Questionnaire for HISP PARTICIPANTS

Age : 32 Years

Gender : Female

Designation: Staff nurse

PHC / Subcenter : V.Kota PHC

Did you participate in the three day training programme at Aptech?

No

What do you know about HISP?

I learned about the maximum and minimum values of ante natal, immunization, inter natal and post natal etc

And I learned about how much is achieved by each subcenter among ANMs

How do you feel about using the system?

I feel it is very easy and time saving while feeding the data. The computer verifying my errors while entering the data. It feels it is the process necessary for us in the technological age

How has the training been so far?

From beginning itself the training is interesting and enthusiastic. When I am sitting near computer I forget my surroundings and time also. It is one of the methods for my work for recalling past work.

What is your main difficulties?

My difficulties while I am on duty I am unable to learn., because I am so busy. While computer and printing no difficulties

In what way do you think this system will change your everyday work?

It is giving work to mind and body, Because in this age I am unable to learn the subject, but computers are not that much difficult.

Do you feel you will benefit from using system?

Yes, it is a very useful system for my daily life

If so, in what way?

It is interesting in the way to our age will be become technological and computerage

Please, if you have any Questions or Comments let us know?

Computertraining need according to our duties.

Questionnaire for HISP PARTICIPANTS

Age : 53 Years

Gender : Female

Designation: Public Health Nurse
PHC / Subcenter : .Paipallem PHC

Did you participate in the three day training programme at Aptech?

yes

What do you know about HISP?

Due to this HISP for me easy to prepare PHC reports and all, second one is collection of reports from staff (MPHAs)is very easy

How do you feel about using the system?

Using of system is very nice, but I have not been fully using the system

How has the training been so far?

well

What is your main difficulties?

Time

In what way do you think this system will change your everyday work?

If we learn well good change will come in everyday work

Do you feel you will benefit from using system?

yes

If so, in what way?

1. save time
2. Improve ower other activities

Please, if you have any Questions or Comments let us know?

Continues training is very important

Questionnaire for HISP PARTICIPANTS

Age : 31 Years
Gender : Female
Designation : MPHAF
PHC / Subcenter : V.Kota-UPHC-V.Kota.

Did you participate in the three day training programme at Aptech?

No.

What do you know about HISP?

1. To put the data.
2. Easy way
3. Time saving.

How do you feel about using the system?

1. I want to sit before the computer 24 hours.
2. Want to learn very well.
3. It would be better if we had still 2 computers.
4. Painting is very nice.

How has the training been so far?

Very nice.

What is your main difficulties?

Nothing.

In what way do you think this system will change your everyday work?

It will be the easiest way.

Do you feel you will benefit from using system?

Yes.

If so, in what way?

Please, if you have any Questions or Comments let us know?

1. This is very nice that Mr.Chandra Babu Naidu has introduced
2. Before six months I use to think whether I would learn computers But now I feel happy that I know some thing.
3. I am proud that I am in C.M. Constituency.

Questionnaire for HISP PARTICIPANTS

Age : 32 Years.
Gender : Female.
Designation : Staff Nurse.
PHC / Subcenter : UPHC.

Did you participate in the three day training programme at Aptech?
No.

What do you know about HISP?
I learnt about the maximum and minimum cases of anteres, Immunization, Intrerated and postel netel etc and I learned how much of achieved by each sub center in A.N.M.

How do you feel about using the system?
I feel it very easy and time saving while feeding the data. The computer verifying my errors while entering the data. It feel it is the process is very necessary for us in technology age.

How has the training been so far?
From beginning itself the training is interest and enthusiastic. When I am sitting near computer I forget my surroundings and time also. It is one of the method for my work for us calling paster work

What is your main difficulties?
My difficulties while I am in duty I am unable to learn because I will be so busy. But in operating the computer there is no difficulties.

In what way do you think this system will change your everyday work?
Ti is giving work to mind and body. Because in this age I am unable to learn the subjects but computer is not much difficulty.

Do you feel you will benefit from using system?
Yes, it is very useful system for my daily life.

If so, in what way?
If it is the way to continue our son age will become technological and computer age.

Please, if you have any Questions or Comments let us know?
Computer training need according to our duties.

Questionnaire for HISP PARTICIPANTS

Age : 51 Years
Gender : Male.
Designation : MPHS
PHC / Subcenter : V.Kota/V.Kota

Did you participate in the three day training programme at Aptech?
Yes.

What do you know about HISP?
It is easy that every thing is in a single HISP programme. All programmes will be in a single sheet so that it will not be confused and we can know what are all going in PHC'S.

How do you feel about using the system?
By learning computer we can do more work in less time and it is easy to do also. Our work has been reduced to 80%.

How has the training been so far?
Very nice.

What is your main difficulties?
During the field work we cant do this programme.

In what way do you think this system will change your everyday work?

Do you feel you will benefit from using system?

If so, in what way?
Please, if you have any Questions or Comments let us know?

Questionnaire for HISP PARTICIPANTS
Age : 30 Years
Gender : Female
Designation : HA(F)
PHC / Subcenter : V.Kota / V.Kota-II S/c
Did you participate in the three day training programme at Aptech?
Yes
What do you know about HISP?
This is very useful project according to me. From this lot of time will be saved, we can enter the data correctly, If we are not there also our seniors can see our monthly data. By graph we can see our work. This is very usefull.
How do you feel about using the system?
If I sit before the computer I won't come to know the time, I liked that so much. Operating the computer is first to me I feel it tough but now it is some what easy. Now I feel to sit before the computer. In my service this is a great experience. It is very nice.
How has the training been so far?
It is very nice. they thought us how to enter the monthly data and working with Excel. I never expected that I get a training like this. I liked this very much.
What is your main difficulties?
We learnt only data entry. If we had another system then it will be helpful because in our PHC we have more sub center.
In what way do you think this system will change your everyday work?
I feel that I want to finish up my field work soon and I want to sit before the computer. This is a big change in my life. It is very easy.
Do you feel you will benefit from using system?
Yes.
If so, in what way?
Time save, if I am not there also our seniors can see our monthly reports and there is no necessary in waiting for me. We can give the monthly reports when ever we want. We can enter the data correctly.
Please, if you have any Questions or Comments let us know?
Since we have only one system we cant sit before the computer much time. Especially me I want to sit more time before the computer but I have no time because we have 11 Sub centre so every one should enter the data. I will be thank full to APTECH, C.M., J.C., for giving the computer to our PHC. I will be thank full to Zubeeda Madam and Bhagya Madam also and thanks to every one. I request you that to put the computer in all of the constituencies also.

Questionnaire for HISP PARTICIPANTS
Age : 35 Years
Gender : Female
Designation : MPHA(F)
PHC / Subcenter : V.Kota / Padigala Kuppam
Did you participate in the three day training programme at Aptech?
Yes.
What do you know about HISP?
This is very useful for us by introducing this. From this lot of writing work has been reduced. I feel happy to see this kind of system.
How do you feel about using the system?

By using the HISP lot of record work has been reduced and stationery also been reduced. We can gain upto Rs.100/- per month.

How has the training been so far?

We learnt about HISP and other programmes. I wish you to extend the training.

What is your main difficulties?

By finishing our duty it is hard to sit before the system since we have only one system.

In what way do you think this system will change your everyday work?

It helped us in writing the work less and to work in the field for much time.

Do you feel you will benefit from using system?

Yes.

If so, in what way?

Please, if you have any Questions or Comments let us know?

Questionnaire for HISP PARTICIPANTS

Age : 30
Gender : male
Designation : medical officer
PHC / Subcenter : PHC Shantipuram

Did you participate in the three day training programme at Aptech?

No I was on leave at that time

What do you know about HISP?

HISP means Health Information System Programme, it is using the Information Technology and provide better and improved healthcare to the rural population. Also to reduce the paperwork of health workers and health supervisors

How do you feel about using the system?

It is very useful for improving our working pattern and then to provide better health care to the public

How has the training been so far?

Satisfactory

What is your main difficulties?

Learning Computers and attending to daily routine work is some what difficult. There are lot of disturbance in PHC while learning computers

In what way do you think this system will change your everyday work?

Spending lot of time in preparing reports of the health workers and supervisors will be reduced dramatically, information will be available at the click of a button. The saved time can be utilized by the healthworkers for their foieldwork

Do you feel you will benefit from using system?

yes

If so, in what way?

I can monitor the work of the health workers more easily. Information can be available easily and paperwork will be reducd. Communication will be faster.

Please, if you have any Questions or Comments let us know?

Learning computers and attending to routine work simultaneously is some what difficult. The time span of computer training (2 ½ hours) is not sufficient.

Questionnaire for HISP PARTICIPANTS

Age : 55
Gender : f
Designation : PHN
PHC / Subcenter : V-kota /WTA

Did you participate in the three day training programme at Aptech?

yes

What do you know about HISP?
To know health data is very useful to MPHAs and supervisors and higher authorities. To enter correct data and it will save time and space
How do you feel about using the system?
We feel better if learning computers
It is easy to enter data
We can entertain , games and paintbrush
How has the training been so far?
The training is very useful, but we are facing more difficulties in using the mouse, and key board but we learn paint and word pad
What is your main difficulties?
The main difficulties is how to use the mouse and keybord. We have idea how to use the key board and it is very difficult
In what way do you think this system will change your everyday work?
The system save time and
Do you feel you will benefit from using system?
yes
.**If so, in what way?**
To save time and it is very easy to enter correct data and it is very useful for higher authorities and for PHC staff
Please, if you have any Questions or Comments let us know?
The period two month is not sufficient