University of Oslo
Department of Informatics

"All I want is a system that works"

Evaluation of the health information system in Cape Town, South Africa – using an information audit to capture views from the grass root level.

Elisabeth Jakobsen (elisaj@ifi.uio.no)
Ann Kristin H. Johansen (akhjohan@ifi.uio.no)

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Abstract

This thesis presents a study of the health information system as seen from facility level in the area of Cape Town, South Africa. During our fieldwork, we have tested, adapted and evaluated an information audit within primary health care clinics. This audit is meant to be a basis for future annual evaluation of the status of the health information system. It covers areas such as training and support of staff, use of information, feedback from higher levels, data collection process and staff's perceptions of the information system. The thesis describes in detail the audit development process, and our recommendations to the equipment situation in health care facilities in Cape Town.

In addition to the work on the audits, we conducted a thorough investigation of the status of computers and other important equipment for dealing with data and information. This work resulted in a report on the status of computers and IT-equipment in district hospitals, 24-hour units and community health centres in Cape Town. This report was requested by the provincial administration of Western Cape because of their need to budget for new equipment in the curative facilities. As we saw the benefits of this computer specification part for managers when planning and equipping their facilities in the best way, it was included as a separate part of the information audit.

This thesis also includes an analysis and discussion of the results from the paper-based information audits we conducted, and this is presented as a general evaluation of the health information system at the facility level.

To give a small taste of what we discovered, we found that the majority of workers at facility level, 60 % have a positive attitude towards the information system, even if the majority states that there is still room for improvements in many areas. 50 % of the facilities have no working computer. 40 % of the facility workers told us that they have not been able to make any use of the training they have received on information and computers. Only 22 % can provide examples of information usage in the facilities.

As for the evaluation *process*, we saw the importance of keeping the questionnaires short and simple. We also found that the personnel at facility level are important pieces in the evaluation, with their closeness to the collection of data. In our opinion, the facilities should not be left out of the process, because of their important role in the health information system, even if it takes time and effort to get the views from the personnel at the grass root level.

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1 INTRODUCTION

The theme of this master thesis is evaluation. The base for the thesis is two different kinds of evaluations. One is an evaluation of the health information system in South Africa. The other is an evaluation of a tool for investigating the health information system – the information audit. Both evaluations focus on improving management information systems.

> *"An information audit is a systematic evaluation of information use, resources and flows, with a verification by reference to both people and existing documents in order to establish the extent to which they are contributing to an organisations objectives."*
>
> [Definition of information audit by Association for Information Management, UK]

A challenge with management information systems is that there is one group of people collecting and registering data and another that is supposed to read, interpret and use the data registered. But do any of these groups really take into account the information they produce and have at hand when making decisions and plans? Both our evaluations provided us with results that we hope can be of use within the health sector for answering this question. The results can also help in adjusting the system so that information is used more.

1.1 What is this thesis about?

This thesis is about evaluation of health information systems, and a suggestion on how to perform such an evaluation, using an information audit at facility level in the health sector in Cape Town, South Africa.

Being students at the University of Oslo doing a master's degree in information systems, we got to hear about the Health Information System Project (HISP). This project has been a collaboration between our university and universities in South Africa, with the goal "*to support the development of an excellent and sustainable health information system that enables all health workers to use their own information to improve the coverage and quality of health care within our communities*"[1]

HISP is described as an action led approach that aims "*at creating a nucleus of health workers who are competent to manage information at facility and district levels and support decisions based on accurate information*" [1]. It has been an ongoing process since 1994-1995, and amongst some of the things that has resulted from this collaboration project is the development of a District Health Information System (DHIS), which is a computerised data collection system.

A lot has been written about the different processes HISP and DHIS have gone through, and the success and failures of them. However, just reading different reports and theses on the topic, was not sufficient to get to got to know the real situation of the health workers within

[1] www.hisp.org

this information system – how the grass root level have experienced HISP influence, achievements and failures. HISP started out in 1994-95, and we decided it was time to find out what the situation is after these years. Therefore, we decided to investigate the current situation for ourselves. At first we focused on the district level, and set out to investigate to what extent health data was used to make decisions and improve the health care given. However, our focus shifted more towards the facility level after spending a couple of weeks being introduced to the system and finding out about some earlier attempts to evaluate the information handling situation using information audits for the different levels of the health sector.

The facility level became our focus area, and this thesis presents: (1) our process of further development of the original information audit primarily for the facility level, (2) our report on the computer and IT-equipment status in the facilities, and (3) our findings from the information handling process, including different perspectives on the system captured by the evaluation tool.

To summarize: this thesis is about the health sector in South Africa, and it contains two major elements:

1. A situation analysis of the information handling process in the health sector in Cape Town.
2. Evaluation of the information audit as a tool for the health sector, with results and experiences from the development process.

Results from the information audits are analysed and discussed, and presented as a general evaluation of the information system at facility level in the Cape Town area.

We also present other systems evolution methods and some of the fundamental principles of different approaches and strategies for systems development that could be useful in an evaluation (design) process. We focus on the information audit as a multi-method approach. Our own process with the audit is described in detail, and we discuss the use, benefits and challenges of using such a tool for evaluation within the health sector.

1.2 Who can read it?

Anyone with an interest in health information systems, especially in development countries can read this thesis. We also dig deep into the field of evaluation of information systems, so the thesis can be of value to those interested in the evaluation of such systems, even outside of the health sector.

Very little background is required to be able to read the thesis, but the more knowledge one has about the HISP project and information systems in the health sector in developing countries, and not least in South Africa, the more use one might have of reading the thesis.

1.3 Background and motivation

The motivation for this thesis was a result of the close cooperation between the University of Oslo and the Health Information System Project (HISP) in South Africa. We discovered the

opportunity to write a thesis within this field of global informatics, and for us it was an important motivation that we could use our master's thesis and background in informatics to contribute to the important and meaningful work carried out within the HISP project.

The first semester of our postgraduate studies involved preparation for our fieldwork. We attended courses on health information systems and HISP to learn more about the ongoing project, and about the status of the health information system in South Africa today. In addition we made plans for the second semester's fieldwork in Cape Town. We spent the third and last semester in Norway, writing up and completing the thesis together.

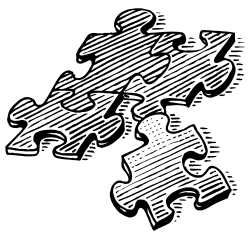
We also appreciated the opportunity to travel abroad, and experience a part of the world that we otherwise may not have had an opportunity to visit. The possibility to do a jointly written thesis, involving cooperation with both fieldwork and with the writing of the thesis, was another motivating factor for us.

A lot has been written about systems development in a third world context, the health sector challenges in South Africa etc., so there was no lack of preparation material in that sense. We did not, however, find so much material on earlier documentation on evaluation processes within this context, and what the current situation of the information handling process is. How had the health personnel experienced the introduction of a district-based health information system introduced by HISP? How far had one come in the process of making use of health data for decision-making and improvement of the health care given? These were questions we wanted to find answers to. And since Cape Town and South Africa was the first area for rolling out the HISP project, it would also be interesting to see how far they had got there.

Not being part of the actual HISP team would allow us to be objective regarding the relative success or failure of the project, and report on topics otherwise not being part of the HISP focus areas, but which would still be important to reveal in an evaluation process.

The ongoing restructuring of the health sector led to many temporary solutions that we had to relate to. Many would perhaps argue that conducting an evaluation in the middle of a huge restructuring process would not produce much useful results; people are likely to feel uninformed of everything that goes on, it would be difficult to get a good overview of existing and future structures, there will perhaps exist temporary solutions when it comes to tasks and responsibilities, communication may be low between levels at times when planning and budgeting meetings take up all time and lower levels in the sector feel ignored etc. The evaluation would just reveal what are already well-known problems, which will be resolved when the restructuring process is completed.

The situation described above is exactly what we faced on arrival. We believe, however, that it is especially at times like these that one must not overlook the most important part, the basis for the whole health sector, where patients get their first treatment or are referred from and where all health data are collected; namely the facility – the lowest level of the information pyramid. The facilities are likely to be the ones that are affected the most by changes made higher up in the hierarchy, and they should have a say. An evaluation becomes an important tool in further development – to help guide decision makers onto the right track.



An evaluation of the information system today can reveal weaknesses at an early stage, ease the working situation of

employees and reduce problems in the future. This was our motivation for performing an evaluation of the health information system in Cape Town. One must also keep in mind that this restructuring process is now a 10 year old process; a lot has changed to the better, but nonetheless, a lot remains. The challenge of fighting epidemics and poverty means that one cannot wait for all pieces to fall into place before the system can be evaluated and, if necessary, changed to the better – "the show must go on". People keep getting sick, data must be collected and decisions must be made to ensure ongoing improvement of both people's health and the working conditions of health personnel. While waiting for improvements of the system one should make the situation as comfortable as possible, and in that way, indirectly, one also creates solutions to existing problems. And it is such problems and solutions we hope can be discovered with an evaluation like ours – small pieces that can contribute to a better whole; pieces that are valuable contributions in planning and decision making at higher levels.

This view was what we started out with. We wanted to start at the grass root level and collect those little grains of gold that were important to discover and put into words, and that would hopefully make a difference.

1.4 The problem area and problems addressed

The problem area for this study is the public health sector in South Africa, and how information is used among different leaders in the sector.

We started to explore this issue while still in Norway, before we went to South Africa. There turned out to be a research project already going on about the same issues we were interested in. The project had the title; "*Evaluation of the factors affecting the level use of routinely generated health information by District Health Managers in the Cape Town Metropole"* (see appendix G; "*Use of Info by Mx research*", by Institute of Informatics at University of Oslo and School of Public Health, South Africa).

The background for this study was that even though the quality of routine data that is collected in the health system has improved substantially over the last years, the managers have not followed up by using this information for making decisions. It is hoped that our study will discover why this is so, and what can be done in order for the managers to make better use of the information available.

We thought that this was a good and interesting point of departure, and the project proposal had several interesting research elements. In the proposal there were several objectives, and some of them we found particularly interesting. The ones that interested us the most were:

- To evaluate the potential usefulness of the available information, for proactive planning and managing by district health managers.
- To evaluate the present level of use of routine information by district health managers.
- To determine the barriers preventing the use of information in proactive managing and planning.

However, after a few weeks in Cape Town, we came across the information audits that were developed for investigating the general status of the health information system in South Africa. These audits included many of the same elements we found interesting, and from this point on, our research took a new direction – we wanted to find out about the status of

information handling and usage, and we wanted to pilot and further develop the information audit as a tool. That is; we ended up with two major elements in our research:

1. Pilot, develop and evaluate the information audit as an evaluation tool.
2. Find out as much as possible about how the situation is in the health sector with regard to issues like information handling, equipment, training and user-satisfaction during the pilot – an analysis of the health information system.

So, we moved a bit away from the original project proposal, where the main focus was on the managers at district level. Instead, we concentrated on the managers one level below; namely the facility level. We wanted to do our investigations as close as possible to where the data is actually collected. Another important reason why our focus was finally set on the facility level was a strong need from the district information management in the provincial branch to know about the situation in the facilities. For example, they did not have an accurate overview over computers and equipment in the facilities.

This thesis describes our process of the developing and piloting the audit and what methods we used for our data collection etc. We investigate the field of information system evaluation further by presenting and discussing what methods and strategies one has for evaluating (health) information systems, the benefits and disadvantages with the different methods, especially the information audit on the basis of own experiences with this type of tool:

"An information audit is a systematic evaluation of information use, resources and flows, with a verification by reference to both people and existing documents in order to establish the extent to which they are contributing to an organisations objectives."

[Association for Information Management, UK]

The major elements in the facility information audit are:

- Training and support of facility staff in health information handling
- Feedback from higher levels to the facilities
- Facility health workers' perceptions of the health information system – major achievements and failures
- Resources available and needed at facility level
- Facility staff situation – lack of personnel and high workload
- Collection of data elements at facility level
- Information use and flow within and from facility level

These topics are discussed in depth.

In addition to getting staff at the clinics to answer questions related to the above mentioned topics, we carried out a thorough investigation of computer equipment in the curative care clinics on behalf of the provincial administration. They were in the middle of a huge reconstruction process, and needed to know what amount of equipment to budget for. As a part of the audit we therefore developed an (in the end separate) part about computer specifications and other equipment, so that the management for the curative services could base their decisions about the need for new equipment on accurate numbers. Based on our experience from the clinic visits, we give general suggestions as to what an ideal computer/equipment situation at facility level should be.

1.5 Our expectations

What expectations did we have regarding the results of our evaluation?

From what we had read prior to our field work, a lot of research and focus was on information use at *district* level. We did not find much material on the information use at facility level. Here, the focus was rather on the accuracy and timeliness of data. A significant challenge was to increase the motivation of the personnel at facility level to collect more accurate data.

"Even when health workers are properly trained and have access to the tools needed to record and report data, evidence points to low health worker motivation to provide quality data in a timely way." [Posner & Fields, 2003]

Our expectations were that we would find low motivation among facility staff regarding the data collection process, but we did not know the main reasons for this.

In a report to the National Health Information System in South Africa (NHISSA), the HISP team says that; "[…] *we should see the quality of data improving, especially if feedback is given to the end-user on where they are making mistakes and not defining the conditions accurately enough*" [HISP Activities, 2003].

Here again, the focus is on having the facilities improving the quality of the data they collect, but not a word is said about *including* them in the use of information, to make the data collection more interesting for them as well, and at the same time enable them to improve the health services they provide by making good decisions based on accurate data. Therefore, this was something we wanted to investigate closer, and the reason for putting our main focus on the facility level.

We expected facility staff to have been trained in data collection, but we did not know what kind of training or how much training they had received. We did not expect much information use at the facility levels, since most research seemed to focus on district level use of health information as mentioned above.

We expected the data flow to run satisfyingly from facility to district level, and that the main problem areas of the information system today was the poor quality of the data collected at facility level and the low degree of information use of the data at district level.

We did not know the general situation in the health sector in Cape Town before we arrived there, as all the reconstruction processes made it difficult to get familiar with the details of the system while still in Norway. We expected things to be a bit more defined than what the real situation was (at least for the curative health care side) and that the curative and preventive services would be more equal with regards to structure and resources. Lack of structure within the health sector in general seemed to slow down the efforts to improve the health information system more than we thought.

1.6 Limitations/what is not discussed

We focus on the information handling process at facility level in the Cape Town area. The initial plan was to also investigate use of health information at district level. But we quickly

realised that to cover both levels with a thorough data collection process followed up by analysis and evaluation would be too comprehensive. Therefore, our focus was set on the fundamental level of the information pyramid, namely the clinics providing primary health care. Our research and discussions will evolve around this level of information use. Only to a very limited degree is the district level included with regard to information use.

Due to our limited time schedule, the number of facility visits was limited. Primary health care delivery is divided into two separate services; one for the preventive and another for curative health care. We were able to visit about half of all clinics providing curative health care in the Cape Town area, and a few preventative care clinics as well. Although our findings can be generalized to some extent, they will apply mainly to the curative side of the health sector in Cape Town.

When it comes to the completion of the information audit in the curative health facilities, we were not able to cover all the facilities in the Cape Town area. There are 52 in total of these health clinics, and we covered 20. Time permitted us to visit three of the preventive clinics, to find out whether the audits would be applicable here as well. From our experience there did not seem to be any problems in transferring the audit directly from curative to preventative facilities – the major differences concerned what data elements were collected. The number of pilot tests is perhaps too small to draw any certain conclusions about whether the audits fit well into the preventative context, or if it must be adapted more, resulting in the preventative clinics having their own version of the evaluation tool. In our opinion, it is beneficial to use the same tool, as this would mean less administrative work, and ease the reporting and presentation of the evaluation results.

When it comes to the results and analysis of the audits, different circumstances made some of the audits useful only in part. We experienced some cases where the interviewees did not have the time to complete the whole audit, or where they wanted to spend some more time on it, and submit it to us later, which they then failed to do. The most complete part of the audit is the computer specification section, where we have data from all 23 units. The total corpus of complete audits we ended up with consists of 20 audits with supplementary interviews, and they cover district hospitals, 24-hour units and community health centres.

In order to be able to say something for certain about the situation (e.g. on the equipment status) in the curative health care facilities, it would have been preferable to have investigated all the units. For the development of the audit, however, it is not very likely that we would gain very much more insight in how to structure the audit and what questions to ask by including more facilities in the research.

Regarding further piloting, it would have been interesting to do some more testing of the audits aimed at the higher levels, such as the district manager and district information officer. Testing in other areas than Cape Town could also have been useful, as we know little about how clinics elsewhere are organised, and whether the same questions are applicable in other parts of the country, particularly in the rural areas.

We have not focused much on detailed evaluation of the different types of software used in the health sector, or on other technical aspects. Our focus has been on the information collection/accuracy/use, feedback, training, equipment, and on the development and evaluation of the audit as a tool.

1.7 Our research approach

Our research consists of two main stages; (1) investigations prior to work concerning the information audits and (2) research directly involving development and testing of the audits.

In our prior investigations we used methods like interviews and observation as mainly qualitative methods to collect information about the current situation within the health information system in Cape Town. Information managers and officers at regional and district level along with the staff at School of Public Health, UWC (University of Western Cape) were in focus during these first weeks.

Our research approach further, in the work on the information audit in Cape Town, can be described as an action research approach. This process was an ongoing collaborative process with key persons within the health sector and facility staff members, to come up with the most suited tool for conducting an evaluation of the health information system at clinic level. This approach became a multi-method approach where we used interviewing, observing, collection of written documentation and used existing (from prior audits) and new questionnaires. The questionnaires consisted of both quantitative and qualitative questions.

1.8 About the content/chapters in the thesis

The thesis is organised in the following manner:

Chapter 2 – Theory and literature review: gives a theoretical framework for our research on evaluation of information systems. It includes theory on information systems, systems development and health care systems, and thus provides knowledge for understanding different aspects of information systems. In an evaluation processes and further development of an information system, one might take advantage of different strategies for understanding the complexity within information systems and organisations, and methods for dealing with some of the challenges experienced in the process.

Chapter 3 – Evaluation methods for information systems methods: this chapter presents different evaluation methods that can be used when evaluating an information system in general. It aims to describe challenges relating to the evaluation of health information systems, and the information audit as a multi-method evaluation tool is especially highlighted due to our experience with this sort of tool at facility level in Cape Town.

Chapter 4 – Background: Chapter 4 gives the reader some general background information about South Africa and its history in terms of apartheid, the restructuring of the country etc. The chapter also talks about the Health Information Program (HISP).

Chapter 5 – Research approach: our research approach as action research is described along with the methods we selected (from Chapter 3) for our data collection and evaluation of the health information system.

Chapter 6 – Health care and health information systems in Cape Town: this chapter presents the situation within the health sector in Cape Town as we experienced it the autumn of 2003. Different levels within the sector and the staff and resource situation are briefly described. It

also touches upon topics such as the role of HISP, competition between strong personalities and different health information software etc.

Chapter 7 – Information audit research: in Chapter 7 we give a detailed picture of our auditing process and the cyclic, collaboration work with development and adjustment of the audit as an evaluation tool.

Chapter 8 – Analysis of our findings based on the information audits: this chapter presents our findings as a direct result of the completion of the paper-based audits at clinics in the Cape Town area. Here we categorize and summarize the answers given.

Chapter 9 – Discussion and recommendations: in Chapter 8 we present our findings directly collated from the audits, whereas this chapter consists of a general discussion of evaluation methods and the benefits and disadvantages of using an information audit like ours in the evaluation process. We make a comparison of our findings with other surveys, evaluations and studies done earlier in the same region, or in South Africa in general. From our empirical findings we present general recommendations for improvements of the health information system in Cape Town, based on the analysis of some of the major topics covered in the information audit.

Chapter 10 – Bibliography.

2 THEORY AND LITERATURE REVIEW

Our main focus in our thesis is on evaluation of already implemented systems. We are therefore not directly concerned with systems development. We have chosen, however, to include some theoretical considerations that are primarily useful in the understanding of systems development, but are also valuable in the evaluation of a system.

The results that come from an information systems evaluation should have some effects and initiate improvements on the existing system. Otherwise, the evaluation process and results produced would be wasted. The effects and improvements can for example be further development of the system, it can be that a system is replaced completely or partially by another, or it can lead to changes in the organisational structure to optimize the effect of the current information system. The evaluation process is the first stage in a process for further development of a system, and is therefore a very important part of the whole development process. The line between systems development and the research carried out prior to developing a system from scratch, and the evaluation done when it comes to further development and improvements of an existing system, becomes somewhat blurry. In this perspective, systems evaluation could benefit from making use of some of the theoretical consideration from systems development. Theories for understanding the different aspects of an information system and strategies for systems development may therefore be applicable to systems evaluation, and different development methods from systems development theory can be used in the design phase of evaluation procedures. By doing so, one may be able to tailor the design of the evaluation better to the given situation, and capture the information that is needed in further decision-making about the system, as this is a result of deeper understanding of the system, its use and impact on people and organisation.

Thus, the theory in this chapter is interesting for systems evaluation as well as for pure systems development. The theories are mainly presented in relation to information systems development, but we have also tried to relate them directly to the evaluation of information systems (IS). We refer to Chapter 3 for more specific methods on evaluation design. The theory in this chapter can be viewed as a kind of background material for an evaluation design and process.

We emphasize that what is outlined in this chapter are “minimalistic” versions of theories, and we encourage the reader to use the references to get a deeper understanding and a richer picture of the theories presented than the scope of this thesis allows.

Information and knowledge in organisations and the difficulty of managing these two important assets is briefly discussed as an introduction to the information systems theory.

2.1 Knowledge, information culture and information use in organisations

The reason for collecting data is that it can be turned into information, which in turn can be converted into the knowledge of an organisation. Defining what the "knowledge" of an organisation consists of is not easy, as it includes such relatively vague terms as experience, intuition, judgement and lessons learned. Employees are constantly creating knowledge, just by doing their jobs [Henczel, 2000]. Some of this knowledge can be captured in documents or databases, and saved for later use and for other members of the organisation.

Some of the knowledge, however, is not that explicit, and exists only in the heads and hands of individual workers. In part, this tacit knowledge is impossible to pass on to others in an easy way, like the routines that come with experience. However, some of this knowledge is tacit only because there is no suitable forum in which to share it.

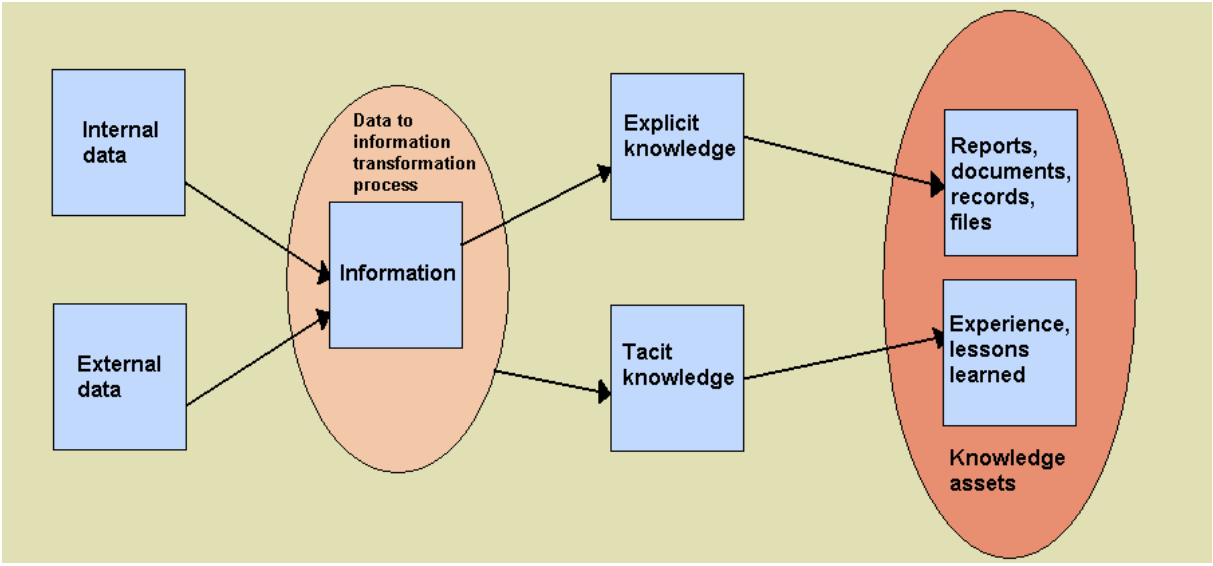


Figure 1. The figure illustrates the "data to information to knowledge" process that takes place in every organisation [Henczel, 2000].

The term "tacit" refers to something that is *"implied or indicated but not actually expressed"* [Merriam-Webster online dictionary]. Mintzberg (1975) points out this problem in relation to managers, and says that the manager has an important task in finding systematic ways to share privileged information with other workers. "*There are great dangers in centralizing the organisation's data bank in the minds of the managers. When they leave, they take their memory with them. And when subordinates are out of convenient verbal reach of the manager, they are at an informational disadvantage*", he states [Mintzberg, 1975].

"There are great dangers in centralizing the organisation's data bank in the minds of the managers."

– Mintzberg, 1975

In the information setting in the health sector, this tacit kind of knowledge takes two main shapes;

1. Tacit in terms of impossible to express and transfer and communicate to others. Many kinds of experience gained over time fall under this category, where the way of doing different tasks is stored in the workers head and hands, and is not accessible to others. They have to practice and receive their own experiences.

2. Tacit in terms of knowledge that only exists in heads of employees or within the walls of a clinic because there is no established ways in which to communicate the knowledge. In this case the information is there, ready to be captured, but for one reason or another, this does not happen. Often the reason is that the information is not considered valuable enough to be worth collecting, but in some cases it is just due to a missing link in the information system. An example here is the overview of the computers in the primary health clinics in Cape Town – knowledge about the status is available, but no effort has been made to gather this information. The facility workers have not had a formal way to communicate their computer situation, unless there are major problems with the equipment. Another example of tacit knowledge is the experiences health facility staff have with the use of information that they collect themselves. A lot of knowledge is produced when it comes to information use, explicit like reports and graphs, tacit like learning from experiences, interpretation of data etc. The latter may be lost when the majority of staff is not involved with information management and use, and/or when experienced personnel quit.

Information culture

Every organisation has an information culture, but often the culture is based more or less on coincidence. It is, however, also possible to cultivate and make incentives and frameworks in order to lead the information culture in the wanted direction [Sauerborn, 2001].

Even so, there are still several organisations that have not made any choices regarding their information culture. In many cases developing such a culture, would mean starting more or less from scratch. To succeed in developing an information culture in an organisation, it is crucial to have thorough knowledge of the organisation in question. All sides of an organisation can influence how an information culture will work, including the strategy, traditions and formal and informal relations within as well as outside the organisation. The health sector in South Africa has come a long way in its work to establish an information culture, compared to what the situation could have been if the sector had continued on the track it was on during apartheid. Because of the re-structuring of the whole health sector after the fall of apartheid, the use of information was examined, and the management had the information aspect in mind when developing the new health sector.

No matter how the information culture of an organisation is built up, and how it came about, it is important with good quality in every step of the information pyramid in order to get quality in the resulting information. This is not always easy to accomplish, as it requires assets such as time, resources and feeling of ownership from the actors. There should be quality assurance from the point of data collection to the final result, be it a graph, written report or something else.

When producing information of high quality, it seems to be crucial that everyone involved in the process feels ownership towards the information system, as well as towards the collected data and the resulting information. Sauerborn (2001) states that the best way to ensure that all potential users of the information system have a sense of ownership is to include them in as

many phases of the design as possible. They should have a say in deciding what kind of data to collect, choose indicators and defining which information should go to which users. By doing so, one increases the likelihood of the system being relevant to those who use it, and the information from it is more likely to be used in decision processes.

Just as important as having information of good quality, is to *limit* the amount of information. Any organisation should take a conscious choice regarding what information is relevant to collect, process and keep. Many organisations try to manage any information they can get their hands on, whether it is significant or not. An example can been seen from the data collection process in the South African health sector some years ago, where all kinds of data elements were being collected. Nothing was ever really used, for decision making or anything else, the overwhelming collection of health data was just a heavy burden on the facility staff, and had no impact on the function of the health system.

Using information for making decisions

Studies, such as Rodrigues and Israel (1995) and Dunn (1980) state that private organisations with a need for profit use information substantially more often that public organisations. The case is no different in public health organisations information system use in the private health care sector has long been more extensive than in the public sector, due mostly to the need for detailed financial information.[SA Health Review]. If true, this factor will be negative for decision making in the public health sector in South Africa. On the other hand, "*knowledge from inside the organisation itself is used more frequently for decision-making than knowledge from an outside source, researcher or evaluator*" [Sauerborn, 2001]. This will have a positive effect, if the health sector starts auditing their own performance on their own accord.

"Knowledge from inside the organisation itself is used more frequently for decision-making than knowledge from an outside source, researcher or evaluator"

– Sauerborn, 2001

Also, and perhaps surprisingly, the chance is greater for the decision-makers to rely on information when the decision is routinely made and not likely to induce large conflicts. When faced with high-risk decisions, they often make use of other kinds of input like gut feeling and more or less educated guesses [Sauerborn, 2001].

A common remark is that there is a difference between those creating the information and those using it as a basis for decisions. There is a risk for blocking of information use because of poor communication between "data people" and "action people". The challenge for the data people is to become more tabloid in their way of communicating, but still keep all the standards of quality of the information intact. Data is likely to be used more if the data people understand the needs of the decision makers better. Training for both parts will lead to more effective use of data in decision making. Teamwork where both data people and action people participate is also a useful way to increase their mutual understanding, and give insight in each other's work. Again, in turn, this can lead to better use of information.

2.2 Information systems and systems development

It is difficult to give an exact definition of what an information system really is, because it can include so much (or so little) and take many different forms.

The American National Standards Institute has approved the following definitions for an information system (Telecom Glossary 2000);

*"**1.** A system, whether automated or manual, that comprises people, machines, and/or methods organised to collect, process, transmit, and disseminate data that represent user information. **2.** Any telecommunications and/or computer related equipment or interconnected system or subsystems of equipment that is used in the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of voice and/or data, and that includes software, firmware, and hardware. **3.** The entire infrastructure, organisation, personnel, and components for the collection, processing, storage, transmission, display, dissemination, and disposition of information".*

Heeks (1998) gives a shorter definition of an information system;

"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."

In both definitions the human factor is taken into consideration, and we will say more about the information system as a social system in 2.3.1.

Implications of context within systems development

By "context" we mean the situation in which systems development takes place. It is something which is pre-given but is continuously shaped by human agency (Sahay, intro IN364). There are several different contexts; cultural, political, social and economic.

A need for context sensitive approaches versus the earlier context-insensitive approaches has evolved in order to meet the challenges arising from rapid change, multilevel- and side-effects, actors with different interests, new technologies and new forms of organisations and organising – factors that create complexity.

Systems development in developing country context is an example of how the variation in context requires very different approaches to system development than for the countries where the development methodologies originate. In our section on health information systems (2.5) and health information systems in developing countries (2.5.1), we give a concrete example to improve the understanding of the implications of context and the importance of awareness when it comes to systems development within a different context than a first-world business context.

2.2.1 Information systems as social systems

In our chapter on evaluation methods (Chapter 3), we emphasise the importance to see and understand an information system not only as a discrete technological artefact, but also as a complex web of social relations. The risk of failure may be higher without this understanding when designing or evaluating an information system where the predefined and expected effects are not realised. The Social Informatics Report by Kling et al. (2000) uses the term "technological determinism":

"While technical determinism can be applicable and useful in situations that are characterized by high degree of control and short time frames, it has limited value in dynamic and complex situations that unfold over longer periods of time. Technological determinism cannot adequately account for the interactions between ICT, the people who design, implement and use them, and the social and organizational contest in which the technologies and people are embedded". [Kling et. al, 2000]

Social Informatics Report focuses on social aspects of ICTs. Social informatics refers to the interdisciplinary study of design, use and consequences of ICTs that take into account the interaction with institutional and cultural context [Kling et al. 2000].

Bratteteig and Gregory (2001) state that design is about change: *"changing artefacts as well as changing people, organisations, and communities"*. The systems design and development process is also a social change process, where the traditional planning models used are not very helpful because of their emphasis on control, documentation, and reduction of choices. Therefore, Bratteteig and Gregory argue that the understanding of systems development design can benefit from social science theories. We present one of these theories – the actor-network theory – in section 2.2.2.

Web models as a theoretical framework, described by Kling & Scacchi (1982) is another way of studying information systems in a social and political context. By taking into account social relations between participants, the infrastructure supporting the information system, and the history of computer-based technology in the organisation, these web models try to define the social context of complex actions around the computer system [Walsham, 1993].

It is a general tendency that systems development has started to draw upon the knowledge of other fields like social theory and also anthropology, philosophy and sociology. Braa & Sørensen (1998) look at information systems as heterogeneous networks, where "everything is connected to everything". Various other authors emphasise that systems development must be culturally appropriate, and that solutions cannot be transplanted from one context to another (e.g. Hull (1994, Braa et al. (1995), Heeks et al. (1999)). The risk of failure is large if one does not fully understand a problem and a situation before solutions are implemented. Sociologist Anthony Giddens' structuration theory has become one of the main strands of qualitative, interpretivist mode in information research, as a way of trying to understand information systems within an organisational context. This theory is described in section 2.2.2.

The social systems view and systems evaluation

Targett (1995) states that "*evaluation has too narrow an interpretation in many organisations, being taken to refer to the quantification of well-defined benefits with the sole objective of getting the project over organisational fences*". Blackler and Brown (1985) agrees with this view; "*whilst social and organisational factors may be crucial for the successful implementation of [IT], most evaluation models fail to emphasise or even to include such factors*".

In a social context, evaluation should for instance consider who the stakeholders in the situation are, what their needs are and how to resolve conflict between those needs.

In Chapter 3 we discuss further how IS evaluation should consider the issues of social and organisational processes.

2.2.2 Information systems and organisations

Kling et al. (2000) cover the difficult and complex research area of interaction between organisations and information systems with the term “organisational informatics”. Giddens’ structuration theory from the sociological field has been especially helpful in analysing these social interactions. Another important theory concerning organisational informatics is information infrastructures. We also describe another theory that could be useful as a language for describing how, where and to what extent technology influences human behaviour: the actor-network theory (ANT).

Structuration theory and information systems

Anthony Giddens developed structuration theory as a general theory of social systems, and the theory is not directly connected to the study of information systems. Nevertheless, it has received considerable attention from information systems researchers, and it has been used primarily for theory development and analysis of empirical case studies. The structuration theory can provide a fundamental understanding of organisational context, which might be useful in order to perform successful systems development.

Anthony Giddens’ structuration theory tries to resolve a debate between two social theories: one about human agents and human actions (the context), the other about the structure of social systems (the process).

At the theory’s centre is a cyclical relationship between social structure and human action:

- Social structure -> Human action, by enabling and constraining.
- Human action -> Social structure, by producing and reproducing.

Giddens calls this the duality of structure. Meanings, norms and power are three integral elements of interaction and also of structure. These three elements are what link action and structure. He represents the duality of structure in social interaction in the following figure;

	(Meanings)	**(Power)**	**(Norms)**
INTERACTION	Communication	Power	Morality
(MODALITY)	Interpretative scheme	Facility	Norms
STRUCTURE	Signification	Domination	Legitimation

Figure 2. Giddens’ structuration theory – duality of structure.

In this figure, the 'modality' row links the other two, action and structure. For example, communication (the action) comes about when the actor applies an interpretation schema to signification. The three columns express three "integral elements of interaction".

Jones in [Kouroubali, 2002] classifies the uses of structuration theory in information system research into four main types:

1) The modification of the theory to accommodate the construct of technology. Such examples are the development of adaptive structuration theory and the structurational model of technology.
2) The application of the theory to analyse information system cases and to explore the theory’s strengths and limitations in empirical research.

3) Its use as a meta-theory, a general approach to look at actions, perceptions and structure and their interconnections.
4) A selection of Giddens' concepts in combination with newer theories such as actor-network theory to guide research on information systems.

Significant contribution to the use of structuration theory in information system research has come from Walsham [Kouroubali, 2002]. Walsham discusses the application of structuration theory to the field of information systems within organisations. He presents a practical framework for understanding organisational change. The framework is concerned with different aspects of the organisational change process such as content, social context, social process and context/process linkage.

The development of a framework for understanding the process of the adoption and use of ICT-based initiatives for development is important when it comes to systems development in different contexts, for example in developing countries. Structuration theory can help forming the basis for this framework. For example, Walsham and Sahay combine the informative character of structuration theory with the methodological component of actor-network theory to investigate problems in developing Geographical Information Systems in an Indian government department [Kouroubali, 2002].

Structuration theory and systems evaluation

Research should investigate the way IS affects human actions and organisational structures and the reason it affects them that way [Kouroubali, 2002]. Kouroubali (2002) says further that "*Studying the dynamic relationship between cause and effect could help make better design and implementation decisions to achieve desired outcome*".

This is true for the *design* of an evaluation as well; by understanding the relationship between actions and structures and the cause and effect they have on each other, one could design a better evaluation. It would be better in the sense that one would know where the major difficulties and implications of the information system would lie, and where to put focus and look for new solutions that would reduce those difficulties and implications that keep the systems from optimal performance.

Information infrastructures

Information infrastructures typically comprise a patchwork of different information and communication technologies that are somehow integrated across an entire corporation or between corporations [Rolland, 2002]. Hanseth and Monteiro (1998) use the term 'Information infrastructures' to help explain that information systems are something bigger than traditional information systems, groupware, and stand-alone applications. Information infrastructures are complex webs of information systems that encompass a whole network of human, social and technical components, and that grow over time and that are intertwined [Hanseth, 2000].

Hanseth (2002) explains how an infrastructure limits and influences an existing infrastructure (the installed base):

"The fact that infrastructures are open and evolve over a long time has important implications for how this evolution unfolds, and what kinds of strategies may be adopted in order to manage or control it. When an infrastructure is changed or improved, each new feature added to it or each new version of a component replacing an existing one, has to fit

with the infrastructure as it is at that moment. This means that the existing infrastructure, the installed base, heavily limits and influences how the new can be designed, and in fact, how it can evolve".

An infrastructure is never developed completely from scratch; it is and must be based on the already existing infrastructure, the installed base. This installed base becomes, over time, increasingly difficult to modify, extend, or radically change. Rolland (2002) refers to recent literature that points out the complexity of re-designing existing components or introducing new ones, as it often has unintended side effects that have impact on other components, which again requires these to be modified in a domino-like fashion.

The view that information systems are social systems can be combined with the information infrastructure view; the information system is looked upon as an information infrastructure and the installed base is made up of a web of social systems [Braa & Nermunkh, 1997].

Information infrastructures and systems evaluation

From Hanseth's and Monteiro's view that information systems are something bigger that traditional information systems, groupware, and stand-alone applications – it becomes important in an information system evaluation process to capture this "bigger something", in order to fully understand how the IS function. What Hanseth says about the installed base, and how an infrastructure limits and influences it, becomes important when an evaluation seeks to improve an existing information system, as each new feature added to the installed base will need to fit into the existing structures at that moment. With this view on information systems, an evaluation should take into consideration how suggested new components will fit with the current system, as no component can be implemented in a system without fitting the existing infrastructure, or influencing its surroundings. This can help reduce/discover future problems with further development of a system based on an evaluation of that system.

Actor Network Theory

Simplified, an actor-network is the act linked together with all of its influencing factors (which again are linked), producing a network. An actor-network consists of and links together both technical and non-technical elements [Monteiro, 2000].

Under the principles of agnosticism, generalised symmetry and free association, actor-network theory attempts to be impartial towards all actors in consideration, human or non-human, and makes no distinction in approach between the social, the natural and the technological [Monteiro, 2000].

Unlike action research, actor-network theory is not concerned with the emancipation of the researcher or practitioner and is not focused on making us better at developing information systems. Nevertheless, an ANT analysis may provide details to understand the success or failure of a particular innovation.

ANT shares fundamental principles with other qualitative approaches, and especially with ethnography. Like ethnography, actor-network theory is useful in handling complexity without simply filtering it out. Actor-network theory has been used to investigate the success of a number of technological innovations and, in particular, to describe failures.

Tatnall and Gilding (1999) suggest that ANT has something useful to offer to information systems research particularly in areas like business use of the World Wide Web, issues in IT

project management, computer-based collaborative work, interface design, usability testing, the use of distributed systems within organisations and other areas that involve a consideration of some of the social and political issues in information systems. Actor-network theory can also be used as a tool to enforce critical reflection on our own role as actors. It can be helpful in order to get a detailed description of the concrete mechanisms at work which glues the network together, without being distracted by the means, technical or non-technical.

One must keep in mind that it is naive to expect ANT to instruct us in separating foreground from background. Employing ANT still requires a researcher to make critical judgments about how to delineate the context of study from the backdrop. ANT is a strategy for unpacking the complexity of our everyday life, it tidies up the mess and makes things that seem complicated look obvious [Monteiro, 2000].

Actor-network theory can be useful for studies of information systems in situations where interactions of social, technological and political issues are regarded as particularly important. Experience from the Health Information System Project, HISP (see Chapter 4, section 4.4), clearly indicates the usefulness of identifying actors and actor-networks of all kinds when analysing the process of developing standards and large-scale complex information systems. The important driving force behind aligning other actors in for instance the process of standardization may be identified if there is focus on the various actors. An example is how the software developed to capture and process a pilot site data set, rapidly became a highly efficient actor in aligning minimum data sets and thus provided a real-world basis for a national Health Data Dictionary. Years of workshops and committee work had not been able to produce similar results on the ground [Braa & Hedberg, 2000].

Actor-network theory and systems evaluation

Actor-network theory can prove beneficial when it comes to evaluation of information systems. As mentioned above, this theory has been used to investigate the success of a number of technological innovations and, in particular, to describe failures – in other words used for *evaluation* of these innovations.

Actor-network theory is much used in Information infrastructures. It provides a language to describe how, where and to which extent technology influences human behaviour [Monteiro, 2000]. To put it simply; there are a lot of things that influence how one carries out a task or use a system, and as Monteiro (2000) puts it;

"You do not go about doing your business in a total vacuum but rather under the influence of a wide range of surrounding factors."

"You do not go about doing your business in a total vacuum but rather under the influence of a wide range of surrounding factors."

– Monteiro, 2000

In an evaluation process it is important to understand those factors that influence users of a system, to be able to say something about how well the system functions or is adapted to the given context. ANT can allow the evaluator to zoom in and out of a situation as suits the purpose of the evaluation, by focusing on some aspects and influencing factors at a time.

2.3 Theoretical foundations of systems development

"Systems development is planned change concerned with both the building of an artefact and introduction of the artefact in the use situation – a planned social and cultural change" [Bratteteig & Gregory, 2001].

The complexity in system development

Today's systems development has new and different goals compared to earlier. Nowadays systems development is much more than designing and developing a single software application. It must also consider the people, hardware, processes and software, which are important resources needed for success.

Why has the software development environment become so complex? Mainly it has to do with the technologies (platforms, tools, languages, etc.) changing constantly, and that the systems we develop are never static. The development methods we use also enable us to be very flexible.

Other issues that add to the complexity of systems development are new organisation forms like distributed teams, temporal, spatial and cultural differences, communication challenges and short time limits.

2.3.1 Strategies for systems development

There exist several different strategies and development models for developing and implementing an information system. In this section we present some strategies for use, before some of the most common development models are outlined in the next section. We also draw parallels from these strategies to systems evaluation, and how developing an evaluation can benefit from the strategies. Again, we refer to Chapter 3 for more on specific evaluation methods.

Scandinavian approach

In other countries, strong emphasis on democratic participation and skill enhancement is often viewed as a distinctively Scandinavian approach to systems design. This Scandinavian approach can be described as a kind of "*politically significant, interdisciplinary, and action-oriented research on resources and control in the process of design and use*" [Ehn, 1993].

The Scandinavian approach is especially known for its strong focus on participatory design (see the participation section further down). Ehn (1993) calls it a work-oriented design approach. Lyytinen et al. (1998) characterize it as a "grass root" approach because it tends to focus on individual application systems, rather than the total information system.

Some of the people who have had a deep impact on the Scandinavian IS community and research are [Iivari & Lyytinen, 1998];

- Swedish professor Börje Langefors who established IS research (ISR) communities through his visionary work on information system design (ISD). This again led to a Scandinavian prominence in the European ISR in the 1970-80s.

- Norwegian professor Kristen Nygaard; known for his pioneering work on the Simula language and object-oriented programming (1960s), and his initiation of the trade-union-oriented approach in Scandinavia (1970s).

Adaptation of information systems to the local context, empowerment through practical learning, and the creation of local ownership through participative processes are central issues in the Scandinavian projects, which, despite the differences in context, offer important lessons also for third world IS design [Braa & Hedberg, 2000].

Scandinavian approach and systems evaluation

The Scandinavian tradition with its emphasis on democratic participation may be relevant in an evaluation process. A democratic participation would mean that the users of a system can speak freely and influence the issues and questions an evaluation should investigate.

Prototyping

A suggestion for definition of software prototyping is given by Nielsen (2003); *"An early demonstration of relevant parts of a desired IS, which are to be combined with other processes in system development to improve the final system"*.

Prototypes are 'instruments' used within the software development process and different kinds of prototypes are employed to achieve different goals [Nielsen, 2003]:

(i) *Explanatory prototypes* are used to explain, demonstrate or inform. They could be used, for example, to demonstrate to a client what sort of courseware you intend to develop.
(ii) *Exploratory prototypes* are used to determine the nature of the problem, and to clarify the requirements and goals of the courseware.
(iii) *Experimental prototypes* are used to evaluate proposed development solutions, in order to find an optimal one.
(iv) *Evolutionary prototypes* are used to refine your development solution. They can be a good way of dealing with evolving requirements.

Budde et al. (1992) also delineate the construction techniques employed in prototyping as either horizontal or vertical prototyping. Prototypes can be developed technically in different ways.

The advantages with prototyping are that the resulting system is easier to use and maintaining user needs is more easily accomplished, problems are detected earlier and the design is of higher quality and inquires less effort. The disadvantages are that users want to add new modules that were not initially included and that demands for more features often arise. This might lead to a longer and more expensive developing process. The prototyping approach also requires very experienced team members.

By creating early versions of future application and solutions, one can create a basis for discussion amongst relevant groups in the development process.

Prototyping and systems evaluation

Prototyping relates more directly to pure software development, but can also be linked to an evaluation process. One can assume that prototypes of an evaluation design can be produced and presented, and then benefit from discussion from relevant groups.

A mixed approach: prototyping and specifying

An empirical interpretation suggests that mixed approaches to software development will benefit from the strengths of both specifying and prototyping (Mathiassen, Seewaldt & Stage, 1995). Effective software development must deal with complexity and uncertainty. It does so through specifying (abstraction and decomposition) and new experimental approached based on prototyping, respectively.

The spiral model mixes specifying and prototyping in a systematic way.

Cultivation

Braa (1997) uses the notion cultivation as an important framework when performing systems development in a multilevel and sensitive context. The information system is viewed as a social system, and local recourses are used. The use of a participatory process and a slow bottom-up approach is a strategy for creating local ownership and commitment.

Cultivation and systems evaluation

Dahlbom and Janlert (1996) refer to cultivation as an approach of building on what already exists in the process of change. Local resources are used and one views systems as social systems. When it comes to regular evaluation of an information system, for example a health information system, to get good situation reports of how well a system functions over time, a need to make this evaluation regular, inexpensive and automatic may evolve. By looking into what resources one already has, for instance existing reporting routines, software modules that need just a little bit of adjustment etc., one should be able to accomplish an evaluation of this kind without too much extra resources or work added to people's job descriptions.

Participatory design

The beginning of user participation in information systems development, or Participatory Design (PD), was in trade union participation in Norway in the design and introduction of new technologies in the industry.

In Participatory Design "*the people destined to use the system play a critical role in designing it*" [Schuler & Namioka, 1993]. In systems development, participatory design approaches seek to include future users in most parts of the design process, even as co-designers. Ideally, users at many levels participate so that the change can be shaped from several perspectives (Bratteteig & Gregory, 2001).

"The people destined to use the system play a critical role in designing it."

– Schuler & Namioka, 1993

Participatory Design in practice is so diverse and there is no single definition of it, but there are some common features that are agreed upon[2]:

[2] Participatory Design from the Computer Professionals for Social Responsibility website; http://www.cpsr.org/program/workplace/PD.html

- Respect the users of technology, regardless of their status in the workplace, technical know-how, or access to their organisation's purse strings. View every participant in a PD project as an expert in what they do, as a stakeholder whose voice needs to be heard.
- Recognize that workers are a prime source of innovation, that design ideas arise in collaboration with participants from diverse backgrounds, and that technology is but one option in addressing emergent problems.
- View a "system" as more than a collection of software encased in hardware boxes. In PD, we see systems as networks of people, practices, and technology embedded in particular organisational contexts.
- Understand the organisation and the relevant work on its own terms, in its own settings. This is why PD practitioners prefer to spend time with users in their workplaces rather than "test" them in laboratories.
- Address problems that exist and arise in the workplace, articulated by or in collaboration with the affected parties, rather than attributed from the outside.
- Find concrete ways to improve the working lives of co-participants by, for example, reducing the tedium associated with work tasks; co-designing new opportunities for exercising creativity; increasing worker control over work content, measurement and reporting; and helping workers communicate and organise across hierarchical lines within the organisation and with peers elsewhere.
- Be conscious of one's own role in PD processes; try to be a "reflective practitioner."

User participation in design is desirable for several reasons with mixed motivations; improving the knowledge upon which systems are built; enabling people to develop realistic expectations; and reducing resistance to change and increasing workplace democracy by giving the members of an organisation the right to participate in decisions that are likely to affect their work [Bratteteig & Gregory, 2001]. It is this third principle that distinguishes Scandinavian approaches to participatory design.

Different techniques can be used in user participation: field work (interviews, document analysis, observations), system descriptions (wall graphs, sketches for design) and system presentations (alternative prototypes, computers in the work environment, field trips).

User participation is very much emphasized in industrialized countries, and is also a very helpful and necessary approach for successful systems development in developing countries. It can, for example, help people deal with computer phobia and fears, and thus increase the user organisation’s technological capacity to sustain the system and reach a positive socio-economic impact [Mursu et al, 2000].

Participative approaches for systems development in developing counties is a fundamental reason for reducing gaps between the systems design and reality [Heeks et al., 1999]. However, in some contexts it can be difficult to have many people working together.

One project within the health sector in South Africa concerned children’s health, and in this project a number of role players were involved in the process – community health workers, parents, family members, teachers, social workers and government officials, to mention some. The variety of roles these actors held indicates that a multi-leveled and multi-sectoral group affects the situation of children at facility level [Byrne, 2003]. This example also shows that in the public sector there are often other kinds of actors involved than in business organisations, where the goal is to make money and gain the highest profit possible. But, as

Byrne (2003) points out, the culture is often poor when it comes to involving certain actors from the community in health information systems and other information systems. In particular, the voices of women, children and youth are not often heard.

Participatory design and systems evaluation

Participation can be crucial when it comes to system evaluation design. Evaluating a system without knowing what the management wants to use the results for can produce a lot of irrelevant information about a system. Here, participation from management and the evaluator is important. If the evaluation is to function by itself – for example having people answering paper-based or electronic questionnaires independently of an evaluator interviewing them, cooperation between the evaluator and the people to be asked is important. This will help formulate questions so that misunderstandings and misinterpretation are reduced. If an outside source is to evaluate the system, without any participation from the users of the given information system, there is a possibility that the resulting answers from the evaluation differ from the one where participation has been a central element in the process. Sometimes it can be important to use an external, objective part to carry out the evaluation, so that the results are not influenced by any personal opinions.

2.3.2 Development models

There are different models to software development which can also be applicable to the design of evaluation procedures. Usually several model are used, and not just one.

Waterfall model

This development method is linear and sequential; one phase must be finished before the next can start. The method is only suitable when the requirements are clear and the user participation is minimal. There have been a number of criticisms of the standard waterfall model. For instance, problems are not discovered until the system is tested. The standard waterfall model is associated with the failure or cancellation of a number of large systems.

In a developing country context where user participation is important and the complexity high, this would not be a good model for the systems development process to follow.

Waterfall model and systems evaluation

Using the waterfall model when designing an evaluation one assumes that the evaluation with all its themes and questionnaires are designed and fully completed, without much testing. It will not be changed if there turn out to be problems with it afterwards, when the evaluation process has already started.

Spiral model

The spiral model was suggested by Boehm in 1988, and is still regarded as one of the best models. It is particular applicable to large and complex software systems.

The spiral model builds on the prototype and waterfalls models. It is a cyclical development approach, combining a series of spirals, each advancing the systems definitions and implementation, and determines risk in every phase of development.

In the spiral model each iteration involves six steps; (i) determine objectives and constraints, (ii) identify and resolve risks, (iii) evaluate alternatives, (iv) develop deliverables and verify

that they are correct, (v) plan the next iteration, and the final step (vi) commit to an approach to the next iteration.

One limitation of the spiral models is that it does not deal well with frequent change. It can deal with change between phases, but once inside a phase, no change is allowed.

Spiral model and systems evaluation

In contrast to the waterfall model, the spiral model allows the evaluation to be shaped gradually. Testing and piloting may discover problems with existing questionnaires, and introduce additional issues important to include in the evolution of the system. After a testing, one withdraws and makes changes. Each phase results in a new version of the evaluation, which is introduced and tested. No testing is done before a version is completely finished and introduced again.

Evolutionary model

This model tries to deal with the problems and criticisms of the waterfall model. The idea is to develop an initial implementation and improve the system through feedback. It is suitable for the development of small systems where the complexity is low and the uncertainty is high.

Evolutionary model and systems evaluation

The evolutionary model allows one to deal with more frequent changes. An initial evaluation is designed, and changes are made frequently as feedback to the functionality is given.

Incremental development

This model combines the waterfall model and the evolutionary model. It has several advantages. The limitations are that increments should be small and each of them must deliver some functionality.

Systems development in developing countries, when taking the overall complexity into account, needs to be incremental. The system must be built step by step, in close cooperation with users who test prototypes and give feedback to gradually improve the system.

Incremental development and systems evaluation

Incremental development can be used when one does not know exactly what to look for or what aspects to focus on in an evaluation. Using an incremental model in evaluation design, as one can build/design the evaluation step by step, in close cooperation with the people requesting the evaluation and the users of the information system to evaluate.

2.3.3 Summary of system development theories

Systems development is a complex matter. It is no longer just about developing a single software application. It must also consider all the hardware, people, processes and software in the system.

In order to understand the role of information systems, their development and use, several theoretical approaches can be applied. Some of these theories make no distinction regarding the context of the first or the third world; they argue that large information systems are best understood as social systems and try to understand how the process of change within these

social systems is linked to the broader context, how human actions are produced and reproduced through social systems.

There are several different strategies and development models for systems development; some are more relevant for systems development in the third-world context than others. Changes must be incremental and piecemeal in order to take the overall complexity into account. The need for user participation is stressed during the design process, as they are the experts.

The approaches, strategies and models for systems development described, are rarely used in an individualized way. Today, they are imbedded in the overall development strategy for the specific systems development instead. They provide guidelines for developing and designing information systems, and prescribe methods or procedural suggestions that cover activities in the development life cycle.

The differences in the use of information systems and in information systems development between industrialized countries and developing countries are not based on the technology itself or on software engineering methods. The differences are mainly caused by the social preconditions, and are severe challenges for the information systems development methods and practices. To be successful, the development process (with all the methods and practices) need to be adjusted to a country's socio-economic and technological context, in order to be able to the take the infrastructural, organisational, social and political differences into account.

2.4 Health information systems

"Managers at all levels need appropriate routine information to analyse the health situation, set relevant objectives, and make appropriate plans which can then be locally-monitored using pre-defined indicators. Most importantly, the availability of good quality, timely data from all service delivery points is crucial to support the district health system." [DHIS manual]

This section will concentrate on the type of information systems we have been involved in during our fieldwork in Cape Town. The issues presented are most likely relevant to other kinds of information systems as well, but we have focused on the primary health care context.

The Alma-Ata declaration (1978) states that primary health care *"is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process."*

The evaluation chapter (Chapter 3) also covers aspects of health information systems, and briefly describes today's status for these systems as a background explaining the need of evaluation.

Health information systems as management information systems

In the literature, the terms "Health Information System" and "Health Management Information System" are used as synonyms for information systems in district health systems. Both terms basically refer to the same thing, the latter becoming more popular. Lippeveld (2001) defines a management information system as:

"*A system that provides specific information support to the decision-making process at each level of an organization*" [Lippeveld, 2001, p.3]

Health managers face a manifold of responsibilities and with the need to carefully allocate the scarce resources, the necessity to base health management on adequate information use becomes obvious. It is therefore not surprising that the "*main constraint* [for implementing the primary health care approach] *reported by practically all countries is inadequate information for the managerial process*" [WHO, 1987].

2.4.1 Properties of information and management information systems

An information system should convert anonymous data into useful management information. The HISP manual for facility health workers introduces the following processes that should be supported by a healthcare information system:

Process	**Elements involved in the process**
Collecting data	• Routinely and non-routinely data are collected. We mostly deal with routine health data systems in the public sector in this thesis. • To ensure comparability between different facilities, districts and provinces, it is essential to standardize definitions of both individual data elements and indicators. • Data collection tools can be: patient record cards, tally sheets, registers, tick registers. Data collection tools should be assessed using the SOURCE criteria[3].
Processing data	• Ensure data quality. Good data quality should be: available on time and at all levels; correct, complete and consistent; reliable and accurate enough to support decisions; represent all records of similar data; comparable, i.e. using the same definitions of data items. • Collating data: gathering together data (various reports) from various sources and putting it together into a comprehensive and representative report. Data should not be duplicated. • Reporting data; i.e. a monthly report (RMR[4]), which is a valuable summary of the activities of the facility. Its proper use involves a number of critical steps. Reporting should be both vertical and horizontal. • Target population for health programs (e.g. HIV/AIDS, nutrition); general information on the total catchment population is not enough – raw population data needs to be processed so that facility staff know the target population to be served by each program.
Analyzing data	• Self-assessment: compare actual activities with plans made and targets set. The four concepts coverage, quality, continuity and risk are the cornerstones on which self-assessment is based. • Indicators: tools used to convert raw data into useful information and to enable comparison between different facilities. `Indicator = (Numerator/Denominator) x 100 = …%` • Operational targets; show the intended level of accomplishment of objectives. Targets need to be SMART; **S**pecific, **M**easurable,

[3] Data collection tools should be: **S**imple and easy-to-use for collecting data and extracting it; **O**verlap between tools should not exist; **U**seful to data collectors locally, supervisors and researchers; **R**elevant to key functions of the unit; **C**learly laid out and easy to understand; **E**ffective.
[4] RMR; Routine Monthly Report for the DHIS (District Health Information System)

	Agreed; **R**elevant, **T**ime bound.
Presenting data	• Tables: enable comparison between facilities over time. • Graphs: help workers to summarize data, detect trends over time, search for patterns among large amounts of data, and analyze the relationships between variables. • Presenting the population: population pyramid, population pie. • Facility map[5]: an essential tool to enable health staff to understand the area around the facility and the population they serve.
Interpreting information	• Comparison: a facility should compare itself to: targets set locally and by the district; other facilities; other areas; norms and standards. • Trends: comparison over time, may show changing patterns of health in the catchment population. • Epidemiological thinking: always relate data to a known population: **W**ho gets sick, **W**hat conditions, **W**hen do they get sick, **W**here do they live, **W**hy do they get sick, **H**ow do the health services deal with them?
Using information	• Timeliness: information must be current to be useful to managers at all levels. • Feedback: if the major purpose of information is to inform the actions of potential users, then feedback is the most important mechanism to achieve this purpose. Feedback can be written (reports) and/or verbal (staff meetings, supervision)

Table 1. Properties of a health care information system.

These processes form an information cycle (fig. 2.4.A) designed to identify and promote actions at local level to improve the health of a population.

[5] See the manual "Mapping for Primary Health Care" produced by the EQUITY Project for a detailed mapping process description.

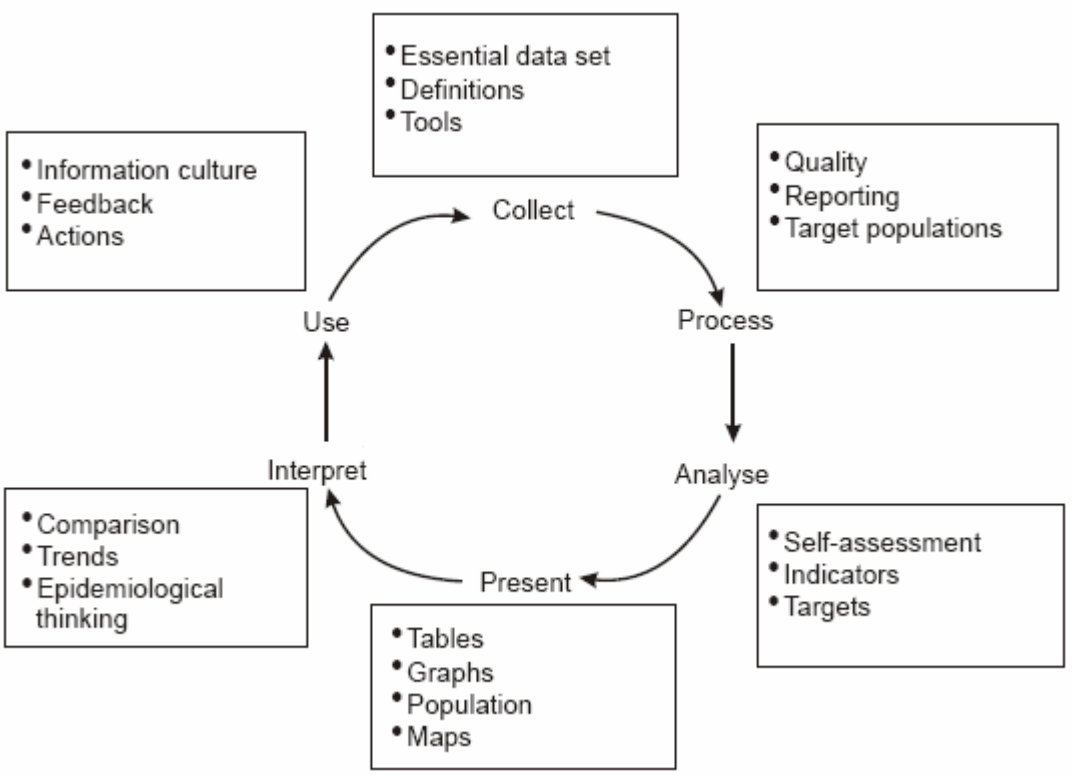


Figure 3. The information cycle [DHIS manual].

To place this *information cycle* in the context of the real world, the DHIS manual also presents a *management information cycle* (see fig. 2.4.B), where the significance of this process for a facility is that information must be used in the environment in which it is captured. The manual states that *"unless a data item can influence decisions, support change, or promote action in the place where it is captured, it should not be captured!"*.

"Unless a data item can influence decisions, support change, or promote action in the place where it is captured, it should not be captured!"

– DHIS manual

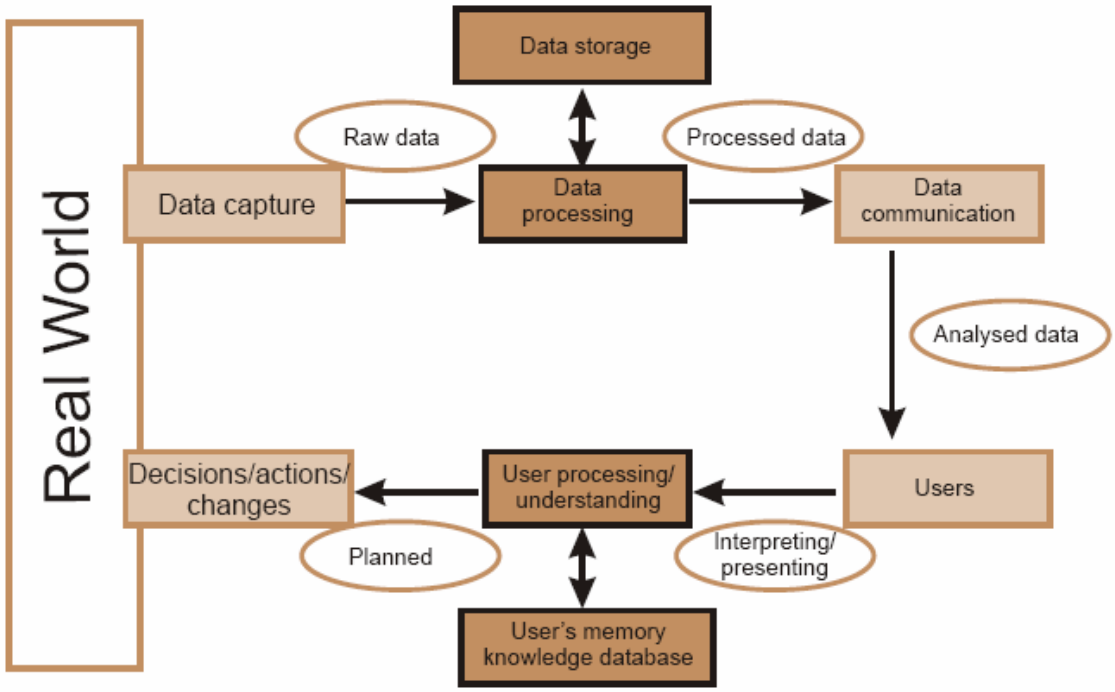


Figure 4. Management information cycle [DHIS manual].

In this management information cycle, data is captured by clerks, nurses and doctors, etc., at facility level. The 'users' in this system refer to the people at the facility who use the data for decision making and action; for instance the facility manager or other management. However, in the *real* real world one knows that this management cycle is not always completed by the facilities themselves. Often raw data is just captured at the facilities, and then sent to higher levels. The 'users' within the management cycle in Figure 4 also refer to people at higher levels within the information system, who use the data collected at facility level for various kinds of decision making.

Reporting and feedback cycles, or how information is used at the various levels of the health information system, are not included here.

Levels of information

Most of what we have said so far about health information system concerns the local levels within the health sector, which constitute the main focus throughout this thesis. This is the grass root level where patients are treated and data collected, and therefore the basis for the whole health sector.

"*Primary health care clinics are the first line for health care delivery in terms of National Health Policy. For most people using the public health service, this is the commonest point of contact and the basis on which the service is judged. It is therefore essential that these clinics function well"*. [Health Systems Trust, 2003, p.6]

The facility level is the bottom level of the *information pyramid*. The information pyramid is a way of looking at the number of data elements collected at each level of the primary health care (PHC) information system (Fig. 2.4.c).

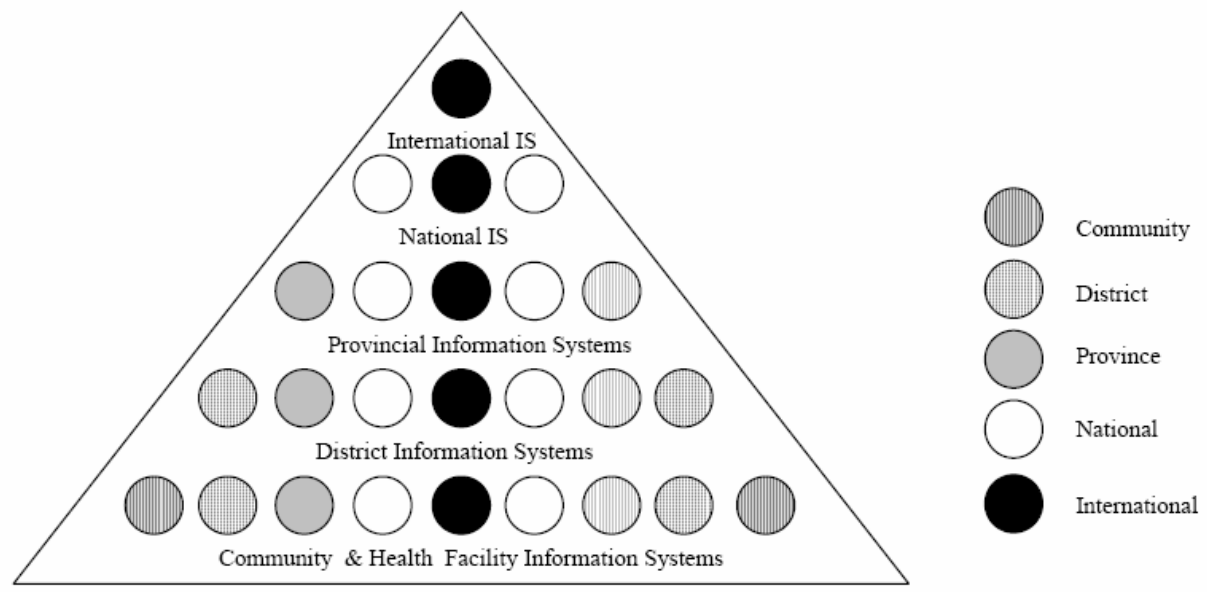


Figure 5. The Information Pyramid.

Different amounts of health data are collected at the different levels. The bottom level has the highest need for data and information. The different information needs reflect the different responsibilities in the system.

"The healthcare information system structure should permit generation of the necessary information for rational decision making at each level of the health system, each of these levels has specific functions that require specific decisions to be made".

[Lippeveld, 2001, p.3]

Types of data collected in a HIS

"Every health system requires a well-crafted mix of information sources and methods to provide the information needed for guiding and executing essential decisions and actions".

[RHINO, 2002]

The types of data being collected in a health information system can be classified into following groups [Skobba, 2003]:

- *Routine data:* Activity data about patients seen and programs run, typically being collected as the clinicians are going about their daily business. Examples are number of vaccinations given, number of deliveries. Typically data is being collected by clinicians on custom-made paper forms/sheets.
- *Non-routine data:* Special studies and other surveys collected by health workers and data collectors.
- *Semi-permanent data:* Data seldom changing, such as population in the district, facility data (number of beds, number of staff, etc.). These kinds of data typically do not belong to any program.
- *Permanent data:* Data rarely changed, such as geographical data (roads, rivers, etc.).

The distinction between routine and non-routine data tells us how often it is collected, and also reflects the intended use of data.

Types of health information systems

Health information systems can be categorised into two main groups;

- Clinical health information systems
- Routine health information systems

We focus on routine health information systems in our thesis. The next section will describe this group in a little more detail. Clinical health information systems are often large and complex systems within a hospital, incorporating patient-specific data.

Routine health information system

"The strength of routine information systems is that they put data directly into the hands of decision makers and managers at all levels of the health system".

[RHINO, 2002]

Routine health information can be defined as "*information that is derived at regular intervals of a year or less through mechanisms designed to meet predictable information needs*"

[RHINO 2002, page 2].

Routine health information systems include systems for collecting and using;

- health services statistics for routine service reporting and special program reporting (malaria, TB, and HIV/AIDS)
- administrative data (revenue and costs, drugs, personnel, training, research, and documentation)
- epidemiological and surveillance data
- data on community-based health actions
- vital events data (births, deaths and migrations)

The regular collection and use of routine information can promote local ownership and control of essential health system functions.

Since this kind of system puts data directly into the hands of managers and decision makers, the routine health information system is relevant for planning and budgeting, continuous quality improvement, and responding effectively to clients' needs.

Primary health care and district based health information system

The Alma-Ata declaration (1978) describes the primary health concept:

"Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process."

This concept was criticized by those trying to implement it for being too comprehensive, ambitious and difficult to implement. National implementations failed because the attempts were centralized, and tasks became too expensive and difficult to manage. Based on these experiences the Harare Declaration (1989) was developed, suggesting the health district as the most suitable operational unit in which to implement the primary health care strategy.

The district based health information system has proved to be a good and practical model for a primary health care infrastructure. Within this model the concerns regarding accelerating the application of known and effective technologies and of strengthening community involvement and intersectoral action for health are both accommodated for. The district health system provides a realistic setting for dialogue and planning involving both professionals and non-professionals concerned with health and social development [Smith & Bryant, 1988].

An example of a district health information system is the DHIS (District Health Information System) developed in South Africa by a collaborative university-based project known as the Health Information System Project (HISP) to support the management at district level. We refer to Chapter 4 for more about this project (sections 4.4 and 4.5).

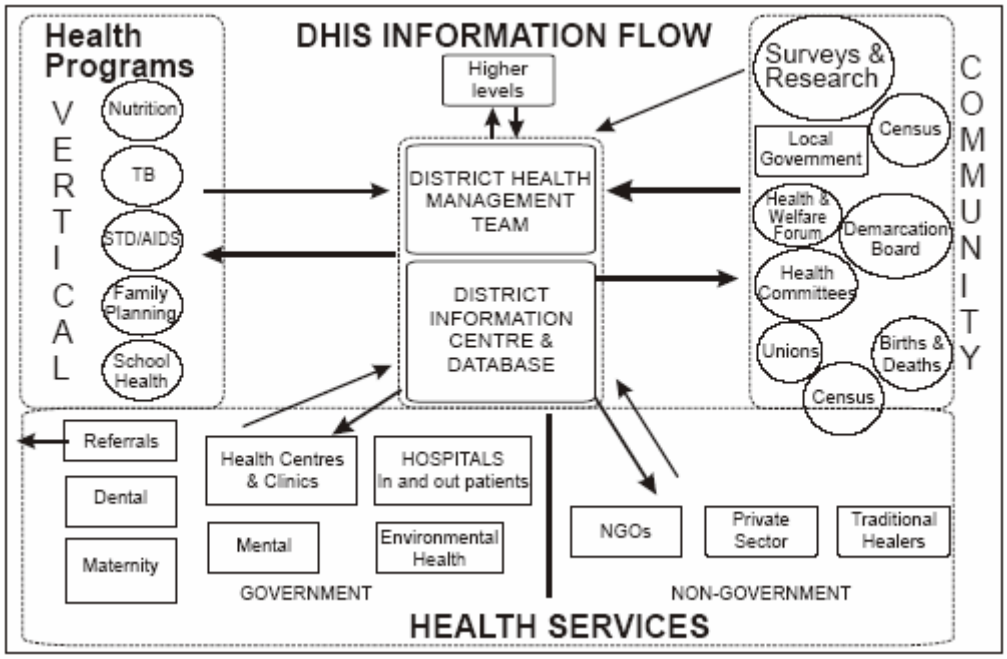


Figure 6. Example of health information flow within a district; DHIS in South Africa [DHIS manual].

2.4.2 Health information systems in developing countries

We start by introducing some important issues concerning the third-world context, before going into specific topics on health information systems.

Developing country context

The fact that developing countries own about 4% of the world's computers even though more than 80% of the world's population lives there, tells us that there is a huge gap in access to the global information infrastructure between the countries. 80% of the world's population has no access to reliable telecommunications, and one third has no access to electricity [Harris et al.,

2000]. According to UNDP[6], more than half of the world's population has never made a telephone call.

Many problems relate to inadequate infrastructure that results in poor power supply and telecommunications. The infrastructural development also needs to keep up with the rate of technological change, and there may be a lack of resources to research, develop, manufacture and support technology to do so. High prices on tools and equipment is a problem, and to maintain a sustainable use of IT, appropriate and available equipment is necessary. New technology may in turn raise demands for managerial and organisational changes in order to benefit the most.

Another group of problems deals with the shortage of skilled personnel, which leads to poor maintenance, lack of planning and difficulties in managing change. System developers in developing countries are often less adequately trained or educated to manage complex information systems development processes than developers in industrialized countries where education focuses more on the information system in an environment and not only on the software engineering.

The third group of problems relates to 'unsupportive public sector culture' as well as 'colonially inherited administrative culture' [Mursu et al., 1999], where the problems relate to 'over-politicized decision-making processes' and 'bureaucratic complexity'. A national IT policy that can give guidelines on how information technology would contribute to the social, economic and political conditions in a country is important but often absent.

If we take Africa as an example, many African countries have huge economic and political problems which cause insecurity of life and uncertainty of the future and this is not a good basis for long-term initiatives like information system development. The World Development Report 1998-99[7] for Africa states that most of the countries need to put a lot of effort into increasing their knowledge base and to invest in education in order to take advantage of new technology. It is important that developing countries strengthen educational and other empowering strategies, and that they include broader organisational, social and political issues into systems development.

As we have seen, a wide variety of problems lead to challenges for information systems development and evaluation that are different from those experienced by more developed countries. In South Africa the 11 official languages create additional challenges.

Systems development and evaluation within the third world context

The technology of information systems is likely to be the same in industrialized and developing countries, but the uses and preconditions differ, and from the problems mentioned above one could conclude that the methodology of information system technology must be adjusted to the socio-economic and technological context of the country. The choice of a development methodology should take into account its sensitivity to the cultural, social, political and moral aspects of systems design.

The culture of communication, nature of work practices, methods/processes of communication, constraints to communication, experience with new ICTs, how new ICTs can

[6] United Nations Development Programme, 1997.

[7] World Bank, *World Development Report*, http://www.worldbank.org/wdr/wdr98/index.htm, 1998/1999.

be integrated effectively into work practices at various levels, and resistance to technology – these are all important issues that must be thoroughly examined when it comes to system development and implementation.

The development process and methodology must evaluate whether the choice of technology is good, and if there is capacity to sustain beneficial use of it locally. This is important to ensure that the new system is not abandoned when the development project is finished. It is also important that the investment in new equipment and new systems is not wasted, and that additional costs such as maintenance and further development are affordable.

Another important issue is whether development of a new system can be justified or not. Here one needs to take into consideration the ethics and socio-economic justification of the information system. Does it make life easier for the users? For example, a computer will not cure diseases or feed people. The effects are rather indirect and might not be visible instantly, but can for instance make the healthcare in a developing country more efficient and improve the supply of resources in a longer perspective.

Not only for systems development in the third world, but also when it comes to systems evaluation, is it important to take into consideration the above. In developing countries, where the economy may not allow for long-term, expensive evaluation processes, one must instead take advantage of existing resources, structures and working routines when planning to carry out an evaluation. The health sector suffers from staff shortage, lack of training etc, and when conducting an evaluation of the health information system one must keep this in mind. Additional and heavy workload on staff to conduct the evaluation is not a good idea, one must rather try to capture the information needed in the most timesaving and inexpensive way, without putting to much pressure on primary health care workers (whose main concern is the patients' well-being).

Most places, at least at facility level, there are few computers and a very poorly developed network, so electronically-based evaluation procedures are most likely to be out of the question for facility level in the nearest future. Here, paper-based, effective (short, easy to use, capturing the necessary information) questionnaires can produce the wanted information. However at district level, if a good network of computers exist an electronic reporting system may be effective.

One must also keep in mind that systems developers and evaluators may have limited education, and be working under high financial, infrastructural, administrative and time constraints, so to be practical, methods should be straightforward, rapid, informal and flexible.

Technology and learning transfer

A computer system developed for and in a Western context and later transferred to and implemented in a developing-country context faces a huge risk of failing because of the gap between system design and reality. Walsham (2001) underlines the importance of sensitivity to cultural differences when working in a cross-cultural context, and emphasizes the need for understanding and empathy for the norms and values of others.

Several research projects have focused on difficulties with north-south transfer of technology. Kaasbøll and Nhampossa (2002) give an example of a south-south technology transfer of a

health information system[8] between South Africa and Mozambique. One would think that this transfer would be easy because the health system had been developed in and for a third-world context and transferred to a third-world context. But problems arose despite similarities in terms of functionality and infrastructure. Most importantly, there was a lack of computer professionals to install and adapt the system, and this resource is scarce and costly not only in developing countries.

Braa *et al.* (1995) stress that a technology has to be learned and mastered rather than just transferred as isolated machinery. When transferring technology, it is crucial to ensure learning to all involved actors as well.

These concerns apply to systems evaluation as well. Using existing evaluation design, care must be taken. The risk is that the evaluation is not adapted to the local context within the system it is supposed to evaluate – resulting in irrelevant answers, and waste of resources. An evaluation must always be tailored to a specific situation and system, and using an evaluation created for another context faces a high risk of failure.

2.4.3 Common problems with health information systems

In this section we mention some of the common problems HIS face today. These are problems that especially information systems in developing countries struggle with, but they may be highly relevant to other contexts.

Top-down or bottom-up

There are a lot of problems connected to a top-down approach when building an information system. Bentley (1987) claims that information systems are designed at the top by people who very seldom know much about health staff's work and responsibilities. System designers are not involved with the users of the system. Bentley's perspective can be transferred to systems evaluation design; evaluation procedures are decided upon without the involvement of the users of the system that is going to be evaluated. That way, an evaluator may miss some important aspects and forget to ask certain questions about the system that would reveal important problem areas or opportunities for improvements using existing resources.

A bottom up approach on the other hand is a more sensitive way to build a system [Obit, 1997] or design an evaluation. This approach can ensure that the right and relevant data required for use is collected at the bottom level, or that all problems and other important issues that concern the users of the information system are included in an evaluation. The latter gives the right focus to the evaluation process.

Action-led versus data-led health information systems

Health information systems can be action-led or data-led. A data-led information system seeks to hold every conceivable bit of information, and focuses on the data collection itself. An action-led information system looks at what decisions one can actually make and tries to identify and collect the information one needs to make those decisions.

According to several authors (Standiford, Annet & Cibulskis (1992), and Braa, Heywood & Shung (1997)) primary health care management needs an action-led approach in order to use the information to influence action. An action-led information system will be more effective

[8] HISP; Health Information System Program, is an information system development project for the health sector in developing countries.

in the way it reduces the data to be processed. It focuses on the most important data relevant for the decision making.

Lack of decentralisation

The process of moving power from central levels to the local actors is still going on in the health sector in South Africa, and this is a slow process, as was remarked in a Health Review for South Africa; "*It is possibly still too early in the process to detect a correlation between level of decentralisation of authority and use of information. This is a long process and managers need concrete, useful products before they can use available information effectively*" [SA Health Review, 1998].

The background for decentralisation of the health system is that decisions and planning happen closer to the patient and user of the system. A common problem with systems that are heavily centralised is that managers are not able to supervise the efficiency of health services. This leaves power in hands of higher levels of the information system, and not where it is really needed as a base for appropriate decisions for particular situations.

The South African Health Review (1998) also states that "*As decentralised districts are given more authority, managers are beginning to demand improved quality and timeliness of data because they can see its value for local decision making and routine supportive supervision of Primary Health Care (PHC) facilities*".

Poor quality of data

The management of the health information system in South Africa is very concerned with the quality of data, and a manual developed by the EQUITY Project[9] for health workers at facility level states that "*the worldwide experience is that the more information is used by people who collect it, the more accurate it will become*". The manual also gives the following standards for good quality data;

- Available on time and at all levels
- Correct, complete and consistent
- Reliable and accurate enough to support decisions
- Represent all recorders of similar data
- Comparable, i.e. using the same definitions of data items

The health information team is also aware that, although the quality of data has improved considerably in later years, there are still some common errors that deteriorate the quality of the data. The following table shows some common errors in health data collection [Heywood & Rohde];

Error	Example
Missing data	Data items for whole months missing
Duplicate data	Multiple counting of a fully immunised child
Thumb suck	When data collection tools are not used routinely, staff just fills in a likely-looking number (often using preferential end digits)

[9] EQUITY Project – "*strengthening equitable access to quality health services for all South Africans*". A project of the South African Department of Health supported by the United States Agency for International Development through Management Sciences for Health.

Unlikely values for a variable	A man being pregnant; low birth weight babies exceeding number of deliveries
Contradictions between variables	100 births a month when there are only 2000 women in childbearing age
Calculation errors	Missing in adding
Typing errors	Data wrongly entered onto the computer
Capture in wrong box	Condoms distributed in the place of intra-uterine devices
Intentional errors	Increase headcount to improve workload

Table 2. Common sources of error [Heywood & Rohde].

Aggregation of data

There is a risk that data becomes too aggregated on its path towards higher levels in the system [Opit, 1987]. In such cases it becomes difficult or impossible to say something about specific districts, since their data have been merged with data from other districts, making the information an average that might not apply for any of the districts submitting data.

This is a particular risk in top-down systems, where relevant information from one district or area might be disguised among data from other district or areas. Too high degree of data aggregation is an argument for empowerment of actors at local levels. Data should be collected, analysed and turned into information at a local level, and local information should be used for local action [Opit, 1987].

Lack of standards

Following the same standards throughout the entire information system is important if one wants to be able to compare items of information from different parts of the system with each other. The local actors may define their own data sets and ways of collecting data, as well as decide whatever additional data they might want to collect, but routine data must interact and be transferable to the higher levels. Although, on the one hand, it is important to have standardized kinds of data throughout the system, it is also important to recognize the fact that different levels have different data needs and different needs for detail.

In South Africa there is a hierarchy of standards, allowing each level to accustom data within an overall framework. This has helped settling disagreements about what should be the shared standards between the different provinces [ibid].

Patient security is an argument that has been brought into play when promoting a uniform and understandable standard for health information regarding electronic patient records [Data standards, 2003]. In Cape Town, a patient folder system is being rolled out, but this system was made on the initiative of management in Cape Town, and nationwide standards for such information do not exist.

Minimum data set

Often, a problem with HIS is that too much data is collected. Several authors (Boerma 1991, Braa 1997, Heywood et al. 1994) are concerned with the principle of having focus on relevant data. Only data that will be used should be collected, and this data is described as the minimal essential data set that is required for monitoring health services achievements. Each level of the information pyramid should have their own minimum essential data set in order to fulfil their tasks and responsibilities.

The benefit of having a minimum essential data set is that it (from the website of Department of Information Technology, India[10]):

- Ensures uniform recording of health data.
- Ensures that critical information required to profile a disease is not missed.
- Provides an evidence-based information system for better decision making.
    - Doctors can use past experiences from a variety of scenarios to suggest appropriate treatment.
    - Planners and policy makers can allocate resources more effectively for health programs that are most impactful.
- Reduces cost requirement for sharing and communication health data in a heterogeneous system environment.

All these benefits make it easy to conclude that the minimum data set is a (the most?) critical management decision-tool in the health sector.

Limited usage of data

Producing information is not the objective of a health information system, the objective is using it. Sauerborn (2001) claims that good data will be transformed into useful information, which in turn is likely to influence decisions. As a second step, one will see that information-based decisions can lead to a more effective and appropriate use of scarce resources. Consequently, there should be a spiral formation, stimulating more good data, and more information-based decisions. But for this to occur, it is essential that the information that is supposed to influence the decision-makers is relevant, reliable and available. There are also a number of inappropriate uses of information, like non-use, under-use, misuse, premature use and over-use of information, although non-use and under-use are probably by far the most frequent [Sauerborn, 2001].

If those making decisions are convinced of the reliability and validity of the information, it tends to be used more, Sauerborn (2001) claims. Also, the quality of the data the information is based on must be guaranteed for, and ownership should be fostered among all potential users of the information if the information is to be used more. A challenge here, especially with complex systems like a health information system, is to identify as many stakeholders and users as possible, and also determine how influential the different actors should be on different levels of the development process.

Others take a different approach than Sauerborn's view that good quality data leads to more use of it. In HISP, this issue is turned upside down, as the manual for facility workers states that the more information is used by the ones who collect it, the more accurate it becomes, and that this is a worldwide experience [Heywood & Rohde]. In this perspective, good quality data is not necessarily succeeded by more information usage, but extensive information use will lead to good data quality. This can also be the foundation for a positive spiral, as a high level of information use will lead to better quality of the data, which again causes more reliance in the data, making decision makers even more willing to use the data as a base for their decisions, and so on.

Huge amounts of information can be a problem, and decision-makers often seem to get lost because of the large quantities of information that do not really have any relevance for them.

[10] http://www.mit.gov.in/telemedicine/annexure4.pdf

An important task is therefore to tailor the information, and realize that different users need different output.

But even if information handling and use have been major concerns in a number of developing countries in recent years, people still use data to a very limited degree. Several studies of health information systems in development countries, from among others South Africa, Mozambique and Mongolia, show that the use of data is scarce, and that only to a limited extent is information analysed and used, not least for making decisions at a local level in the health sector [Braa, Heywood, Sunking, 1997], [Braa, Nermunkh, 2000] and [Braa et al, 2001]. In Mozambique the findings were that the health workers in facilities as well as at district and regional level regard their information system "purely as an upward reporting system, and not as a system that may support them in their own work" [Braa et al, 2001]. There were similar findings in the other studies mentioned above. On this issue, these studies indicate that the problems in facilitating support for local action in health information systems are both general and global.

3 EVALUATION METHODS FOR INFORMATION SYSTEMS

In order to be more certain that the information that is derived from an information system is accurate, complete, relevant, and in other ways good enough to use as a base for making decisions, it is important to evaluate the performance of the system, and look at how the system is used.

This chapter explores different ways of evaluating information systems. The most common and traditional methods like interviews and observation are described, and also more comprehensive methods like mathematical and computer simulation models and network analysis, to mention some. We mention special considerations when evaluating health information systems. The information audit as an evaluation tool is especially highlighted due to our experiences with this method in health facilities in South Africa.

3.1 Making methods decisions for an evaluation

When deciding data collection options and strategies for a particular evaluation, one should answer the following questions [Patton, 1987]:

1) *Who* is the information for and *who* will use the findings of the evaluation?
2) *What* kinds of information are needed?
3) *How* is the information to be used? For what purposes is the evaluation being done?
4) *When* is the information needed?
5) *What* resources are available to conduct the evaluation?

Having answered these questions may help in determining what kinds of data are appropriate in the evaluation. Patton (1987) states that "The challenge in evaluation is getting the best possible information to the people who need it – and *then getting those people to actually use the information in decision making*."

Qualitative and quantitative data choices

When choosing a particular evaluation design, one must also consider what data to collect; qualitative and/or quantitative. The two different approaches to evaluation both have advantages and disadvantages.

By choosing qualitative methods in the data collection process, one gets the opportunity to study a few selected issues or cases in depth and detail. This method produces a wealth of detailed data about a limited number of people and cases. Qualitative methods try to capture the richness of people's experiences in their own term.

Analysis of qualitative responses can be difficult, compared to the quantitative measures that are easily aggregated for analysis, because responses from qualitative research are neither systematic nor standardized.

Quantitative methods, on the other hand, examine a much larger group of people and cases, using a set of limited questions. Using systematic and standardized measures, the answers to these questions fit into predetermined response categories. The advantage with quantitative methods is that they give a broad, generalizable set of findings. They do not, however, provide a forum for elaborations, explanations, meanings and new ideas to the same degree that qualitative methods do.

3.2 Qualitative methods in evaluation

We will now explore three kinds of data collection methods that are relevant in qualitative methods:

1) in-depth, open-ended interviews
2) direct observation
3) written documents (open-ended written items on questionnaires, personal diaries, program records)

Qualitative evaluation data can be presented alone or in combination with quantitative data. The use of multiple methods including combination of qualitative and quantitative data has become more and more popular in the evaluation profession.

Interviewing

In-depth, intensive interviewing is the major way in which qualitative evaluation seeks to understand people's perceptions, feelings and knowledge.

Interviews are a very popular form of investigating information systems. Interviews can be performed in several different ways. In a formal interview, the interviewee is aware that the information he provides is recorded on tape or paper, and that the interview is a part of a research. An interview can also be informal, and for the interviewee appear as an occasional chat or discussion. The interviewee might or might not know that the one he talks to is an investigator.

A formal interview can have a varying degree of structure. One extreme is that all the questions are predefined – each single word might even have been decided beforehand. If more than one interview is performed, the questions are asked in the same order and same way every time. In a semi-structured interview, the investigator has defined some topics he wants to talk about, but is flexible, and can pick up on issues the interviewee wants to discuss. On the other extreme is the unstructured interview, where no questions are predefined.

Observation

Because there are limitations as to how much can be learned from what people say, direct participation and observation may be the best methods to improve understanding of the program under evaluation. One gets a kind of insight into the program setting that is hard to get only trough interviews.

Data derived from observations are qualitative, and can take different varieties. The data can come as statements from staff and patients, gestures and other non verbal expressions, characteristics of the physical settings, descriptions of how the work is performed,

observations on the amount of the time used on the information system, and portion of time used on other tasks.

Observational methods include both participant and non-participant approaches. When following a non-participant approach the investigator act as a detached observer, and is supposed to not interfere with the work or influence the setting. To be able to do this, one must take great care when the investigator is immersed into the environment. Otherwise, there is a substantial probability that the presence of the investigator will skew or influence the activities of the subjects [Friedman &Wyatt, 1997].

The other approach is that the investigator becomes a part of the working team. Doing observations like this takes time and can be difficult since it might require the investigator to have specific skills prior to the observations. It is also crucial that the workers accept the investigator as part of their team. The reward is that the investigator can get a more vivid impression of the working conditions.

A report on an observational evaluation tries to take the reader into the program setting that was observed, the evaluation writer becomes the surrogate eyes and ears for the reader [Patton, 1987]. The data must have depth, details and be descriptive in such a way that the reader can put himself into the setting and understand what goes on, all this without the data being irrelevant.

Collecting evaluation data though observations are very demanding work; the observer must have the right skill, competence and rigor to be able to function as a good instrument. Further limitation to observation as an evaluation method is that it is not possible to observe *everything.* It is a labour-intensive and expensive evaluation method.

Observation and interview integration

The two qualitative data collection methods, interview and observation, are often treated as two separate techniques, but are fully integrated approaches in practice.

Patton (1987) says that “every face-to-face interview also involves and requires observation” and that “the skilled interviewer is also a skilled observer”. To give an understanding of how observation and interviewing are mutually reinforcing qualitative techniques, he describes the qualitative evaluator role:

1) The qualitative evaluator must have sufficient direct, personal contact with the people and program being evaluated to understand what is happening in depth and detail.
2) The qualitative evaluator must be able to provide a meaningful context for what takes place and what people actually say.
3) The qualitative evaluator will report a great deal of pure description of people, activities and interactions.
4) The evaluator will capture and report direct quotations from people, both what they say and what they write down.

Analysis of documents and artefacts

In an information system, a lot of documentations will be produced in many different shapes – papers, computer systems, forms etc. These items can be examined retrospectively, and are

useful in order to find out what has been done, and how it has been done – for example to find out whether the right tool is being used, and whether the tool is used right.

Themes in qualitative methods

The following table briefly introduces some of the major themes in qualitative methods [Patton, 1987].

Naturalistic Inquiry	As opposite to an experience, evaluators engage in naturally occurring activities that are not planned or manipulated for purposes of the evaluation. It is particularly useful for studying variations in a program implementation (to describe naturally unfolding program processes and impact over time when participants and conditions change).
Inductive Analysis	An evaluation approach is inductive to the extent that the evaluator attempts to make sense of the situation without imposing pre-existing expectations on the program setting. Inductive designs begin with specific observations and build toward general patterns. Categories or dimensions of analysis emerge from open-ended observations as the evaluator comes to understand the existing program patterns.
Direct Contact with the Program: Going into the field	Field work is the central activity of qualitative evaluation methods, and means having direct and personal contact with people in the program in their own environments. This method involves participating where possible in natural program activities and getting to know program staff and participants on a personal level.
A Holistic Perspective	The holistic approach assumes that *the whole is greater than the sum of its parts*, and also assumes that a description and understanding of a program's social and political context is essential for overall understanding of that program. The purpose of a holistic approach is to avoid creating a program evaluation "monster" of isolated, unrelated and out-of-context parts.
A Dynamic, Developmental Perspective	A process oriented approach, capable of capturing and monitoring not only anticipated outcomes but also unanticipated consequences, treatment changes and the larger context of a program implementation and development.
Case Studies	A case can be a person, an event, a program, a time period, a critical incident or a community. A quantitative case study seeks to describe a case in depth, in detail, in context and holistically. *The more a program aims at individualized outcomes, the greater the appropriateness of qualitative case methods.*

Table 3. Themes in qualitative methods [Patton, 1987].

When to use qualitative methods

Patton (1987) suggests types of evaluation where it may be particularly appropriate to use qualitative methods:

• Process evaluation • Evaluating individualized outcomes • Case studies • Implementation evaluation • Describing diversity across program sites • Formative evaluation • Evaluate quality • Quality assurance and quality enhancement • Legislative monitoring • Unobtrusive observations	• Personalizing evaluation • Responsive evaluation • Goal-free evaluation • State-of-the-art considerations: Lack of proven qualitative instrumentation • Exploratory evaluation research and evaluability assessment • Adding depth, detail and meaning to quantitative analysis • Breaking the routine: Creating new insights • Grounded theory and program evaluation

Table 4. When to use qualitative methods [Patton, 1987].

Designing qualitative evaluations

We use Patton (1987) as an example of qualitative evaluation design, and highlight some main issues of his evaluation design in this section.

Patton (1987) distinguishes between conceptual issues and technical design issues. But whether the technical design is quantitative or qualitative, it is important to have support and understanding of the evaluation amongst the participants. The following questions concerning conceptual issues should therefore be answered;

- Who are the primary stakeholders for the evaluation?
- What is the purpose of the evaluation?
- What approach, model or framework will be used to provide direction for the evaluation?
- What are primary evaluation questions or issues?
- What political considerations should be taken into account?
- By what standards and criteria will the evaluation be judged?
- What resources are available for the evaluation?

These are questions for the interested participants in the evaluation to answer: stakeholders, decision-makers, and information-users – including founders, staff, administration, clients and policymakers.

The technical design issues, on the other hand, are concerned with data collection and analysis, and ask the following questions;

- What will be the method(s) of inquiry?
- What will be the primary unit(s) of analysis?
- What will be the sampling strategies?
- What comparisons, if any, will be made?
- What kinds of data will be collected? From whom? When? Using what instruments?
- How will the quality and accuracy of the data be ensured? What level and what type of accuracy are needed?
- How will concerns about validity and reliability be addressed?
- What kind(s) of analysis will be conducted?
- What kind(s) of statements and findings will result from the evaluation?

“There are no perfect research designs”

Strategies and tradeoffs are terms that go together when conducting an evaluation. Tradeoffs results from limitations of resources and time, the complexity of the reality of social nature and political considerations.

When deciding on the evaluations issues and questions to study, the first tradeoffs are made; should one investigate few issues in depth, or more issues in less depth (breadth versus depth tradeoffs)?

An evaluation designer is also faced with questions about how deep one should go into the study, and what units to analyse. The questions about depth should be answered with how much time and effort the evaluator is willing to invest – and able to invest. When it comes to selecting the right units to analyse Patton (1987) says that “*The key factor in selecting and making decisions about the appropriate units of analysis is to decide what units it is that you want to be able to say something about at the end of the evaluation.*” If one knows what kind of information or the level of information the decision makers need, it is easier to make this decision, although decision makers would rarely be able to give the exact units of interest here. So again it lies in the hand of the evaluator to choose the best way, and find the best translation between stakeholders’ questions and the appropriate units of analysis.

Choosing a sample

In order to achieve a purposeful sampling it is important to choose cases from which one can learn a great deal about central issues in the evaluation (information rich cases). Several different strategies for selection information rich cases exist, in which the logic of each serves a particular evaluation purpose. See [Patton, 1987] for more details on these strategies.

To determine the size of purposeful samples there are no guidelines, and this issue must be negotiated between key participants. “The sample should be large enough to be credible given the purpose of the evaluation, but small enough to permit adequate depth and detail for each case or unit in the sample” [Patton, 1987].

An important thing to remember is that all decisions about what one wants to say with the data, purpose and degree of credibility must be made in the evaluation *design*. It is too late to make design decisions about generalization when the data analysis has begun.

Design alternatives and methodological mixes

In order to overcome some of the weaknesses related to one single data collection strategy, an evaluator can combine different approaches and combine the strengths of the different ones.

Building checks and balances into a design through multiple data collection strategies is called *triangulation*. Four types are identified [Denzin, 1978]; (1) data triangulation – a variety of data sources are used in a study; (2) investigator triangulation – several different evaluators or social scientists are used; (3) theory triangulation – multiple set of perspectives are used to interpret a single set of data; and (4) methodological triangulation – multiple methods are used to study a single problem or program.

Patton (1987) claims that triangulation is ideal, but that it is very expensive. In the real world, with limitation on budget and time and political constraints, it may be more useful to

implement one approach very well, rather than having a series of poorly implemented methods.

Triangulation is important in the way it recognises that the evaluators need to be more open to several ways of looking at a program. However, Patton says there are strong arguments for maintaining the integrity of a pure qualitative methods approach in evaluation, and that mixing parts of different approaches is a matter of philosophical controversy. But in practice the relevance and usefulness of the information outweighs concerns about methodological purity.

Patton also talks about another approach where mixed methodological approached are created by combining and borrowing parts form pure methodological strategies. The ideal-typical qualitative methods strategy consists of three parts: (1) qualitative data, (2) naturalistic inquiry, and (3) inductive content analysis. In contrast, the classic hypothetico-deductive approach to scientific inquiry would ideally include (1) qualitative data from (2) experimental (or quasi-experimental) research designs and (3) statistical analysis based on deductively derived hypotheses.

Some methods can be combined, others can not. For example it is impossible to employ an experimental design and a naturalistic inquiry for an evaluation at the same time in the same program and with the same participants. Another limitation is that while one can convert qualitative descriptions into quantitative scales, it is not possible to go the other way around; converting quantitative measures into detailed qualitative descriptions.

In his chapter on designing qualitative evaluations, Patton concludes that there is no easy answer to which evaluation design is best, and which strategy will provide the most answers. Each case is different; stakeholders interests differ, the purpose of the evolution differ and so does the available funds, and the evaluators themselves (interest, ability, bias, etc.). His best advice is to employ those methods best suited to producing the information that is most needed in a given situation.

3.3 Other evaluation methods

In addition to qualitative research [Anderson, Aydin & Jay, 1994] mention other evaluation methods that we include as an important part in our methods chapter.

Survey Research Methodologies

A sample of individuals, departments or organisations answers predefined questions, and with this as a basis, a quantitative description of population characteristics or of the relationship between different variables is made. Descriptive responses in a more qualitative fashion can also be included in the survey methodology, and researchers can get indications on what problems exists, as well as their seriousness and pervasiveness.

This methodology is in general widely used to study the impact of different information systems. What is generally not catered for with this type of study is an examination of the relationship between information systems and their external environment, the dynamics of how change takes place, and societal impacts of the information system.

Cohort/Time Series Studies

These types of studies are used to follow individuals (cohort studies) or performance measures (time series studies) over a period of time. This is done in order to evaluate the impact of implementing a computer system. The point is to collect the data on different points in time, e.g. prior to the implementation and then 6 and 12 months after the implementation. The method is suited for examining cause-and-effect relationships. It is, however, an expensive and time-consuming kind of study to conduct. There is also a need for a large variety of parameters to investigate, in order for at least one of them to be of interest.

Earlier studies of this kind have been used to show that parameters, like workers' orientation towards change and the initial attitude towards the system, can predict the adaptation to the system. Other studies measure time saved after introducing a new system.

Experimental Research Methods

This method can be used to measure the consequences of a system with regard to individuals, work groups, and organisations. This kind of research has mainly been conducted in laboratories, and is characterized by: (1) random assignment of subject to treatment and control conditions; (2) manipulation of one or more independent variables; (3) measurement on their effects on the dependent variables; and (4) control over other independent and intervening variables that affect the dependent variable.

The great benefit in this type of study is that the researcher can use the controlled conditions the laboratory gives to test hypotheses derived from theories or other empirical studies. The problem, however, is to transfer the results to real life, and predict what impact the system in reality will have on the users and the organisation, as the actual organisational setting most likely will contain a large number of unforeseen and uncontrollable factors.

In many other fields of research, the laboratory experiments are performed with one treatment group and one control group, so that the results can be compared. This is not easy to do when examining computer systems, since the subjects in most cases are aware of what group they belong to, and because of this, we lose the aspect of objectivity from those who take part in the experiment.

Another approach, that is somewhat closer to the real environment for the system, is to use a quasi-experimental design. The quasi-experimental design differs from the experimental design in that the treatment group and the control group is not picked at random. Instead, the treatment group is chosen because the subjects are willing to serve as guinea pigs. The control group is then picked out in order to match the treatment group as closely as possible. In this method lies a bias, since the individuals of the treatment group are more willing and enthusiastic towards the new system than most others.

In this set-up, the researcher can test the hypotheses in a natural organisational setting. By doing so, the results will be more relevant than those only supported by results from experiments performed in a laboratory. Compared to the strict lab experiments, the researcher must make some compromises in the quasi-experimental model, as there will be variables that can be both extraneous and confounding, and are beyond control, whereas in the laboratory experiment, the researcher should have control over all the important factors.

Mathematical and Computer Simulation Models

Without interfering with the ongoing work in the organisation, and quite inexpensively, it is possible to study the operational effectiveness and predict the effects of changing the operational environment, using simulation models. Simulation experiments involve the manipulation of mathematical and logical models that describe the behaviour of the individuals and the organisation in response to an information system. Both dependent and independent variables, as well as their relationship, are included in the model, making these kinds of studies highly valid.

But even with the advantages of these models, the use is limited. Many real-life settings can not be simulated accurately enough, especially where humans are main actors. One requires numbers that indicate certain activities, and the variables are often too many and the structures too complex.

Combining methods

Examinations of complex social interactions as determinants generally require a combination of quantitative and qualitative methods. The combination gives an insight none of the methods can provide on their own. In the same study it is for example possible to test hypotheses and explain why and how an information system brings about change.

Network analysis

This approach focuses on interactions that occur between individuals and/or departments, for example when a medical information system is adopted and its use diffuses throughout the organisation. The hypothesis is that an individual's response to a new information system is affected and constrained by their position and roles of the social system they take part in. An individual's use and adaptation of the system depends on group interaction.

This view differs totally from those who regard the individuals and organisational units to be independent of one another in ways of responding to the information system. The approach attempts to identify the communication structure or the underlying social structure. This method for analysis is based on graph theory, clustering methods and multidimensional scaling.

3.4 Stakeholder theory and view

The stakeholders' central role is frequently repeated when it comes to evaluation of information systems. Therefore we felt the need to amplify the stakeholder theory and some issues around this theme.

Different stakeholder groups have different demands, and therefore evaluation and evaluation methods that influence them should be adapted for the different groups.

A wide range of people and interest groups have involvement with any organisation. They include; stock/shareholders, customers, suppliers, employees, the local community, government and others. These actors also have different and varying degree of influence on the conduct and progress of the organisation.

The stakeholder theory is a criticism of the strong stockholder doctrine in the U.S. corporation law and financial-economics theory, which implies that management's main responsibility is

to maximize economic rents on behalf of the firm's legal owners. In the stockholder theory, no other stakeholders count.

R. Edward Freeman (professor of Applied Ethics at the University of Virginia's Darden School) argued that managers should serve the interests of everyone with a "stake" in (affecting or affected by) the firm. Freeman uses the term "the big five" about shareholders, employees, suppliers, customers and the communities in which the firm operates. According to Freeman the purpose of the firm is to serve and coordinate the interests of the big five. He claims the firm's management are morally obliged to strike an appropriate balance among the stakeholders' interests when directing the firm's activities.

Although this original stakeholder theory concerns the law and finance sectors, it is transferable to other areas, for example the health sector. In the health sector, however, there will be other stakeholder groups, and different interests than just making money. Here, patients' well-being and right use of resources are some of the prior concerns. Section 3.6 introduces different stakeholders within a health information system.

Stakeholder theory has achieved a degree of acceptance in the strategic management literature, and is being referred to in new textbooks as a tool of strategic analysis. There is, however, substantial resistance to this theory in the financial-economics literature, where there is a counter-movement favouring stronger stockholders' rights and corporate-governance standards [Windsor, 1998]. Generally, in the literature, there also remains a dispute over the meaning of the term 'stakeholder'.

Criticisms of the stakeholder theory ask why firms and management should give something back to those they routinely give so much already. Employees are paid wages and benefits in return for their labour, customers get goods and services in return for revenues and in addition firms pay taxes and obey the law. Marcoux (2000) ask why firms must give something more to those whom they have already compensated.

3.5 Special considerations when evaluating health information systems

Let us start by defining what a medical or clinical information system is. Health care organisations use new computer-based products in order to improve efficiency, reducing costs and improving patient care. These products include computer applications where the health care personnel interact directly with the computers, and are referred to as the medical, clinical or health care information system. They range from comprehensive systems that coordinate all patient care in all departments of a hospital to smaller separate systems covering one department.

[Anderson, Aydin & Jay, 1994] refer to [Garner, 1990] and a survey that indicates that "hospitals use less than one-quarter of the abilities built into their computer systems". Findings by Dowling (1980), Lyytinnen (1988) and Lyytinnen & Hirchheim (1987) indicate that more than half of these systems also fail because of user and staff resistance.

A recent Norwegian study states that even now information system projects often become much more expensive than estimated. Three out of every four projects exceed the estimated budget, and the public sector has less control than the private sector – in the public sector the

budget overruns are as high as 67%, compared to 21% in the private sector. In addition, four billion NOK are spent each year on projects that are aborted, or where software is never implemented or used [Moløkken et. al., 2004].

The pressure of being cost-effective pushes health care organisation to perform detailed evaluations of the information systems in order to justify expenditures, with very few guidelines for designing effective evaluation strategies and selecting appropriate methods to examine the system use.

A multimethod approach

Evaluating health care information systems is a multimethod approach. An evaluation strategy should go beyond the technical aspects of an information system. Even so, the people who develop, implement and evaluate clinical computer systems often address only the technical aspects of the systems. The success lies rather in the integration of the computer system into a complex organisational context.

Anderson, Aydin and Jay (1994) provide developers, administrators and evaluators with a practical guide for determining what questions to ask and the most effective methods available to answer these questions. They say that what is most important when it comes to designing an evaluation is:

1) Any evaluation must be preceded by a clear statement of study objectives.
2) The investigators should recognise their own perspective and assumptions concerning how information systems affect and are affected by the organisational setting in which they are implemented.
3) Only when having fulfilled the above are the investigators ready to review and select appropriate methodologies to answer their research questions.

Complexity of medical systems evaluation

Evaluating medical information systems is a complex issue, where several different fields come into play. There are almost no limits to the number of different focuses one can have on evaluations concerning the information systems in the health sector – e.g. evaluation of hardware; software; what data should be collected; how patients, health personnel and other actors are influenced by an information system; how databases are built up; etc. The investigator can work from a medical, technical, economical or sociological point of view. Health care is a safety-critical area, and therefore users of a medical system may want more proof of its effectiveness and security, than in other areas.

It is particularly complex to evaluate a medical system because it lays in the intersection of three, in themselves very complex disciplines: medicine and health care delivery, computer-based information systems, and evaluation methodology [Friedman & Wyatt, 1997].

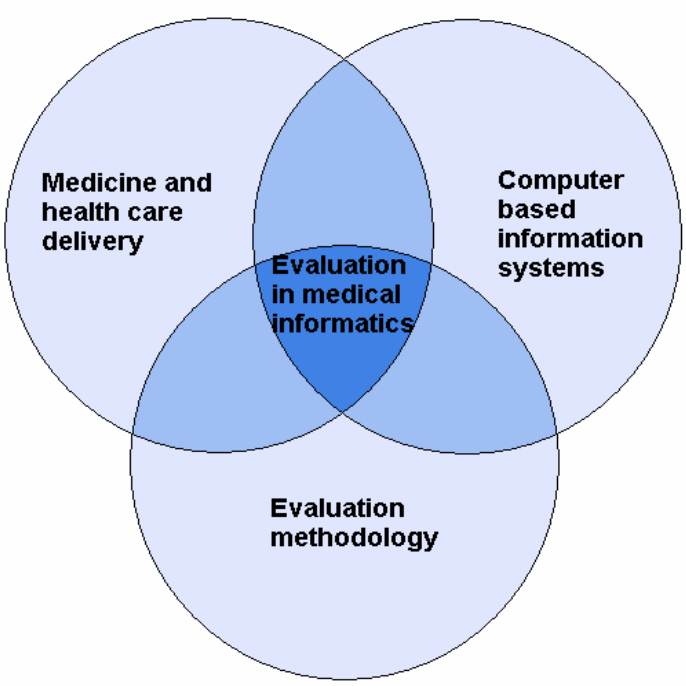


Figure 7. The figure shows the complexity of medical systems evaluation [Friedman & Wyatt, 1997].

Reasons for performing evaluation

Despite the difficulties, there are a number of reasons why one would want to perform an evaluation in health information systems, and the five major ones are:

1. *Promotional*: Systems must be evaluated in order to assure physicians and management that they are both safe, cost-effective, and benefit patients as well as institutions.
2. *Scholarly*: Ongoing evaluation must be conducted in order to uncover the principles of medical informatics as a discipline.
3. *Pragmatic*: If the developer is to gain any knowledge about which techniques and methods are effective, or why some systems fail, it is necessary to evaluate the systems. This will also be of use to other developers, who can learn from the mistakes of others, and build on their good ideas.
4. *Ethical*: An evaluation is an insurance for health care providers that the system is safe, and in addition it makes the system justifiable in preference to other information resources.
5. *Medicolegal*: to reduce to risk of liability, information recourse developers should have evaluation results to show to; to allow them to assure users that it is safe and effective.

[Friedman & Wyatt, 1997]

3.6 Stakeholders in evaluation of health care information systems

Different groups within a health information system may want to know different things about the same system. Friedman & Wyatt (1997) mention the key stakeholders in a clinical

information resource project to be the developer, the user, the patients and the person responsible for purchasing and maintaining the system.

Turunen (2001) also apply general stakeholder thinking in the evaluation of primary health care information systems. Turunen states, however, that the basic stakeholder groups must be divided into more precise categories than the basic division into users, managers, developers, patients and outsiders give. He classifies people according to their educational background, since this also helps take into consideration their relation to the evaluation and the special characteristic of primary health care.

Users	Physician
	Nurse
	Supporting employee
Managers	HC
	Non-HC professionals
Developers	HC*
	IS-background
Patients	
Outsiders	Financiers
	Purchasers
	Others

Table 5. Classification of stakeholder groups for the purposes of identifying stakeholder groups in the evaluation of health care information systems [Turunen, 2001]. *Personnel with health care background.

Turunen provides an algorithm for defining the basic stakeholder groups:

- Check through all simplified stakeholder groups in Figure 1 and drop out groups that are unnecessary in terms of the phenomenon. Stakeholder groups mean groups which are connected with the phenomenon we are studying and which are affected by the phenomenon. A small-scale round of interviews with key individuals can shed more light on the matter. It is notable that some of the stakeholder groups that are important for the approval of evaluation results may be hidden.
- Identify which groups should be included in ‘others’.
- Check through each remaining group and decide whether each group should still be defined more precisely, i.e. does a stakeholder group have a relevant subgroup?
- Repeat step 3 for each new stakeholder group identified in step 3.
- Think again about everyone who is involved and make sure that no stakeholder group has been left out.
- Prioritise, i.e. consider which the essential stakeholder groups for the phenomenon are and what their opinions are.

He also made a summary on which evaluation methods that suited what groups. For example, that a cost-benefit analysis is more suitable for a manager than a developer, and that a quality of life measure is more suitable for a nurse than for a developer.

Some of Turunen's other findings were:

- Evaluation in the context of a person's own work seemed to be more important to the users than evaluation of how the program functions.
- Managers want a wide range of different measures: economic evaluation, evaluation from staff's and patients' perspective.
- Developers expect a user-oriented evaluation method, and they want the results to be presented as technical solutions or suggestions.
- A quantitative research method is preferable at the planning stage when starting a project. In order to develop a system, a qualitative approach is also needed. This is the "*Dilemma of medicine-related research"*.
- Pre-evaluation is useful in terms of credibility for performing evaluation among managers with health care background. User information satisfaction measures should be used in pre-evaluation.
- Steering groups should be set up for making it easier to carry out evaluation projects.

It is important to keep in mind that the generalization of a case study like this is always limited. Turunen's division into different stakeholder groups in a health care information system can be useful, but may need different approaches and categories of stakeholder than what is outlined here. Each evaluation must fit the situation and objectives set.

3.7 Addressing organisational issues into the evaluation of medical systems

There is a growing interest for the non-technical factors like social, organisational and political, which influence an information system project. New design methodologies are being developed to address these concerns. Outcomes related to selected technical or economic factors have most commonly been used in evaluation of information systems. Less consideration has been given to social, cultural, political or work life issues [Kaplan, 1996]. Newer evaluation, however, takes a social interactionist perspective, in that it looks at relationships between different characteristics; system-, individual- and organisational characteristics.

Theoretical framework for evaluation

Kaplan (1996) describes a social interactionist framework for researching organisational issues concerning computer information systems in medicine and health care. Kaplan states that "evaluation that focus on selected technical, economical, user, or medical criteria may not be sufficient to improve outcomes and realise benefits information systems can offer". One must also understand what contributes to impacts and outcomes. Interactionist studies often take a process approach, and to help understand how to evaluate these processes Kaplan describes three classes of models of organisational change and information technology assessment; (1) Research, Development and Diffusion – system is developed by experts, and users either adopt it or are considered to be resistant to it; (2) Problem Solving – more collaborative, experts and clients working together to develop a system and (3) Social Interaction – emphasises how a system is communicated through channels over time. These models can function as a guide for information system leaders and researchers to the most appropriate approach for studying a specific information system implementation. Related to

these models are, in turn, models about what causes resistance to information systems. The models of change are also discussed by Anderson, Aydin and Jay (1994).

Drawing on the models of organisational change, a framework to guide evaluations of how medical information systems affect and are affected by health care organisations are provided in [Kaplan, 1996]:

1) An information system is seen as an external force. Evaluations based on this model treat technical features of an information technology as causing its impact, as in system centred theory. Organisational and technological characteristics are treated as invariant rather than changing over time.
2) An information system is seen as determined by organisational needs in that it is viewed as meeting the needs of managers and clinicians. Systems are thought to be developed in a rational manner, with needs identified and problems solved.
3) Social interactions are considered determinants of system use. This model views uses and impacts of information technology as resulting from complex social interactions within an organisation. Evaluation in this model requires understanding dynamic organisational social and political processes as they occur over time.

Kaplan refers to [Anderson, Aydin & Jay, 1994] and the evaluation questions they have formulated, concerning the 4Cs of evaluation – *communication, care, control and context*:

- What are the anticipated long-term impacts on the ways departments linked by computers interact with each other?
- What are the anticipated long-term effects on the delivery on medical care?
- Will system implementation have an impact on control in the organisation?
- To what extent do medical information system have impacts that depend on the practice setting in which they are implemented?

In addition, Anderson and Aydin, asks;

- Does the system work technically as designed?
- Is the system being used as anticipated?
- Does the system produce the desired results?
- Does the system work better than the procedures it replaced?
- Is the system cost-effective?
- How well have individuals been trained to use the system?

Research methods in medical information system evaluation

There exist numerous research methods to help support one's research questions and the models of change described in earlier sections. These are methods that can be helpful for general evaluation of information system and which we have already described in earlier sections. There are qualitative research, survey research methodologies, cohort/time series studies, experimental methods, social network approaches and combining methods, just to mention some of the most relevant methods available.

Methodological guidelines for evaluation

Kaplan suggests five methodological guidelines for developing an evaluation plan: (1) focus on a variety of technical, economic and organisational concerns; (2) use multiple methods; (3)

be modifiable; (4) be longitudinal and (5) be formative as well as summative. These guidelines may be useful to address the difficulties with sensitivity to the 4Cs and the studying of processes over long time.

3.8 The information audit as an evaluation tool

One way of evaluating an information system, including a health information system, is to use an information audit. The term "information audit" is, however, very vague, and can include many forms of evaluating methods, like surveys, interviews and analysis of documents, as mentioned earlier. There is no universally accepted definition of what an information audit is [Henczel, 2000], but the Association for Information Management in the UK has adopted this definition:

"An information audit is a systematic evaluation of information use, resources and flows, with verification by reference to both people and existing documents in order to establish the extent to which they are contributing to an organisation's objectives."

3.8.1 Example of an information audit process

Henczel (2000) describes the information audit as a process that should explore the following points:

- Identify the information needs of the organisation and assign a level of strategic importance to those needs.
- Identify the resources and services currently provided to meet the information needs.
- Map information flows within an organisation and between an organisation and its external environment.
- Analyse gaps, duplications, inefficiencies and areas of over-provision that enables the identification of where changes are necessary.

Henczel (2000) has also developed a model describing how an information audit can be conducted in order to achieve the objectives of an organisation. This model consists of seven steps that are critical for success in the auditing process according to studies done among librarians and consultants. The model should be regarded as a flexible framework that can be tailored to meet the different constraints and variations of an organisation.

The different steps are:

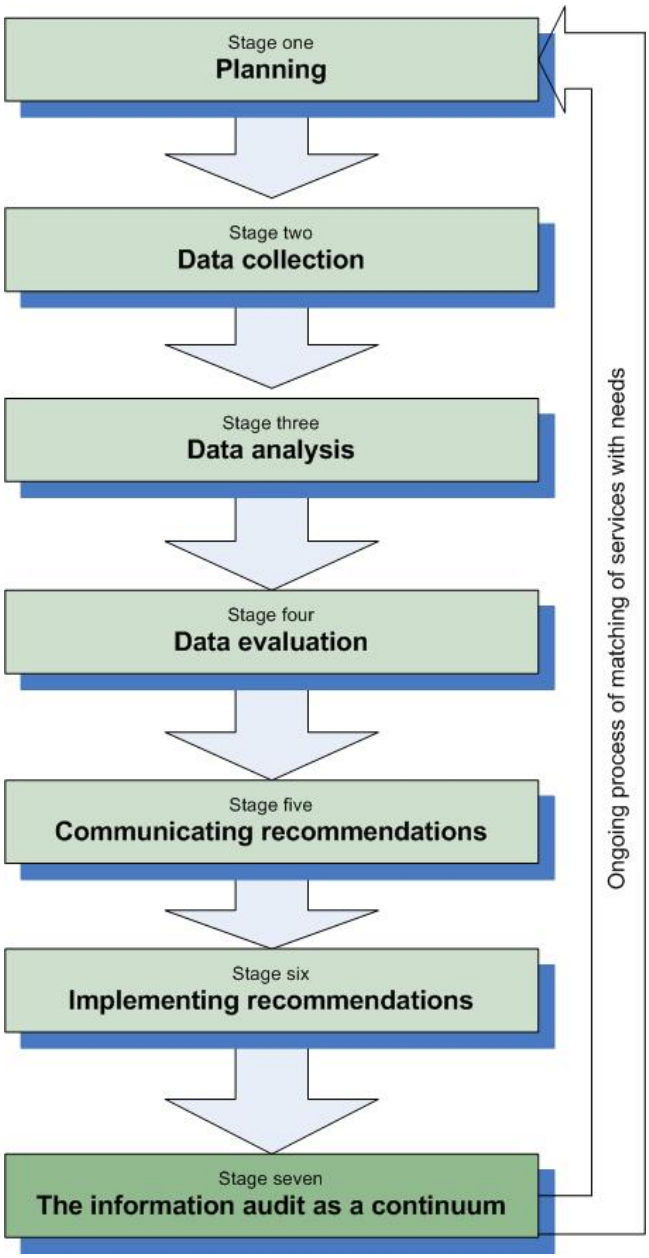


Figure 8. Seven steps that are critical for success in the auditing process [Henczel, 2000].

Stage one – Planning

A proper plan is critical in order to succeed in any kind of project. Henczel (2000) proposes five sub-stages in connection to the planning stage;

1. Understand your organisation and develop clear objectives.

The process should be designed to minimise obstacles and maximise opportunities that exist within the organisation. To obtain this, and to develop a suited audit methodology, it is crucial to understand the structure, culture, communication forms, and the organisation's internal as well as external relationships.

It is important to identify all stakeholders, who can have a variety of roles, like information collectors, information users and administrative personnel. In addition, one must understand why these people are stakeholders, and what impact they might have on the auditing process.

It is useful to find out what else goes on in the organisation, and what has been done earlier. Again, this concerns the understanding of the organisation, and also it is useful in order to avoid doing things that have already been done.

There must be a clear understanding of why an information audit should be performed in the organisation. Before trying to sell the idea to management or employees, the specific objectives one wants to achieve should also be distinctly expressed. Objectives must be kept simple, clear, specific, realistic and measurable**.**

2. Determine the scope and resource allocation
Here one must determine what resources are available for the project, and one must decide what parts of the organisation should be included in the auditing.

Included in the resource allocation, one must count personnel like audit manager and team, time, money, technical resources like computers, phones and copying machines, and physical resources like working space and desks. At this stage it must also be considered whether there is sufficient expertise within the organisation to perform the audit, or if external help should be brought into all or parts of the process.

3. Chose a methodology
Here one must design how data is to be collected, analysed and evaluated, and also how recommendations should be made and presented. One must decide who it is necessary to collect data from, in what form the data should be collected, and how it should be analysed afterwards.

4. Develop a communication strategy
Communication with people involved is important in all steps of the process. Prior to the auditing, its purpose must be communicated, during the process the investigators must keep a dialog with the contributors, and afterwards the results must be presented in a suited manner.

The chance of gaining effective communication before, during and after the audit is greater if appropriate communication channels are identified. Everybody should understand their role in the data collection stage before the audit starts. This increases the ownership of the audit results, and, along with effective feedback after the audit, it is likely to reduce resistance to suggested changes and implementations proposed with the audit results as a base.

5. Enlist management support
Management support is crucial for the degree of success in this kind of project. Management will allocate the necessary resources, and they must have a clear understanding of the objectives of the project. They must also know details of what the consequences are if the audit is not performed.

After these five preliminary steps, the audit team will have an overview over the following; how to conduct an information audit with the resources available; what questions must be asked, and to whom; how long it will take; and what the level of management support is.

Stage two – Data collection
This stage involves the actual data collecting. Methods of collecting data can be questionnaires, personal interviews or focus group interviews. It is important to make sure

that the right questions are asked to the right people. Also, the questions must result in a dataset that is usable in terms of volume, content and format.

Stage three – Data analysis
This part of the process will identify elements like gaps, duplications, and use of sub-standard or inappropriate resources.

There are different tools that can be used in the analysis process, depending on, among others, the volume and complexity of the collected dataset. Anything from an ordinary spreadsheet program like MS Excel and database programs like MS Access can be used, as well as more specialised software and sophisticated business modelling tools.

There are also different kinds of analysis, and three types that are appropriate are; (1) general analysis, (2) strategic significance analysis, (3) information flow mapping.

- *General analysis*
  Data collected by any open questions is analysed generally using common spreadsheet or database programs or specialist tools.

- *Significance analysis*
  In this process, an information resources database should be developed. This database should be used in the development of an "information and knowledge inventory", and to match the resources and knowledge development in the organisation with the objectives of the organisation. This database can give reports on elements like;

  - tasks supported by each information resource
  - the importance of each information resource
  - the information resources that support each organisational objective
  - the tasks for which the ideal resources are not provided
  - duplications of resources

- *Mapping of information flow*
  The information flow helps identify gaps, duplications and flow inefficiencies. Using this as a basis, one can create a "knowledge transfer" model, where one identifies where knowledge occurs, where it is needed, and where it currently goes. Visual representation of this information can identify;

  - bottlenecks and inefficiencies (lots going in, but little coming out)
  - information gatekeepers (lots coming through a single distribution point)
  - dead ends (lots going in but nothing coming out)
  - over provision (services provided but not required)
  - gaps (services not provided, but required)
  - imbalances/biases (inequalities in information provision)

Stage four – Data evaluation
When the data has been analysed, one can identify problems and opportunities, and interpret and evaluate these within the context of the organisation. Once the problems are identified, this gives an opportunity to improve the provision of information, extend information services and improve the quality of knowledge created. Problems that can be uncovered might be:

- lacks in the information framework
- biased distribution of resources
- use of sub-standard resources
- gaps in the provision of resources
- information overload issues
- lack of transparency and accountability
- lack of traceability

It is, however, often neither possible nor needed to address all problems. Organisations often have limited resources (money, people, technical or physical), that keeps it from implementing all improvements that one could want. One must also evaluate how significant the different problems are. In such an evaluation, the following kind of questions must be asked:

- Does the problem have strategic significance? Is it affecting the achievement of the organisational objectives?
- Is there a reason for the problem? Does it matter?
- What are the cost implications?
- What alternatives are possible?
- What are the consequences of suggesting a change? Who will be affected? What other services will be affected?

There might be more than one solution to any of these questions, and one must take care to recommend the most appropriate solution. Also, the recommendations must be realistic, achievable and manageable.

Stage five – Communicating the recommendations
Although important throughout the auditing process, communication is particularly important once recommendations have been formulated. It is also important that the recommendations reach the people who are crucial for making the implementations. Changes must be presented in a positive way, since they may affect the work of some or all of the employees. If communication channels were properly established and maintained during the auditing, the staff should have a feeling of ownership towards the result, see the validity in it, and also recognise that the recommendations come about as a result of what they themselves have expressed.

The most common ways of communicating the audit results and recommendations are written reports and oral presentations. There are, however, several other ways as well, including workshops, seminars, newsletters and postings on intranet or web sites.

Stage six – Implementing the recommendations
When the recommendations have been successfully communicated to the management and the rest of the organisation, plans must be made for implementing the changes. It is important to be aware that any change will affect the rest of the organisation to some extent, and one should be as prepared as possible for these impacts. Nothing can be changed in isolation, and any changes must be carefully planned. The consequences must not be underestimated. Negligence here can easily lead to the failure of the change, not least if a conflict with cultural or political aspects of the organisation arises.

Stage seven – The continuum

The first audit performed will serve as the 1st generation audit. This is a baseline - a rich dataset with a snapshot of how the information situation is in the organisation.

After completing the initial audit, one must make a decision about how the dataset should be maintained and built on, and how to change the database along with the changes in the organisation.

New audits should be performed regularly after the completion of the initial audit. The next will be 2nd generation audit, and so on. These next audits should be more or less the same as the first one, so it is possible to compare the information situation as time goes by. It is, however, important to keep in mind that the audit is not static, and can and should be tailored to be better suited as changes occur in the organisation. It might also be that one finds essential elements that were not covered in the earlier versions of the audit, but that should be included. Or that the audit investigates issues that really are not interesting.

Anyway, it is important that the following audits are not conducted in isolation, but measure and account for any changes that have occurred since the previous audits.

The information audit used as a holistic approach

[Langley, Seabrooks & Ryder] state that "An information audit provides the framework for a holistic examination of the ways in which a business creates, gathers, disseminates, stores and shares information". In their paper "Information Audit as a holistic Approach: A case study" they give an example of how an information audit was used as a holistic approach. The approach was not technical or segmented, it was rather designed to explore more than one information aspect of a division within an organisation.

They went through the following process, and made decisions about: objectives of the audit, decision on who would conduct to audit, data collection techniques, design of data collection tools, piloting, review of pilot results and questionnaires, interview process, support from the division head to emphasize the importance of the project, data analysis and recommendations.

A deeper understanding of information and knowledge management enabled the evaluation team to create their vision of an ideal state, where information needs at all levels are satisfied. Information management recommendations were made consistent with this vision.

They refer to Susan Henczel's information auditing process (described in the previous section) as having provided invaluable insights to their own understanding of the process.

They also mentioned the critical success factors and lessons learned, that might be of value:

1. Visible support from executive management significantly contributes to the success of the audit. Their support not only increases participation, but also ensures recommendations are adequately resourced.
2. Clear communication of objectives and benefits to everyone will increase support and participation.
3. Representation from all stakeholder groups increases the quality of the audit tools and the results.
4. Understanding design principles associated with the data collection tools contributes significantly to the quality of the data.

5. Piloting the questionnaire and interview saves the larger respondent group significant time and frustration by ensuring the quality of the data collection tools.
6. Considering people in every step of the process. This was probably the most important factor of the information audit.

[Langley, Seabrooks & Ryder] emphasise the advantage of using a holistic approach, compared to a technical or segmented approach. They claim the quality of the results is improved by taking all aspects of an organisation's or division's information issues into consideration, not missing any important aspects that might have been overlooked otherwise. This view can be seen in comparison with addressing organisational issues into the evaluation of information systems. Section 1.5.2 talks about non-technical factors like social, organisational and political that influences an information system project.

3.9 Conclusion

The art of evaluation has no rigid rules when is comes to data collection and methods decisions. One must tailor an evaluation design to the specific situation and policymaking context, and there are a number of stakeholders' interests to take into consideration when performing the evaluation. A particular evaluation design depends on a complex network of available resources, practicalities, methodological choices, creativity and personal judgments by the involved participants.

4 BACKGROUND

This chapter gives the reader some background information about South Africa generally and other topics we will discuss and refer to throughout our thesis. We give a more thorough situation analysis on the health information system in Cape Town in Chapter 6, as a result of our empirical findings/fieldwork.

4.1 About South Africa

South Africa occupies the southernmost part of the African continent. It is a place where you find some of the world's strangest and most dramatic landscapes. Earth's most diverse plant population flourishes here, and South Africa is also home of big game, and hosts a varied range of birds. Far south you find penguins, seal and whales.

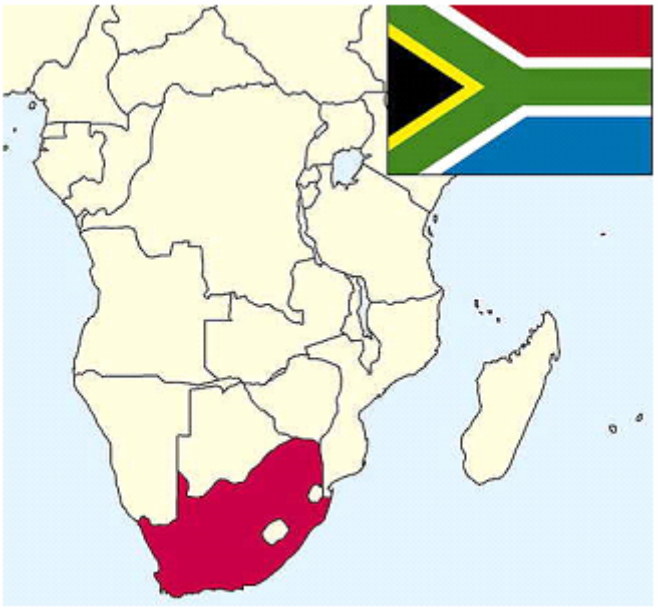


Figure 9. Map showing South Africa at the southern tip of the African continent.

There are also modern cities with skyscrapers and a very well developed infrastructure.

South Africa, with its 1,2 million km^2, is four times the size of Norway. It borders on the warm Indian Ocean in the south and east, and in the west is the Atlantic Ocean with its cool currents. The total length of the coastline is about 3,000 km. South Africa shares its northern border with Namibia, Botswana and Zambia. In the east it borders to Mozambique and Swaziland. Lesotho is like a small island in the middle.

South Africa's population has reached 43 million people. The population is a mix of different groups; the Nguni people (including the Zulu, Xhosa and Swazi), who account for two-thirds of the population; the Sotho-Tswana people, who include the Southern, Northern and Western Sotho (Tswana); the Tsonga; the Venda; Afrikaners; English; coloureds; Indians, and people who have immigrated to South Africa from the rest of Africa, Europe and Asia and who maintain a strong cultural identity. A few members of the Khoi and the San also live in South Africa. 77% of the population is black, 12% white, 8,5% coloured and 2,5% Indians. To cater for South Africa's diverse peoples, the Constitution provides for 11 official languages: Africaans, English, isiNdebele, isiXhosa, isiZulu, Sepedi, Sesotho, Setswana, siSwati, Tshivenda and Xitsonga.

The rainbow nation South Africa is also a land of extreme contrasts. Here you find some of the world's richest and poorest people. Tourists are well looked after, and it is possible for

them to spend their whole vacation in South Africa surrounded by luxury, not being exposed to the poverty in this country. But you do not need to look too close to see that not everybody is wealthy. The vast majority of the population lives in poverty. Unemployment, hunger, malnourishment, and crime are elements of the daily life for many. The rich live in luxurious houses protected with wires and alarm systems, in areas where the vast majority is white. The poor live in townships outside the cities, or in isolated rural areas around the country. And they are many. We know apartheid does not exist any more, but the traces of it still remain. The people of South Africa are still divided.

4.2 Apartheid

Apartheid was introduced in 1948, a few years after World War II. The National Party won the election with its race separation program. The main idea of apartheid was that all blacks should live and be citizens in so-called homelands. Access to white areas was restricted outside working hours. New laws were passed and divided all races into whites, blacks, Indians, coloured or natives with even more sub-groups. Other laws decided where the different races had to live, forbade marriage between the races, or concerned education. Many other laws and regulations followed; resulting in a person's life, from birth to death, being controlled by the skin colour.

To stop any resistance to these new laws, the police was allowed to ban people, so that they had to stay within a police district, and only meet with one other person at a time. In other words, no public gatherings or meetings of more than two people were allowed. The police could arrest people just on suspicion. Millions of people were forced to move, while other millions where arrested suspected for breaking some of the many laws.

Figure 10. Apartheid; toilet signs.

In the beginning of the 50s the resistance was non-violent. The ANC (African National Congress, the ruling party today) held demonstrations, obedience campaigns and marches. The turning point came in 1960. During a demonstration with 5,000 people the police opened fire and killed 69 demonstrates. The government declared state of emergency. Thousands were arrested and ANC was forbidden. The ANC leadership fronted by Nelson Mandela was arrested and charged with treason.

South Africa developed into a police state, where the golden idea behind apartheid was executed: establishment of homelands (bantustans) where the blacks could exercise their political rights. The great black majority was given about 13% of the territory in South Africa – the most unfruitful parts of the country. This resulted in poverty and hunger.

But apartheid became too expensive and too complicated. There was a lack of qualified work force, and increasing international isolation and restrictions created problems. After the Soweto riots in 1976, where the police fired against schoolchildren, further disturbances spread. Over 6,000 people were killed the following months.

PW Botha

In 1978 P.W. Botha became prime minister. He strengthened the security and led several wars against other countries. Still, he became the leader that started a slow reform process, even if he was forced to do so. Blacks were given access to more jobs, the law that forbade sex and marriage between races was abolished. Botha created allies in the Indian and coloured populations by giving them the right to vote. This was too much for some members of the parliament; they broke out and created the extreme conservative party (CP). The apartheid opponents created The United Democratic Front (UDF) in protest. In 1985 Botha declared a state of emergency because of the resistance and many demonstrations against him. International sanctions pushed the economy and communism fell in Eastern Europe. Botha was followed by F.W. de Klerk. He saw the need to negotiate with the black organisations. In 1990 ANC and the communist party were legalized. Nelson Mandela and other leaders were set free. In 1994 the first free elections for all South Africans were held. ANC won and Nelson Mandela was elected president. A coalition government between the two other big parties (Nationalist party and Inkatha) was formed. In 1996, the Nationalist party withdrew.

ANC has won all three elections after the fall of apartheid. The last election took place in April 2004, and ANC got 69,75% of the votes. Nelson Mandela resigned as president in 1999, and his successor was Thabo Mbeki. Mbeki continues to hold presidency after the 2004 election. Mandela is still an extremely influential and highly respected figure in South Africa, and included in his many fields of interest is the fight against HIV/AIDS.

Source: www.news24.com

Nelson Mandela and Thabo Mbeki

Health care under apartheid

According to a report; “Human Rights and Health: The Legacy of Apartheid”, the government spent about four times more on health care for whites than for blacks during apartheid. Black health facilities were usually overcrowded and under-supplied, while white health facilities were under-utilised and equipped with the latest medical technology. The world’s first heart transplant took place in South Africa, for instance. Hospitals, mostly concentrated in white areas, were assigned to particular racial groups. There were no real attempts to deliver health care to the majority of the population. Problems and diseases affecting the black population were often ignored. Reliable data collection on black births and deaths did not exist. The health sector focused mainly on the hospitals, forcing people in rural areas to travel long distances for medical care. South Africa had 14 different health departments, since there was a separate department for every race. The health care system under apartheid is described as a divided, fragmented, inefficient and grossly inequitable system.

4.3 The new South Africa

Prior to April 27th 1994, South Africa was divided into four provinces and 10 black “homelands“, four of which were considered independent of the government. The new

constitution abolished this system and replaced it with nine provinces: Northern Cape, Eastern Cape, Western Cape, North-West Province, Kwa-Zulu Natal, Gauteng, Mpumalanga and Free State.

South Africa has an executive president as government leader. The legislative power is held by the Parliament, which is divided into two chambers: the National Assembly (400 members), and the Senate (90 members). Elections are held every fifth year. The constitution has a number of principles for protection of the fundamental human rights. The nine provinces have a large degree of local self-government. Each province has an elected legislative and chief executive - a provincial premier. The province parliaments consist of 30-100 members, depending of the province's population number. The justice court is independent of both government and parliament. The Supreme Court has an appeal court of justice situated in the country's juristic capital, Bloemfontein. There is also a constitution court that is responsible for the upholding of the constitution.

South Africa's economy is highly developed in many areas, but there are still major weaknesses left from the years of apartheid and international isolation. The government puts in a lot of effort to address the problems, stimulate growth and create jobs, and one of the prior attention areas for the government is to address the economic differences between the population groups. Nevertheless, this gap is expected to persist for many years. Business is becoming more integrated into the international system.

As a legacy of apartheid, the new South Africa inherited one of the least equitable health care systems in the world (Braa & Hedberg 2000). The South African health care system consists of a large under-resourced and over-used public sector and a smaller but fast-growing private sector that provides top quality care to about 20% of the population.

Health care for everybody – reconstruction and development

The Reconstruction and Development Program (RDP) is a program launched by the new government to assist the historically disadvantaged people of South Africa by giving them access to housing, education, medical facilities and jobs. An important part of this program was the reorganisation of the public health system to provide all citizens with basic health care. The Reconstruction and Development program together with a National Health Plan (NHP) for South Africa aims at reconstructing the highly specialized and centralized health sector into a decentralized system of health districts.

The Department of Health[11] uses two conceptual frameworks as guidance in the transformation of the health sector (Health System Trust);

[11] The Department of Health is the government body responsible for the country's health facilities which include well-equipped hospitals and health care clinics.

- Primary Health Care (PHC) Approach - a philosophy and a conceptual model for an ideal health system
- District Health System (DHS) - an organisational framework for a country's health care system

The Primary Health Care Approach formed the basis for the Alma-Ata[12] declaration in 1978, and the District Health System is a worldwide accepted framework for the Primary Health Care Approach.

The Department of Health believes that a district-based health system will ensure local-level control of public health services, and standardization and coordination of basic health services around the country will ensure affordable and accessible health care for everybody.

The government's goal is to ensure that all South Africans have access to affordable, good quality health care. The Department of Health see it as their mission to;

> "*consolidate and build on the achievements of the past five years in improving access to health care for all and reducing inequity, and to focus on working in partnership with other stake holders to improve the quality of care of all levels of the health system, especially preventive and promotive health, and to improve the overall efficiency of the health care delivery system*".
>
> (Department of Health, web)

A lot remains to be done to establish a fully functional health care system. The challenges of restructuring the apartheid system are enormous, and at the same time the ongoing government restructuring have delayed improvements in the health sector. These are some of the reasons why South Africa has been inhibited from responding effectively to the HIV/AIDS epidemic and poverty related diseases like tuberculosis and cholera. These diseases now place a tremendous strain on the health care system, making it difficult to improve the general health of the South African people. An estimated six million South Africans are expected to die from AIDS-related diseases over the next 10 years.

The need for a new health information system

The old health information system was highly influenced by the apartheid system and therefore a very centralised and fragmented system, characterized by vertical command lines, lack of communication and coordination. Due to fragmentation, each province had its own data sets, definitions and standards, and there were no national standards for data collection (Braa & Hedberg 2000). The information system was data-led, which means that a huge amount of raw data was collected and reported to higher levels, without any local use of it in decision-making.

An important part of the national health plan, therefore, was to develop a new national health information system that would help support the new structures of the health sector. The government's goal is a new health care system that provides equal health care provision to everyone. For a new information system to support and uphold this, one needs a system that can monitor and measure to what extent the governments policies are achieved. A system with

[12] "Declaration of Alma-Ata promotes essential health care based on practical, scientifically sound and socially acceptable methods and technology, made universally accessible and equitable at a cost that is affordable, with community participation" (Health System Trust).

national standards becomes important here (Braa & Hedberg 2000). Standardization is also important if the health information system is to communicate with other systems, locally, nationally or internationally.

The new health information system aims at supporting local management and health care delivery. Creation of local ownership is important in order to achieve local management with local use of information. Examples can be taken from Scandinavian projects and the focus on participation in information system development.

It is increasingly being recognized that improved health information systems can help address health care problems; improved information can for instance put pressure on the government to improve health services, and also lead to better resource allocation (Braa & Monteiro & Sahay 2003).

With the development of a new health information system the need for training on information use and understanding arises. We discuss the importance of training and the use of information in decision making in Chapter 8.

4.4 Health Information System Program – HISP

A health information system program was piloted in three health districts in Cape Town, South Africa in the period 1996-1998. The project was proposed by the subcommittee of the Strategic Management Team[13] on Health Information Systems in the Western Cape Province in early 1995 as a pilot project to develop district health and management information systems (Braa & Hedberg 2000).

The proposal was funded by NORAD (the Norwegian Agency for Development Co-operation) for a 2-3 year pilot project.

HISP was based at the University of Western Cape (UWC) and the University of Cape Town (UCT). The HISP team consisted of university staff, activists from the health sector and non-governmental organisations (NGOs), and Norwegian researchers. They aimed to develop a district health information system to support the decentralized administrative structure that emerged (Braa & Hedberg 2000). HISP's two main areas for research and implementation became:

- Development of Essential Data Sets and standards for primary health care data
- Development of a District Health Information Software (DHIS) supporting the implementation and use of such data sets

In the pilot phase (1996-1998) both the first essential data sets and the first version of the application, the District Health Information Software, were implemented.

HISP was relatively successful compared to other ongoing IT-projects in the health sector, and based on the achievement during the pilot phase the Department of Health decided, in 1999, to adopt the DHIS as a national standard in South Africa. Pilot projects started in several other provinces, and a collaboration for piloting HISP in Mozambique also started.

[13] This strategic team was a part of the Reconstruction and Development plan for South Africa. Teams were established to develop plans for the reconstruction of the health sector in all provinces.

HISP spread to all provinces in South Africa and it seemed to be rather successful with a data-input-coverage on up to 95% for 2000-2001. Pilot projects started in other developing countries.

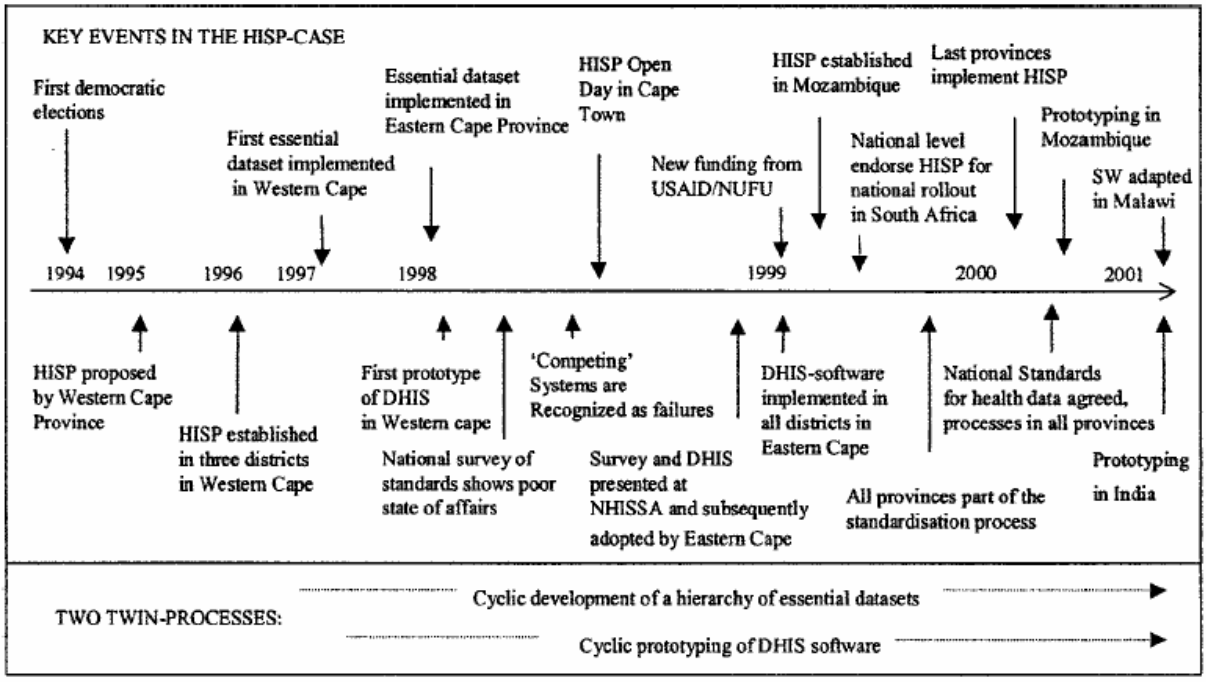


Figure 11. Key events in the HISP-case [Braa & Hedberg 2000].

HISP network

HISP is still an internationally collaborative research and development program between several universities and governmental organisations. HISP operates as a global network within the health care sector across a number of developing countries (Braa & Monteiro & Sahay 2003). Starting in South Africa, it has spread to other African countries: Mozambique, Angola, Malawi, Tanzania, Nigeria and Ethiopia, and also outside the borders of the African continent to India, Mongolia, Dominican Republic, China and Cuba. The countries are all at various stages in the implementation process, and in Cuba the project was aborted after a while. Master and PhD programs are offered in collaboration with the HISP team at universities in Norway, South Africa, Mozambique and India.

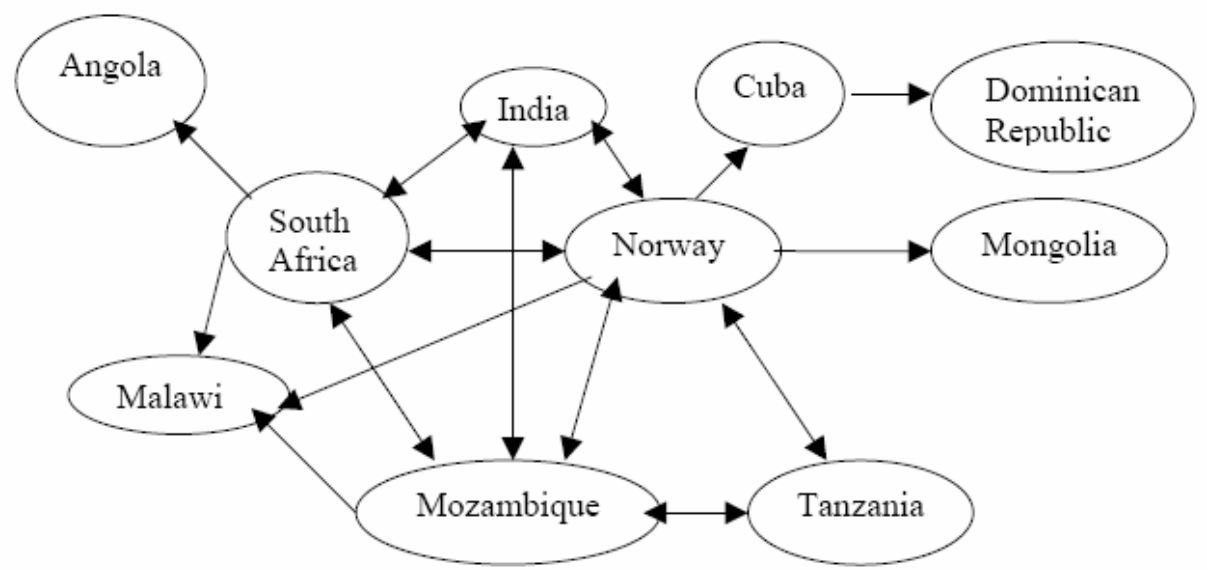


Figure 12. Overview of HISP network [Braa, 2002].

The primary goal of the HISP research encompasses three key issues: "HIS design, development, and implementation; organisational and human resources development; and developing theoretical and practical knowledge about the challenges of implementing HIS in developing countries, with a focus on issues of scale and sustainability" (Braa & Monteiro & Sahay 2003). (more here...?)

4.5 District Health Information Program – DHIS

The District Health Information Program is developed by HISP to support the implementation and use of an essential data set and standards for primary health care data, and is the software in the project. DHIS computerizes the information system in that it supports collection and analysing of a relative small set of data items with the primary purpose to enable use of data at all levels. It allows health services to enter data on a routine basis (monthly, quarterly and annually) or information on an ad hoc basis as in surveys. It also allows users to generate reports and to run accuracy checks on the data.

The following objectives were translated by the design team into concrete inscriptions in the software [Braa & Hedberg, 2002]:

- Shift of control of information systems from central towards local levels - towards more equal control between central and local levels.
- It should be easy to adapt the software to local conditions in order to improve the local flexibility and user orientation.
- Integrating vertical flows at district level as a support for the development of health districts and the health sector's reform towards decentralization.
- Empowerment of local management, health workers, and communities.
- Horizontal flow of information and knowledge, based on the principle of free access to all anonymous, aggregated health data/information.

Some of the features of the DHIS are:

- Users at a local level can adapt the system for their needs by adding their own facility and define their own data elements and indicators, new validation rules, set maximum and minimum limits for data entry, etc.
- Functionality for generating reports can make it easier to give feedback to all levels on the data that is entered into the system. Reports can be tailored to include certain data elements or indicators, from various sources.
- The DHIS supports not only routine monthly or quarterly data, but also the capturing and analysis of semi-permanent data (population estimates, equipment, infrastructure, number of personnel, services provided per facility, etc.) and survey/audit data. Not all information needs to be collected on a routine basis - some can be collected annually or six-monthly through regular surveys, and some semi-permanent data can be updated whenever changes occur.
- The system can incorporate patient data where appropriate, either by interfacing to other Patient Record systems or through a web-based Special Patient (SP) Module linked to the Routine Data Module.

The software is based on a Microsoft Access relational database for storing all data, and it uses Microsoft Excel for data analysis, Word for making reports and Visual Basic forms for data entries.

DHIS's high degree of user definability (based on the premise that the information system must contain data relevant to the smallest organisational unit if they are going to use the system to evaluate their services) has lead to it being translated into other languages, like Portuguese, for use in other countries (DHIS Manual 1_3_0_x).

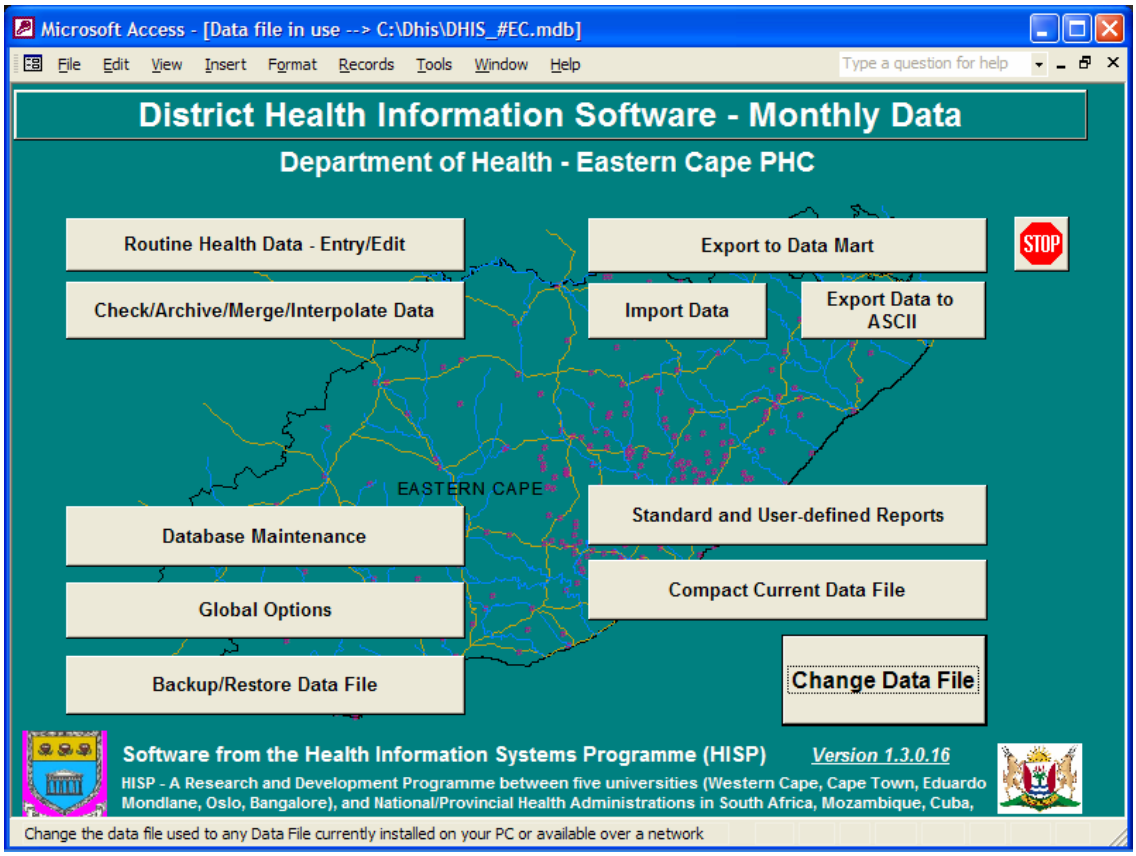


Figure 13. The screen shot shows the English versions of the routine/monthly data module.

DHIS is free and open source software, allowing anyone to use, customize and modify it. But a disadvantage with today's DHIS is that it uses modules from Microsoft that are not free and open. This results in the need for expensive licenses, but the plan is to gradually shift the software towards a platform-independent application suite that runs under Windows and free operating systems like Linux and Unix as well as on the most commonly used SQL-compliant data base management systems (e.g. Access, MySQL, PostgreSQL, Oracle, DB2, SQL Server).

4.6 Information audits performed in South Africa

HISP has defined six steps in a general process for facility information system development ("Using information for action - a manual for health workers at facility level", HISP):

1. Form information teams
2. *Conduct an information audit*
3. Set objectives, indicators and targets to define a facility data set
4. Strengthen local information systems and structures
5. Develop staff skills and understanding
6. Create a district information culture

Although referred to as steps, it is emphasized that the steps are cyclical and may happen in parallel. The process needs to be adapted to local circumstances, and is only a guideline.

There is no generally established definition of the term “information audit”. We see it as a tool that seeks to understand the information need and use in an organisation. It also tries to understand and map the current information flow. Basically an information audit tries to describe everything that has to do with the information handling within a given context.

In this section we will give a short introduction to the information audits that were developed by the School of Public Health (at University of Western Cape, South Africa), Gavin Reagon and Marius Gouws, in order to complete a situation analysis of the health sector. This audit tool was developed due to a need to collect and investigate the same kind of information in each district, so that the results of the situation analyses would be comparable and standardized. The assessment was also a part of a bigger assessment done by a Non-Governmental Organisation (NGO) called the Health Systems Trust. The funder was the European Union.

The main purpose of the audits had been to allow health workers to report on the status of the information handling on a regular (annual) basis. If this regular information auditing functioned as intended, it was likely to save a lot of time, effort and money, in that nobody would need to be hired to travel to every facility and visit every district information officer to get the information audits done. The results of the audit would give an updated status report of the resources (training, equipment, staff) available. It would be something concrete to present at budgeting meetings, and help to prioritise the areas where more resources should be invested.

However, the tool proved too difficult for local staff to implement and two or three different versions were used and tested, without success. Several attempts were made in North West Province, Free State and Western Cape, but they were all considered failures. Even though the information audits were tested, revised, shortened, etc. it proved impossible to make health workers use them independently in a satisfying way. The project was abandoned. The audits were instead just used by the evaluators, so that they would collect most of the same data. However, we heard that this also became a problem – the different evaluators mostly did their own thing.

We found some results from this original evaluation on the Department of Health’s web pages (http://www.doh.gov.za/facts/eusites/), under the title “Health Systems Situation Analysis” for a project called Rural District Health Systems (RDHS) Project, and with the following text;

“*The health situational analyses placed on the web represent the first such situational analyses for the district municipalities concerned.*

These situation analyses paint an overall, but incomplete, picture of the public health section in the district. However, because this is the first time many of the data have been used, some aspects may not be reliable and they should be used with caution.”

These districts were covered by the original information audits;

- Alfred Nzo District Municipality (Eastern Cape Province, South Africa)
- Central Karoo District (Western Cape Province, South Africa)
- Chris Hani District Municipality (Eastern Cape Province, South Africa)
- Kgalagadi District Municipality (Botswana)

- Greater Sekhukune District Municipality (Limpopo/Mpumalanga Provinces, South Africa)
- Ukhahlamba District Municipality (Eastern Cape Province, South Africa)
- Umzinyathi District (KwaZulu Natal Province, South Africa)
- Zululand District (Kwa-Zulu Natal, South Africa)

We do not know how or if these results have been used for anything later on. We discuss some of the findings in chapter 9, as a comparison to our results. This situation analysis from 2002 is referred to the HISP situation analysis further on.

Where we came into the picture

When we came to Cape Town, we were handed the original audits, and decided to test them out as a tool and try to improve them, and also find out more about the status of the health information collection: the use, flow and feedback to and from facility level.

The original information audits were divided into five different audits: (1) Information Audit for Facility Manager, (2) Information Audit for Facility Information Officer, (3) Information Audit for District Information Officer, (4) Information Audit for Line Manager and (5) Information Audit for Program Manager.

Due to our relatively short stay in Cape Town our main focus became piloting the facility manager audit. We also gave a brief introduction to the district information audit to some of the health workers.

4.6.1 Example of the importance and difficulty of performing an information audit in the Cape Town region

To illustrate the difficulties experienced with the information audits in South Africa (as mentioned above) we will now give an overview of the situation in Cape Town. Here, an attempt on conducting an information audit was made, using the original developed audits for the (RDHS) Project.

The Provincial Administration of Western Cape (PAWC) is, in the same way as the rest of the health structure, undergoing major changes and restructuring. Metro District Health Service (MDHS), as it is called from June 1st 2003, has taken over many new responsibilities, for example 4 district hospitals, 4 step-down clinics and all programs like HIV/AIDS, TB, home based care, etc. The programs all require special knowledge and focus, and they are now the key focus area for the Metro. The plan is to develop a computerized system that captures data on all the vertical programs.

The problem is that the Metro had no fresh resources to allocate to the facilities and programs they had become in charge for. Everything happens at once, and it can be described as chaos. Management does not know what it looks like at the district hospitals, because they have never been there. But what is certain is that there is a great need for people, equipment, hardware and software.

A newly hired person, with background from the School of Public Health at the University of Western Cape and HISP, is trying to get an overview of the real situation out in the health districts. One of her aims is to set up an information department for the Provincial Administration, which really did not exist before (lack of information use in the past) but

which is an important part of a well-functioning health care structure. She told us that the last two months had been very dramatic, a huge planning process had taken place, and the Health Care 2010 plan had already been made – a plan that reflects where the health sector preferably should be in 2010. During this planning process they had to use the information they had available to motivate for budgeting e.g., even though the little information that existed was not very accurate. In other words, she had a huge challenge because she had to develop a new system, and at the same time use the results from the system in the planning.

What she did was send out modified versions of the information audits mentioned in the section above, where she added questions about what technical recourses, such as computers, existed in the facilities. This computer specification part was included in order to investigate the IT-needs, and come up with an IT-plan. She hoped this would help mapping the existing resources available in facilities and district hospitals. Unfortunately, it did not provide her with the necessary information. The problem was perhaps not only the questionnaires in the audits themselves but also how they were answered by the staff. Or maybe more correct; how they were not answered. What was returned was in many cases empty sheets. Hardly ever had the computer specification part been filled out fully, leaving a lot of questions.

So, the planning processes for the further development of the sector had to start without the necessary information available. How do you plan something, without knowing what you already have? How do you know that you ask for the right equipment, the right type of training, enough money, etc.? Having taken just a short glimpse into this, as we saw it, rather chaotic situation, we can just imagine what a difficult tasks lie ahead.

For us this just proved more strongly that in terms of planning, a situation analysis is crucial. Despite the failures in the Cape Town region, we think that an information audit, designed for the right context, conducted in the right way, and by the right people, can be a useful tool for getting a necessary situation analysis for ongoing planning and improvement of the health division.

There can be many reasons for the lack of success with the information audit conducted by the provincial administration in Cape Town. We believe the audit was not adapted fully to the context, and that it was not user friendly enough. To expect quality information one can rely on, one needs to use a tool that can be relayed on. The information audits should maybe have been shorter and answered by the right type of staff – that is, a person able to answer all the questions, or at least introduced to them in a way that really made them understand its importance in a planning process to improve the health system situation, and with a proper guidance to learn how to use it.

Our contribution with regards to conducting an altered information audit in both provincial clinics and local authority clinics is presented in Chapter 7.

5 RESEARCH APPROACH

We repeat the two purposes of our research: (1) to develop, test and adapt an evaluation tool for the primary health care facilities and (2) by using this tool, investigate the status of the health information system, especially as seen from facility level. During the first weeks of our fieldwork in South Africa, we also collected information on the general status of the HIS.

The information audit as an evaluation tool and a general methodology used to collect data necessary to accomplish our objectives is described in Chapter 3. The methods we reviewed for data collection (observation, focus group, monitoring information system usage, interviews and questionnaires etc) are also described there.

This chapter will describe in more detail our empirical research approach and what methods we selected for the data collection process, in order to develop the information auditing tool and collect general information about the HIS.

The collection of data for our thesis was done during three months of fieldwork in the Cape Town area. This meant that we were unable to go back to study anything in more detail or resolve any problems afterwards. All our empirical research was done during the site visits. Although we had some e-mail contact and were able to use fax to communicate with people after our return, this contact was limited due to the few replies we got from the persons we were trying to get hold of (we can only assume they went on leave, changed e-mail addresses, were very busy, etc). We had to rely solely on our own observations, notes taken, and decisions made about what was most important to investigate at the time.

5.1 Action research approach

Our research aims were to:

- Develop an effective tool for evaluating the information system seen from grass rot level.
- Based on the data collected with this tool; assess success or failure of the information system, the resources available and what areas that need attention in the further development of the system.

The research approach we used falls within the framework of action research (AR) approach. Action research has been described as a way to build theory, knowledge and practical action by engagement with the world in the context of practice itself [Braa & Hedberg, 2001].

According to Dick (1993) you have two outcomes in action research:

1. Action, bringing about a change
2. Research, increased understanding of the case

This fits very well with our aims; the action or change we sought to bring about was the introduction of the evaluation tool. The research we did around the tool development and the

data analysis afterwards increased our understanding of both the evaluation process and the health information system.

"An action researcher has some vision of how societies or organisations could be improved and uses the research process to help bring this desired future state into existence [...] In addition, the new varieties of action research [...] aim at increasing the system's self development capacity." (Elden & Chrisholm, 1993, p.127 - in Braa & Hedberg, 2001)

The main action research principles are [Elden & Rupert, 1993]:

- *Action research is a cyclical inquiry process:* "diagnosing a problem situation, planning action steps, implementing and evaluating outcome. Evaluation leads to diagnosing the situation anew based on learning from previous activities cycle".
- *Researchers and practitioners:* Action research is carried out in collaboration with researches and those experiencing (practitioners of) a problem situation or system, etc.
- *Rethinking relationship between science, knowledge, learning and action:* Action research uses scientific approach to study social and organisational problems together with the people who experience them.

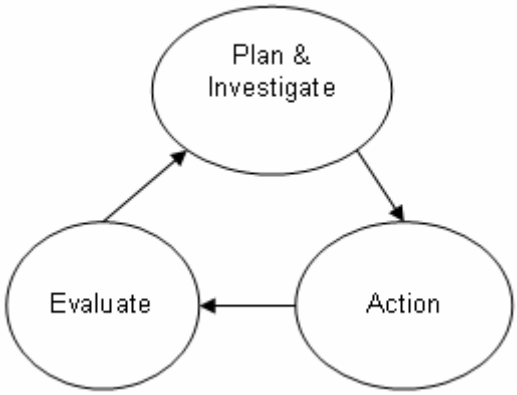


Figure 14. Action research – basic cycle.

Figure 14 shows the basic cycle of our action research:

- *Plan*: we had a plan with what we wanted to do with the audit. We wanted it to become a 'user-friendly', in the sense of simple, clear, specific, realistic and measurable, tool to evaluate the information system seen from facility level.
- *Action*: the audit was revised and tested.
- *Evaluate*: feedback from facility meetings and discussion meetings with district/regional information managers led to adjustments in the questionnaires.

So, the development of the audit as an evaluation tool took the form of a spiral model. We started out with the original audits, and adjusted them to our context and research purpose.

The cyclical process of the action research enables iteration, and in that way, makes it an exploratory approach where one is able to adjust the research as one goes along. The data you collect decides your next steps.

Influence from of the Scandinavian traditions in our action research approach

We see how the Scandinavian traditions have influenced our action research, as we used its principles of: adaptation to the local context, empowerment through practical learning, and the creation of local ownership through participative processes (see section 2.3.1; Scandinavian approach). The evaluation tool needed to fit the environment and objectives set for the evaluation, and by testing out the tool we learned a lot about the system under evaluation and how to improve it. During this testing, facility staff was also introduced to the tool and learned about the evaluation process and the benefits from conducting it. We got the impression that a lot of the facility staff saw the need for an evaluation and the importance of their contribution. This was something that would benefit *them* in the long run, and this created a kind of ownership towards the tool. It also led to very frank and open-hearted answers from our respondents.

The Scandinavian tradition with its emphasis on participation was a central theme in our action research. In order to improve the audit as an evaluation tool, there were different groups of people we had to consider the needs of. The two major groups were: the facility staff that were part of the evaluation and the information mangers at a higher level which needed the information (captured by the evaluation tool) for budgeting and decision-making. These two groups had different interests – the facility staff not wanting more work being laid on their shoulders, and the managers wanting updated richly detailed descriptions of the information handling status. So our task became to try and fulfil these wishes by developing a tool that was simple, clear, specific, realistic and measurable (see Section 3.8.1). Participation with the key persons within these groups was essential.

Elden and Rupert (1993) also emphasise the importance of participation in a research process:

- Impossible without some form of participation
- Collaboration support and encourage the cyclical and emergent nature of the AR process
- Those who “own” the problem must be involved with selecting problem and searching for solution

Participation was a very important part of our research approach. Developing the auditing tool became an ongoing process in collaboration with the people who designed the original audits, some of the key people at district level of the information system for whom the results of the audit and the audit itself as a future evaluation tool would be beneficial, and the health facility staff at the clinics we visited. They were the users of the information system we were evaluating and creating an evaluation tool for, so it felt natural for us to involve them in the process. The audit development process itself is described in detail in Chapter 7.

5.2 Data collection methods

O’Brien (1998) states that action research is a holistic approach allowing several different tools and methods to be used. Therefore our choice of methods was dependent upon the settings we found ourselves in, and also keeping in mind the future use of the audit and what resources and methods would be available for an evaluation process (besides the paper-based questionnaires), if any.

After reviewing the different methods we decided on the existing questionnaires to be followed up by a short interview. The original information audit with its questionnaires would provide an opportunity to collect most of the data wanted by use of targeted questions. The questions include both qualitative and quantitative elements. Additional interviews of health care personnel would provide the advantage not only to follow up and validate questionnaire responses, but also to ask questions that could not be adequately addressed in the questionnaires (e.g. specific questions regarding a particular clinic/situation etc).

We were fortunate, as the data collection tools were already designed. Our task was to test them out further and to make adjustments to ensure their relevance in our context of work.

So, besides having answers filled directly into the audit itself, we took additional notes and tape recorded most of the interviews.

5.2.1 Audit questionnaires

The predefined questions in the information audit were our main source for data collection. It functioned as a structured interview to get the opinion from facility staff on some specific issues that are considered important parts of the health information system. By following this structure, one would be able to get a large number of answers to the same questions, and then present the results in a quantitative manner for higher levels as a way to measure the success or failure of the system. The results may then be used in planning, budgeting and various decision-making processes. A structured form like the audit would also help the evaluator not to forget to ask certain questions. Summary of the questionnaires will also be easier due to them all having the same structure, etc.

The completion of our paper based audit became a result of cooperation between the facility staff and us. In times where the manager had time to sit down with us, she usually completed the audit herself, with us just guiding and resolving any unclarities. Other times when we came at really busy periods we had to ask the questions and write down the answers ourselves the best we could.

5.2.2 Additional questions/interviews

Our first couple of weeks were spent interviewing key people (Cape Town Metro information managers, etc.) in the health information system, both at local authorities and provincial administration, and HISP people at the School of Public Health (UWC). We had some specific questions we wanted answers to, such as what was the status of HISP and the software they had developed, general challenges, and the restructuring process, etc. But besides that we were open to information about all aspects of the health sector and the health information system to get as good a background as possible. The people we met spoke willingly about what concerned them the most, and were not afraid to express perhaps rather personal feelings. We took notes from these formal meetings.

When it comes to the audit research, the health facility staff was asked additional questions, in order for us to make room for improvement in the questionnaires in the audit. Staff was encouraged to give us their personal opinions. By allowing this, the structure of the audit changed gradually, questions were added and others were removed according to what staff mentioned as important topics to include in such an evaluation.

In the beginning we started out with a few predefined questions that we wanted to ask in addition to the ones in the audit. These questions were for our own use for later, for the thesis writing, and were not going to be part of the audit as this was rather well-known information to people within the health sector, or questions that were difficult for staff to answer on the sheet. Sometimes they were mainly reminders for us, involving pure observation.

In general, our experience was that the audit's questionnaires captured the most important information we wanted. And we also kept in mind the need to reduce the amount of data collected to make the information relevant and easy to handle and present afterwards. The whole idea was to develop a tool that could work on its own by capturing the right information, and be conducted by facility staff themselves, without being too time-consuming. This was what we achieved as time went by and the audit took shape. In the end we did not feel the need to collect all this other information. Either it was a result of the audit functioning ok and capturing what we needed, or us being too narrow-minded and unaware of what was actually important to include.

5.2.3 Observation

In the beginning of our fieldwork we attended several meetings (budget, waiting times, RMR, etc.) and our role here was mostly as observers and note-takers. These observations were to give us an understanding of how the health information system functioned at district level, meet the relevant people, and help us find a focus area where a contribution on our part would be important and make a difference.

In addition to predefined and additional questions asked at the clinic visits, we also conducted some basic observation at the facilities. This included general impression of working conditions for the staff, conditions of equipment and computers, available space for patient folders etc. Anything that was not right or as it should be, we took note of. When it came to the specific questions in the audit, we observed how the staff were or were not able to understand what was asked, and we took notes to help us improve the tool.

In the beginning we looked for proof of information use at the facilities, like graphs on walls, available space for information handling work and additional computers. However, we did not follow this through for all our facility visits; we hardly ever saw any graphs at walls, many facilities had only one or a few computers. We did not feel the need to document this any further than writing down the computers location in the computer specification section of the audit, etc.

5.2.4 Interviews contra observations

In an interview the contributing subjects of the study are aware that they are part of some kind of research, and might modify their behaviour accordingly. Also, with observation, it is in many cases not possible to observe people without them knowing about it, so the resulting research data is not necessarily less modified if one observes someone in their natural environment, instead of interviewing them.

In our work and testing of the information audits, we chose to use interviews a lot for our data/information collection process, and the people we interviewed were aware that they took part in a study. Another method we could have used to find out how staff members in clinics use information, could be to use observation to find out how staff handled health information during a workday. We decided that using only this method would have been too time-

consuming for us, not least because the health personnel in facilities have so many other tasks besides the ones directly concerning information handling. A lot of the time we had spent observing them would be observations of tasks we were not directly interested in. We chose to use interviews to reveal the use of information, but it could also have been interesting to see how staff deals with information in practice. This would demand a lot of planning so that we could be there on days when some of the major information work was done (Routine Monthly Report for example). Time limit did not give us this opportunity.

We must stress also that although the interviews were our main approach, we also did some observations at the same time the interviews were performed. In chapter 3.2 Patton (1987) pointed out that any interview also contains an element of observation. We observed how the infrastructure of the clinics was, where in the facilities the computers were kept and how the working conditions seemed to be for the staff who handled data and information. Also, we collected some of the information material (documents and forms) that had been produced in the various facilities. This was material that was not produced specifically for research, but was part of the real information corpus produced. An example of this is the Routine Monthly Report (RMR). We collected some copies of what the facilities had actually passed on to the higher levels.

In our research with the evaluation tool, we believe we got more out of interviewing staff that observing them. We would probably not have gotten much additional information, and we would not have been able to cover as many facilities as we could with interviews. But the fact that the interviews were performed *in* the facilities gave us valuable insight in the staff's working conditions.

Interviews were also our main source of information collection during our first weeks, when interviewing managers at district- and regional level within the health sector, although we did some observation when attending budgeting or waiting time meetings, etc.

5.2.5 Tape recording

We spent some time deciding whether to use a tape recorder or not during our clinic visits and meetings. The benefit would be that we would be able to relax a bit when it came to the note taking, and concentrate on what people actually said and have longer discussions with them. But we were afraid that people would not like being recorded, perhaps they would not express personal opinions and would be afraid to criticise the system and people within it. After having done about a half of our visits to the clinics, however, we decided to test it out, and bought a basic tape recorder. It would at least be a useful experience with such a tool, and it would be interesting to see if people reacted differently when we used it.

It turned out to be a useful tool, perhaps a newer more fancy recorder where one did not have to change the tape quite as often would be nice (and less disturbing), but otherwise it worked well. People did not seem to feel uncomfortable in the presence of the recorder, and still spoke freely.

We kept taking notes, but these were less extensive. Their main purpose was to see the chronology of the topics in the interview. This helped us to recover the parts of the tapes we wanted to listen to, and we did not need to listen to everything on the tapes.

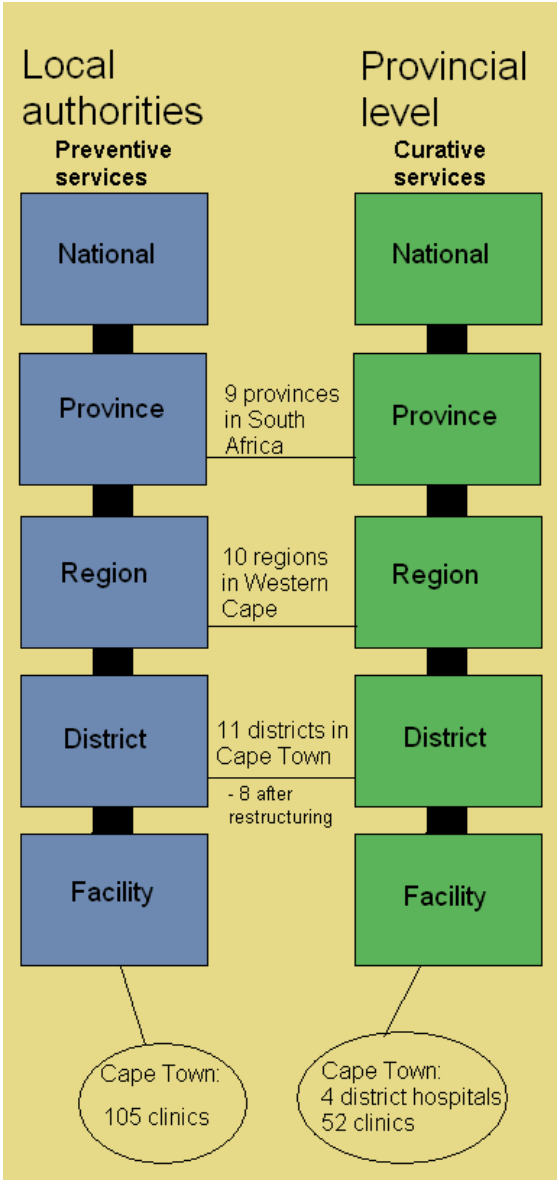
The recordings were thus never fully transcribed, as this would be too time consuming. Instead they were used to resolve any unclarities about answers given in the audit and when it

came to our additional notes. We listened to the tapes and wrote down specific comments and important issues that were mentioned.

6 HEALTH CARE AND HEALTH INFORMATION SYSTEMS IN CAPE TOWN

Information in this chapter mainly comes from interviews with key personnel from district level of the preventative and curative health care information system within the health sector in Cape Town (see Figure 16). We spent some time getting to know the health care system we were going to do research within – we looked for the right approach to contribute some meaningful research that would benefit the local context, and not be just a material collection process for our research.

6.1 The situation of PHC and health information systems in Cape Town today



In Chapter 4 (Background) we described some of the general challenges South Africa has with restructuring the inequitable health system inherited from apartheid. Inadequate or no health care services at all were provided to the majority of the population. The situation during apartheid is reflected in the major health problems today.

Facts about the City of Cape Town [Naidoo, 2003];

- Population: 3.29 M
- 11 health districts
- Health services jointly provided by the Local Authority (LA) and the Provincial Administration Western Cape (PAWC)
- LA operates 105 PHC clinics offering preventive and promotive health including TB & HIV services
- PAWC responsible for obstetric services, Community Health Service Organisations, offering curative services and 2^0 and 3^0 hospitals.

Figure 15. Overview of the two separate health care services in Cape Town – curative and preventative health care.

In today's Cape Town there are a lot of changes going on at the same time, so many in fact, that it is hard, even for a person working within and being familiar with the health sector, to keep up and know everything that is happening and what new decisions that have recently been made etc. We spent the first couple of weeks of our fieldwork period getting an overview of the health care structures and experiencing the system first hand, meeting up with key persons within health management, joining different meetings and so on.

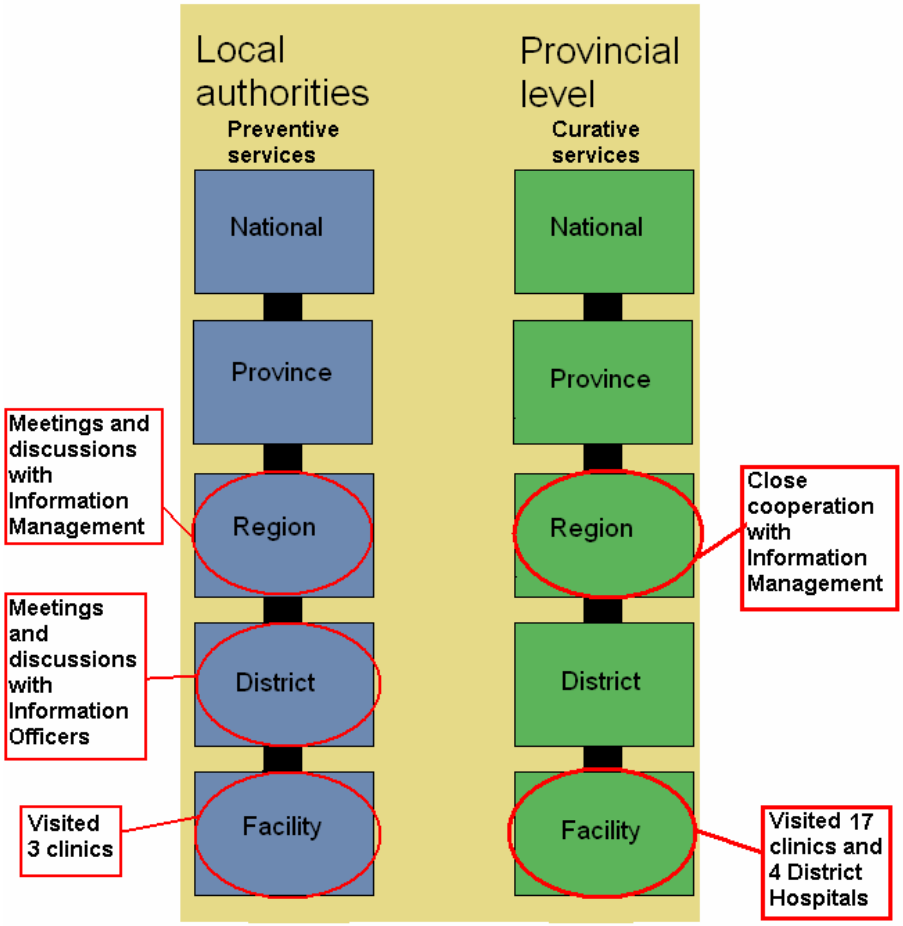


Figure 16. The parts of the health information system in Cape Town we interacted with.

Figure 16 shows where in the system we operated (red squares). In the initial phase, we had meetings and discussions with members of the information team at regional level and district level in Local Authorities (LA). We also had meetings with the information management of the Provincial branch (PAWC).

The structure of information handling in the two branches differs because the Provincial level (PAWC) does not have dedicated information personnel in the districts. Two persons function as district officers for all of Cape Town. This is why we did not interact much with personnel at district level in PAWC.

6.1.1 Restructuring of health system in Cape Town

Local authorities and PAWC

Western Cape, like the rest of the nation, has separate public services for curative and preventive care. The two branches are called Local Authorities (LA) and Provincial level – in

Western Cape it is called Provincial Administration of Western Cape (PAWC). In addition, there is a multitude of non-governmental organisations, private practitioners, community health workers and traditional healers, etc. Vertical programs like HIV/AIDS, TB, home based care and nutrition have been run through other structures.

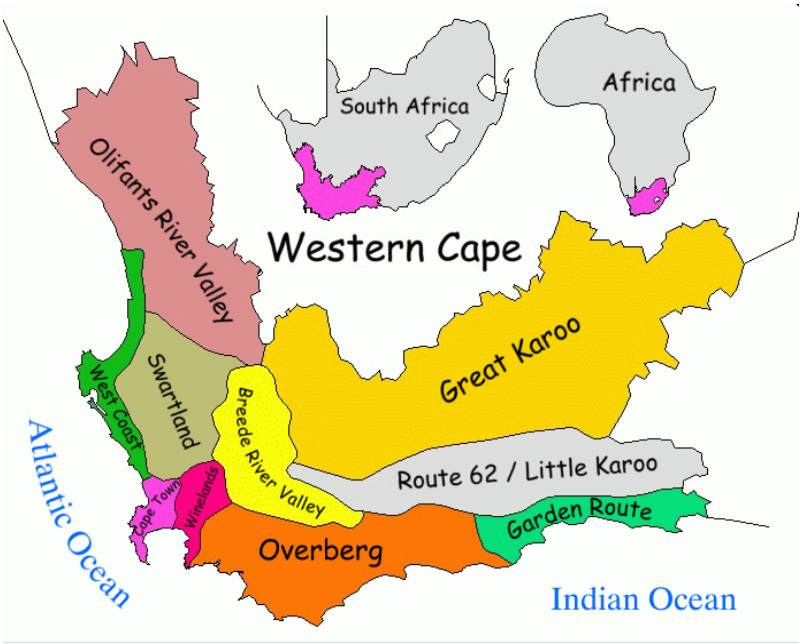


Figure 17. The regions of Western Cape.

The provincial administration of Western Cape (PAWC), offers doctor and nurse driven, adult curative services. Local government is nurse driven, and offers preventive care and curative care for children younger than 13 years.

More and more new clinics are combined clinics, meaning they share the same building and work side by side. But they are still run by different organisations and they have different salaries, training, workload, etc. On average, the Local Authority staff get better pay, are offered more courses on computers and information handling, have computers within all facilities, and have lighter workloads, to mention some benefits compared with clinic personnel at the curative services.

These differences in resources are revealed in the way the facilities handle and use information. Information accuracy and use are higher in a local authority facility than in a PAWC facility.

To some extent these differences are caused by the nature of the services they provide; the curative facilities treat patients with severe illnesses and injuries – they *cure* people. The preventative facilities focus on preventative care – like family planning, vaccinations, informing people about prevention, etc – nothing that is absolutely life-threatening or urgent in the short run. It is easier for the LA staff to close their clinic and go to courses. There are also many more preventative clinics than curative ones, at least in the Cape Town area, and the staff's workload at the preventative clinics are lower. For the curative service staff, however, this is much more complicated, people's lives depend on them being there, doing their job.

The local government also has a dedicated information officer (IO) for each district. This person collates monthly reports from facilities, holds information handling courses, helps facility staff with computer problems, does accuracy checks, reports to higher levels, etc. The Local Authorities also have monthly meetings where they discuss reports and data processes

PAWC does not have any such meetings at this point. At the combined facilities however, staff from PAWC often sit in on LA meetings. Of course a lot of the staff feels it is uninteresting as *their* numbers or services are not discussed.

Local government arranges regular training courses, which are open to all staff. Even PAWC personnel can join if they want – there are no limits to who or how many can go. A facility manager at a combined facility told us that she could join as many of the LA courses she wanted (time permitting), and she had done so. She complained, however, that very few of the other curative clinics used this opportunity. A lot of times, the local government sent out letters to these facilities, complaining about how few participated in the courses they held. Often, excellent speakers from universities, etc., were hired, and ended up lecturing for only a handful of people.

We have seen how the PAWC side benefits from LA's training courses, but the LA side of the combined clinics also benefited from these close working practices. Many staff members at the provincial side mention the fact that they could do the other side's jobs, but not vice versa. The preventative staff were not trained in the curative services PAWC provide, making them unable to lend an extra hand if needed. At one combined facility, the facility manager mentioned that they help the LA side quite often, even their clerk who was responsible for the monthly report (RMR) did both the provincial *and* the local authorities report each month! The clerk realised that this may be a waste of her time, getting nothing in return, still – this was how it had become, and she kept on with it, just as a favour…

Restructuring

A new restructuring process started in 2001 (end of 2000) and will transform Cape Town's 11 districts (see figure 18) into 8. A new health district will have some coloured, some black, some white – a mixture of people, quite the opposite from how it was during apartheid. A health district follows approximately the same border as a school district.

From June 2003 the provincial administration for the Cape Town Metropole was called Metro District Health Service (MDHS). They have responsibility for the Community Health Centres (CHC), and have also taken over the responsibility for 4 district hospitals, 4 step-down facilities (long time care, AIDS patients, etc.) and all vertical programs like HIV/AIDS, TB and an expanded Home Based Care program.

Figure 18. Cape Town and its districts.

We were told that massive changes during the last 10 years had led to demoralized staff. The district hospitals have over time demanded much of the resources the Provincial level have at their disposal, and employees feel that this has led to less resources to the Community Health Centres, and that now these units are next in line for getting an economic lift, and have some badly needed resources distributed to them. The Province needs to wake up and focus on primary health care, which has been neglected, was the opinion of actors in this part of the sector.

In a not too distant future, many information workers believe that the Provincial level and Local Authorities will be merged together in one body, with joint clinics and a closer connection between preventive and curative health care. The tendencies are already pointing towards this, one result being that most new facilities that are opened these days are combined facilities, where Local Authorities and Provincial level work side by side.

The restructuring is, in other words, in no way nearing completion – even if an increasing number of facilities are joint, there is still very much to be done in restructuring the administrative section, as well as adjusting the remaining facilities to the joint future. Some of the personnel in information administration made predictions that within ten years, the two branches will be combined. Personnel we spoke to expressed that they were positive towards this union, even though it means new years of restructuring. They feel that the division that presently exists is unnatural and in many cases adds too much complexity and an unnecessary gap between the services provided to the patients.

Information flow today and in the future

The diagram below represents the flow of data/information from the point of collection to the (former) Community Health Service Organisation (CHSO), until it reaches the provincial level. The staggered line (---) encapsulates the infrastructure of the CHSO before organisational change on June 1st. Fragmentation of services remains a challenge to the newly formed Metro District Health Services MDHS. The dotted lines (···) point to a futuristic model where all data will flow through the MDSH information unit before it is forwarded to the Provincial office.

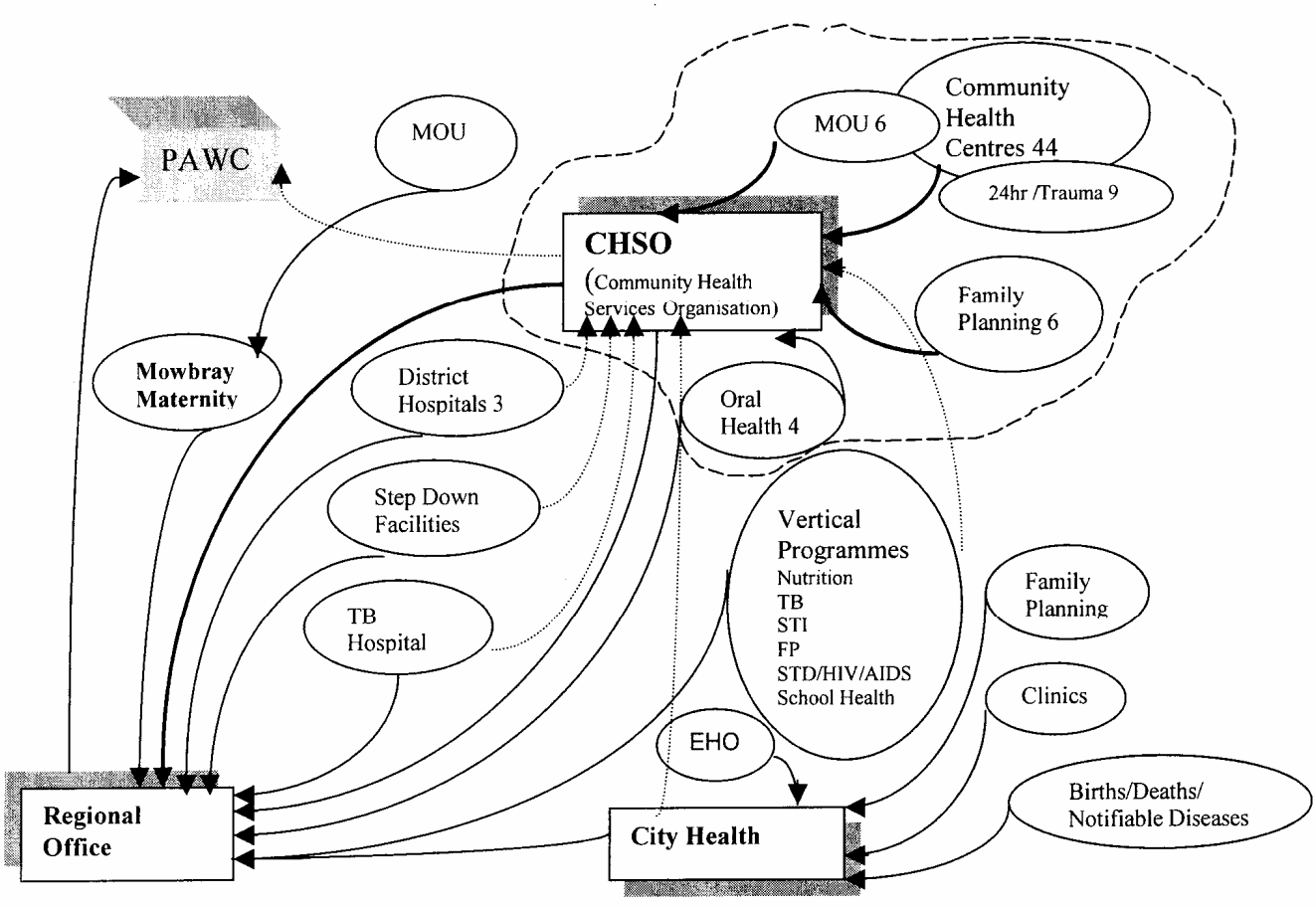


Figure 19. Data/information flow within the Cape Town Metro.

6.2 Local development or global thinking?

When we spoke to the information management in Cape Town, we found that the ideas and views of how the information system should be made and run take two directions. On the one hand there are central actors in the HISP project who think globally and develop systems that are meant to be applicable in several third-world health information contexts. On the other hand we have the information management in Cape Town, who think in more local terms, and create systems tailor-made for the needs in Cape Town.

One challenge that might occur with locally developed software systems is standardisation – the system must be able to provide nationally decided data and communicate with other systems. Another is the use of developing/programming tools – the local system development is very individualized, and what tools are used depend much on the personal preferences of the developers. This can result in a system that is difficult to maintain, because it is written in a language that is not commonly used, or that the programming style differs from the style of other developers. With the DHIS there is the benefit that many developers have been involved, and the documentation and open source software is available, so it should be easy for new developers to maintain and develop the system further. In addition, if the health sector in general was to depend on locally developed systems, the flora of information systems and software would most likely become very fragmented (as we have already seen examples of).

Benefits of locally developed systems include closeness to the development process during the development, giving the development team a better picture of the situation and what is needed in the system. But also afterwards workers predict it will be easier to get support, than with a system developed for a global context. DHIS is an example of this; it has been criticised for providing too little user-support. When the HISP team is not available, it is difficult for the local staff to get the help needed (new updates of the system and installations for instance).

"*When developing a system locally, we only have ourselves to depend on*", one person in the information management team stated.

"When developing a system locally, we only have ourselves to depend on."

– Information manager

Several of the people we spoke to indicated that there is at present a more immediate need for local thinking in the health sector in Cape Town, and it might be the case that systems made for actors in Cape Town prove usable outside Cape Town as well. This local development can therefore benefit larger parts of the health information system than initially intended.

Cape Town is often used as a guinea pig with regards to information systems in the health sector, and also, the health departments are often pioneers of their own accord. Consequently, elements that are first tested out in Cape Town often spread to other parts of the country. For Cape Town, this is an opportunity to be an important and influential part of development, but it also means that they will have to resolve problems that occur, and face the challenges that come with a development process. Health care personnel are the ones that will be exposed to all the new systems introduced within the health sector, and they are the ones who get the hard time learning new systems all the time, as the management and higher levels are unable to decide on implementing and sticking to *one* system (or as few as possible) for all.

6.3 Competition between the different HIS software

The DHIS has been and is the most extensive and comprehensive health dedicated software system within the health sector in South Africa. It is used nationwide, and is a tool for collecting routine data, particularly the Routine Monthly Data (RMR). The DHIS is described more thoroughly in Section 4.5, and the HISP team's future plans for their system in section 6.4.2.

There is general approval of the importance of the data DHIS collect, but not everyone agrees that the DHIS provides the solution actually needed. This has led to the development of a new system, called the Patient Registration System (or Patient Registration Application). This system is regarded as more suited for the needs in the sector by the management of the Cape Town region.

A version of the Patient Folder Application is operative in health care facilities (not district hospitals) today. A new version, that includes more functions (monthly report generation for instance) is ready to be – and has been rolled out at a few facilities. It is predicted that the DHIS software will be phased out in Cape Town, since the new system caters for all the same data collection functions DHIS does today.

In this aspect, Cape Town is in sync with the trends of the time in the rest of the health information system world. In general, there is a world wide movement from the single hospital systems that had their peak in the 80s, towards the patient based systems that have been the main focus the last decade. An increasing amount of information is being made available on different networks, like intranets or the Internet. In the wake of keeping more detailed patient information electronically, issues like confidentiality and medical errors concerns must be addressed in another context than earlier. [Johnson, 2001]

The major difference between the two systems is that the Patient Folder Application is patient-based, meaning all data collected and reported on can be traced back to one specific patient. DHIS is not patient-based; it just enables the health worker to collect health data without anything to really back it up. In fact one can put in just about any numbers and fool higher levels about increased workload e.g.

Patient Folder Application is today used for registration of individual patients and their medical background. When the new version of it comes, it will also be used the same way DHIS is used today; to generate reports. This generation will be easy and automatical, as all patient data and statistics are already entered into the application, also reducing data entering errors. Having the patients electronically registered also reduced the amount of space (which is limited!) needed for paper-based folders, it becomes quicker to look up patients and easier to deal with patients who have forgotten to bring their medical cards, etc.

The critic of the Patient Folder Application from management at higher levels within the information system, and HISP people in Cape Town is that it has been developed using old technology, and the programming code has been difficult to study and update, etc. A team has now been appointed to re-write this system, to make further and future development, documentation, and support easier.

Satisfied DHIS users, on the other hand, promote the flexibility of the DHIS, with for example the possibility of making changes and adjustments to the software as each individual

user sees fit. This is possible both within the program and by changing the code, as DHIS is an open source system that anyone can modify according to their needs. But information management members object and say that this is not as easy as it may appear, as the changes must be made on every computer the DHIS runs on, and this takes time if the system is implemented in most facilities. The alternative is to wait for upgrades in the facilities, but these rarely occur. "*Contrary to what the DHIS team seems to think, software and equipment is not upgraded very often, and the health workers do not have new versions of everything at their disposal at any time*", one information manager stated.

Another system, developed to deal with this update problem in particular, is a web-based application of the DHIS. Operations on this system will be in real time, and the changes will occur instantly in every client connected to the network, and running the program. One can wonder perhaps, if this solution is really thought through, as rather few clinics will be connected to a network, or even be having a computer at all in the nearest future! If this system is to be implemented only at district level, on the other hand, there is, at least at the local government side, more computers on a network available. The data entered into this system at district level will not be patient-based.

Apart from the software systems mentioned here, there are and have been a lot of other systems for different data capture and use. District hospitals use a system called Delta 9 for administrative purposes. We heard of a doctor who developed a local application for the hospital's need for an easier lab-test registration. This system has proved useful and might be rolled out to other hospitals in the future. When it comes to TB (tuberculosis) registration, there has been a number of different software used/considered for use. The DHIS had a separate TB-module, but this was abandoned after a while (we refer to the discussion section about a comparison of two systems). A new TB register has recently been adopted. Information handling staff is being left with the often huge tasks to transfer (re-register) old data into the new systems. Reactions from different groups of staff within the heath information system was that they were quite tired of shifting from one system, just as it had started to run satisfyingly, to another new system. But they felt it was nothing else they could do but start over again.

One can only wait and see who wins this cat-fight, or if the head of the health sector can ever decide on what system(s) to use. In the meanwhile, the health personnel at facility-, district-, and regional level are likely to get first hand experience with a lot of different computer system that supposedly are meant to *ease* their work. We shall not even begin to mention the time and money that must be spent on training of these systems…

We come back to this issue in chapter 9, and give our opinion to what systems are most likely to have a future in the South African health information system.

6.3.1 Overview of some different HIS software that are/has been in use

Like we mentioned above, there are a number of different systems running in the health sector. For instance, they cater for different programmes, like notifiable diseases and HIV/AIDS. The systems are mainly based on a Windows platform, and tools often used are Excel for spreadsheets and Access for databases.

"There is no problem with having a couple of different software systems, as long as they interact and communicate with each other"

– Information management worker

The majority of the information management personnel we spoke to do not regard it as a problem that not all data is included in one single system; "*That would have become too large, slow and unhandy. There is no problem with having a couple of different software systems, as long as they interact and communicate with each other through using standards like rich text or ASCII*", said one information management worker. He pointed out that the amount of data in DHIS is becoming too large, making the program slow in big regions like Cape Town.

In Figure 6 we summarize some of the computerized systems we encountered in the sector.

Name of system	**Use**
DHIS	Health data capturing tool, report generator, etc. DHIS is also used for capturing some data on vertical programs (antenatal care, immunisation) that are not a part of the RMR.
Delta 9	A system used in the district hospitals for administrative purposes.
PARCEL	Used at Brooklyn Chest (tuberculosis hospital), do not use Delta 9 as they have no fee-paying patients. Used for administrative purposes (staff, payments etc).
Logis	A system used in facilities at provincial level for ordering stock
Patient Folder Application	A system for patient registering, used in facilities in LA and PAWC. This system is still mainly used as a substitute for the card index – used for looking up the paper based patient folders.
TB Registration	For registration of tuberculosis patients.
BAS system	Brooklyn Chest, financial use.

Table 6. Some of the computerized systems that are used within the health sector in Cape Town.

Not all health data that is collected uses an application designed especially for the specific purpose. These statistics are rather registered with common Microsoft tools for instance. Table 7 shows some of the health data that is collected, and the tools used for capturing it.

Data element	**Tool**
Notifiable diseases	Access
INP/Vitamin A	Access
Hospital data	Excel
Tops	Excel
Prevention of Mother To Child Transmission (PMTCT)	Excel
Private hospital	Excel
Maternity Obstetric Units (MOUs)	Excel

Table 7. Tools for data collection.

6.4 Looking into the crystal ball – future in the health sector

As we have mentioned, there has been extensive restructuring going on within the health sector, and within the health information field, since the fall of apartheid in 1994. And the restructuring is not yet over; the sector must brace itself for more changes in the years to come.

6.4.1 Healthcare 2010

The health department of the province of Western Cape has initiated a project called Healthcare 2010, which is based on the restructuring that began in 1994. The broad framework of the plan was approved by Cabinet in March 2003.

The overall vision of the project is to "*to ensure equal access to quality health care*" [Healthcare 2010, 2003]. The reasons for why a project like Healthcare 2010 is needed are summed up in the following lines:

"Restructuring is essential because of the need to secure basic access to quality services for the whole population of the province. In addition, the changing disease profile, influenced by HIV/AIDS and TB, amongst others, and intra-provincial and inter-provincial inequities, must be addressed. Finally, the current pattern of services is unaffordable with respect to both capital stock and operational expenditure. Without restructuring, inequities and inefficiencies will continue."

[Healthcare 2010, 2003]

The overall challenges this project is facing are to:

- *Improve substantially the quality of the health service*
- *Simultaneously bring the expenditure within budget*

[Healthcare 2010, 2003]

That is, the plan is to both improve the service to the patients and at the same time cut the costs, or alternatively, get more money.

The Healthcare 2010 team has some plans on how to reach these targets:

- Reshape public health services in the Western Cape to focus on primary-level services, community-based care and preventative care
- Expand delivery of specialist services within the Regional Hospitals to make them more cost-effective and bring them nearer to communities who need them most.
- Adequately support these services with well equipped secondary, appropriately staffed and highly specialized tertiary services.

Within the main plan of Healthcare 2010, there are also a number of sub-plans. These are:

- **Service plan** – define and quantify the health services required by region, district and communities
- **Infrastructure plan –** provide buildings, equipment and maintenance according to the standards set out in the Service plan. This includes fully utilising the units, and maximizing the value of existing assets.
- **Human resource plan** – facilities are to be staffed appropriately, and this plan requires a revision of the existing staff establishments.
- **Financial implementation plan** – allocated budgets will be linked to measurable, time-bound objectives for the medium-term expenditure framework period and beyond to give effect to the restructuring of the Health Services.

The implementation of the plans will happen in an incremental manner, where the steps will not be equal in magnitude or frequency. The Healthcare 2010 team underlines the importance of enthusiastic support from all levels of management, and points out actors like Western

Cape Department of Transport and Public Works, and medical faculties of the Universities and Technikons as key partners.

As mentioned, many of the information workers we spoke to predicted that PAWC and LA will be united soon. The plan for Healthcare 2010 does not contain any clear indications of this, but it stated that there is and should continue to be a close cooperation between the two branches.

For us, the most interesting parts of this plan are those concerning staff situation and equipment – there are, namely, no specific plans regarding information handling. The plan implies that more responsibility should be put on the primary health instances, like the PHCs, and that hospital admittance and average stay in hospitals should decrease. This means that many primary facilities must be upgraded both with respect to staff and equipment, as the facilities presently are not in condition to cope with any higher workload.

The Healthcare 2010 plan recognises the importance of recruiting, training, retraining and retaining personnel. In primary health care, there will be approximately 1,300 new personnel by 2010.

It is also stated that much of the equipment and buildings in the sector is worn out and out-dated, but that it is not possible to upgrade everything to an ideal standard. The most immediate cases must come first and otherwise the workers must make the best use possible of what exists. There are nevertheless plans to give the infrastructure a lift, and not least trying to fill the gap that an ongoing backlog has made.

6.4.2 HISP focus in the time to come

In 2003, the HISP team wrote a report ("Report on HISP Activities to NHISSA") on the major focus areas in the national health information work from now and onwards, and with the report, the team wants to stimulate the provinces to "*evaluate the extent to which they do use information to make decisions*". The target in the time to come is that all districts should reach a level of data usage where they independently use information for making decisions.

The report states that as a country, South Africa has come a long way in creating a complete dataset, and that the challenge now is to improve the timeliness of data submission, and the quality of the data. The report also underlines the usefulness of the DHIS, i.e. in validating datasets [HISP Activities, 2003].

Specifically for Western Cape, it is mentioned that a number of regions have made significant strides towards improved use of information for action, but a challenge is to make adjustments in the data flow from the districts to provincial level. At the time, there are in particular a number of vertical data flow patterns that run outside the DHIS. This results in duplication of entering data and unnecessary waste of resources.

The report points out what kinds of challenges the national level is facing:

- PHC Essential Data Set still awaiting approval.
- Co-ordinating dataflow so as to get a complete dataset on the intranet timeously.
- Getting reports back to the provincial program managers.
- How to increase information use amongst other programs.
- Use of information in planning in general.

Some of the main activities to take place are:

- **Software development:** Continued development and adjustment of the DHIS to accommodate integration of DHIS data with the District Planning Guidelines.
  Important features are:
  - Integrated database which will allow easy combination of data from hospitals, PHC, and other datasets.
  - More user friendly interface.
  - Faster than the current version.

- **Country-wide areas for attention:**
  - Continued activities at Provincial and National levels, in particular in improving the completeness and timeliness of the national dataset.
  - Increasing access to data through placing provincial datasets on internal networks.
  - Completion of documentation of DHIS manual and a document on development of the DHIS.
  - Wrap-up phase of the EQUITY project.

6.5 Special considerations in our further research

This chapter presents our understanding of the situation in the health information system in Cape Town at the time of our visit. The issues and concerns here is information that was collected mainly during our first weeks in Cape Town. These weeks became a necessary preparation period for us, in order to conduct our information audit research.

As we got to know the information system better, were there any special considerations that we needed to make when it came to the audit research?

Structure of HIS and information flow

Because of the huge reconstruction processes that went on, and the difficulty of getting a good overview, we understood that we would run into problems and misunderstandings here. The only thing we could really do was to relate to the current situation and the way things functioned at the time being. We had to address the *current* situation and the *current* challenges within the system, no matter what the future plans for the system were. These thoughts came from the idea that in order to improve a system, an evaluation must be targeted so that existing problems about the system are investigated. It became important for us to include in the audit questions about data collection, information flow, feedback and status of equipment for example, as answers to these questions would help mapping the current reporting structures, feedback flow and resources of the information system. Even if some people would argue that these issues are well-known, we think having the people who actually collect and send data, and receive (or do not receive) feedback giving their version of how things function, would clarify more accurately any “malfunctions” of the HIS, bottlenecks, duplication of data, etc., that may have developed since the last time investigations of the HIS were made. This would be especially important now, before a great restructuring takes place, so that one still has the opportunity to discover new problems and deal with them in time. Or in the time to come, using an information audit one can ensure that all new routines are

correctly followed in practice by all parts of the information system, and discover new needs of training and equipment, or problems arising within the new system.

Data collection tools

Because of all the different computerized data collection tools mentioned in earlier section of this chapter, we decided to register what software programs were installed on the computers within a facility and which ones the facility staff used for their information handling process. The questions concerning computerized tools used were included in the computer specification audit.

Separate preventative and curative health services – separate audits/evaluation?

Since the preventive and the curative health care services are two completely separate organisations in Cape Town, we asked ourselves if there was a need to develop different kinds of audit tool for the two services. But due to the fact that facilities in reality are very similar, that more and more facilities probably are going to be combined we made a choice to develop *one* tool that could be used for evaluation of both services. It is also easier to handle one type of evaluation tool, and that one single tool makes the presentation of the results easier. Using the same tool would also make it easier to compare the two services; differences in recourses and staff's working conditions, access to training in information handling and computers, etc.

7 INFORMATION AUDIT RESEARCH

In this chapter we report what changes we made to the information audits which were the main part of our research, and why. We also explain what elements in the original information audits we decided was important to keep, and how the interviewees responded to the different parts of the audit.

As we mentioned in Section 4.6, the original information audits were developed by members of the HISP team, who also tried them out without much success. Other actors, like information managers at regional level in PAWC, have also tried to make use of the audits. They did, however, not get the desired results.

Our target with the action research was to tailor the audits to the context we worked within, so that they fit the premises and limitations of those completing the audits. In our research we primarily concentrated on the original facility manager and the facility information officer, which ended up in *one* audit for the facility level. We also developed a separate computer specification part for the auditing of the facility level. Research on the District Information Officer audit was limited due to our relative short timeframe.

7.1 The original information audits

The *original* information audits were divided into five different audits:

- Information Audit for Facility Manager
- Information Audit for Facility Information Officer
- Information Audit for District Information Officer
- Information Audit for Line Manager
- Information Audit for Program Manager

The reason for having different audits was to be able to understand the information processes in more detail at different levels of the health information system, and to get the person with the most knowledge at each level to perform the audit.

We decided to focus on facility and district level by working on the facility manager, facility information officer and the district information officer audits. Due to our relatively short time in Cape Town our main focus became piloting the facility manager audit. We also introduced, and gave a short instruction of the District Information Officer audit to some of the health workers, as well as presenting some of the results from the piloting of the facility manager audit.

Next we describe the role and the job descriptions of the different people involved in the information auditing: the facility manager, the facility information officer and the district information officer, to give an understanding of the important and different tasks they have in the information system, and why these people in particular are necessary to include in the auditing process.

Facility manager (FM):

The facility manager is in charge of the facility, and her work is located on the premises of the facility. Clinics in both PAWC and LA are nurse-driven, so in most cases the manager of these facilities is a nurse. She has the administrative responsibility of the clinic, but due to the high workload, she has to help out with patient work as well in most facilities.

There are significant differences between facilities with regard to how involved the manager is in the information work. In some facilities she does all the information handling – which decreases the time for other tasks. In other facilities, the manager is totally absent in the information work, and delegates this to the clerks. A minimum of manager involvement, according to information management, should be that the facility manager looks through data before it is sent to higher levels, but even this is not always the case. In these cases the manager often has little understanding of how information handling works, and the perceptions of what goes on in the facility might be limited.

Facility information officer (FIO):

A relatively new kind of job within the PAWC facilities is the Facility Information Officer (FIO). Earlier, there has commonly been a person mainly doing the information work, but these arrangements have often come about more or less by chance. The person mainly concerned with the information work has traditionally been one of the clerks, but in several cases this work falls on the facility manager.

Lately, it has been decided that all PAWC facilities are to formally appoint a FIO who is in charge of the information handling. Some clinics have done this, but many have complaints because the information work often is just added to all the other tasks the person already does, and she is not relieved of any of those tasks.

Included in the responsibilities of the FIO is co-ordinating of the collection, verification, analysis, presentation and appropriate utilization of institutional health and management information. Another task is to submit required data to Sub-district/Regional and/or Provincial level. The FIO must also be able to conduct basic research, using a variety of sources (i.e. the community, other service providers, etc.), in order to answer questions that might be posed. She also has an important task in ensuring that the skills, knowledge and attitudes (as well as the physical requirements) are in place to be able to collect and deliver data according to expectation.

District information officer (DIO):

The district information officer is an established and well adjusted position in the Local Authorities districts in Cape Town. Each district has their own DIO, or in some cases one DIO covers two districts.

This is not the case in PAWC. Here, only two people have the function of the DIO, and they must cover all the 11 districts in Cape Town. Until one year ago there was only one person with the DIO function in PAWC.

The DIO is responsible for collecting data from the facilities, particularly the Routine Monthly Data (RMR), and run accuracy checks on it. For facilities with no computers, or where the DHIS is not being used – i.e. all PAWC facilities – the DIO must enter the data into the computer. The DIO is also responsible for giving feedback to the facilities, as well as

reporting the data to higher levels. In addition, the DIO should be able to turn data into useful information on a general basis and on request for a variety of actors. She must also give support to the facilities regarding information handling and computer use, and provide training where it is needed.

7.2 What changes where made to the audits and why

The work on the computer specification part and our own versions of the facility manager and district information officer audits was an ongoing process with several discussions and meetings with important key persons like Gavin Reagon (UWC, HISP), Lorna Solomon (Provincial administration) and Hassan Mohammed (Local Authorities). We used a spiral model in the developing process, using our own experiences during the pilot as main arguments for the changes that were made, based on response from people we interviewed, as well as statements from our collaborationists on what information was important to gain from the audits.

7.2.1 The facility manager audit

The original audits for the facility manager and facility information officer were used as a framework for developing a new, revised and simplified version of the facility manager audit. We wanted to take the best parts and use them in the new audit, and we worked from the principle of developing a "user-friendly, context adapted tool, easily conducted by management to report on the status of the information handling and resource status at facility level, without being too comprehensive or time consuming", i.e. the principle the original audits were built on. If the facility has appointed an information officer, the same audit applies to this person. We thought it was best to keep the number of different audits to a minimum. Otherwise it could complicate the auditing process at both facility and district level.

It would simplify the work of the DIO if only one type of audit concerning the facility is sent out, both with regard to the control of what has been returned and in summarizing the results. By saying this, we imply perhaps that the title "facility manager audit" might be somehow misleading if there is a facility information officer or someone else at the clinic who handles most of the health information. If this is the case one can assume that the facility manager has delegated a lot of this work to others, and is not fully familiar or updated on the information status/process. This was our experience when visiting some of the clinics, and in these cases for future audits, we encourage the FM and the FIO to sit down together and complete the audit.

Quite often, a clerk had been given the task to collate health data from different departments within the clinic and was responsible for the RMR. During our visits, the manager sometimes just referred us to this person, not being able or having the time to answer any of the questions in the information audit herself. For us, this just proved that the clinic management several places were not involved in the health information handling, and very likely no information was used in decision-making at clinic level.

For the collected information to be of any use at facility level, the management must actively be involved with it, and use it to improve their health care services. Just pushing the responsibility of reporting some indicators to higher levels over to a clerk can not be categorized as "local use of information". By keeping the title "facility manager audit", we

hoped to give the facility management an indication that this is something they should be involved with, and that these are questions they should be able to answer. The ideal solution is, as mentioned, that the manger sits with clerks and other persons doing the information handling, and completes the audit together with them. This would update the manager on what goes on, and give a more valid completion of the audit. A process of active use of the collected health information may start to develop from this collaboration and involvement by managers. Interest from managers could also improve the data quality and work as motivation for the personnel.

Data sets

The original facility information officer audit and facility manager audit consisted of several tables about the data collection process and what data sets were collected in the facility. 17 different data sets were listed, and one was to tick of the data sets collected at the facility. These data sets were not quite adapted to the context. Not all data sets were relevant, some were included in the RMR (witch was also listed as a separate data set), hospital data sets made no sense in the facility audit and so on. We ended up with 12 data sets, also adding a few blank rows of other additional data sets to be filled in. We kept the 'RMR' as a separate data set, and added the text "Other information collected that is NOT captured on the RMR:" to separate the other data sets that were not captured on the RMR. These data sets may be collected separately by some clinics for local use, or be part of a programme:

- Births
- Deaths
- Notifiable Infectious Diseases
- TB
- HIV/AIDS
- Nutrition Program Information
- School Health Program Information
- Oral Health Program Information
- Environmental Health Information
- Community Health Workers and counsellors
- PMTCT (prevention of mother to child transmission)

By doing this, a lot of confusion about the interpretation was avoided. There was no need to tick of any further data set that was already in the RMR, only if additional data were collected and used/reported separately (in addition to the RMR) at the clinic.

At first we wanted to include the whole RMR in the audit, to find out what data each clinic captured. What we found out was that this was really unnecessary and led to more work for the person completing it. A district information officer (or someone corresponding) would know from the monthly reports received from the clinics, what data sets were captured, by using either the RMR-sheets submitted from the facilities, or by using modules in the DHIS software. There was no need to ask this all over again. One could maybe argue that this would apply to all the data collected at the facility. We felt it was necessary to include the other datasets (mentioned in the list above), because this information could either be collected just for local use (not reported or sent to anyone), or it is sent to someone else than a district information officer if it is a part of a special program. Because of the long and ongoing restructuring process, problems with a spaghetti-like data flow and cases with data duplication is still an issue today, and something one wants to get an overview over, and make more reasonable. By having the facility level reporting on their own data collection and flow, it

might be easier to discover irregularities, bottlenecks, duplication, etc., of the information flow between- or to/from different levels in the information system.

Data collection/collation tools

Questions about data collection/collation tool were originally included only in the facility information officer audit, not in the facility manager audit. See the following examples:

Dataset	**Name of Data collection Tool or Tools**	**Type of Collection tool (tally sheets, tick registers, registers, forms, lists, other)**
dataset 1		
dataset 2		

Table 8. Name of data collection tools.

Dataset	**Name of Data collation Tool or Tools**	**Type of Collation tool (tally sheets, tick registers, registers, forms, lists, other)**	**Frequency of collation (daily, weekly, monthly, 3 monthly, etc.)**	**Has all data collected in 2001 been collated and entered**
dataset 1				
dataset 2				

Table 9. Name of data collation tools.

We were afraid of misunderstandings about collection and collation, in the sense that not everybody would be able to separate the two terms. To clarify;

Collect:	Raw data (numbers, names etc.) is collected with different data collection tools; client cards, tally sheet, registers, tick registers.
Collate:	• Summarizing data from the same data elements but from different sources. • Summarizing data from the same source but over a period of time Example of collating; the RMR; gathering of data from various sources (units within a facility) and putting it together into one comprehensive and representative report.

Table 10. Explanation of terms; collection and collation.

We were trying to turn the auditing tool into a simple tool with no need for a long manual to explain all terms. Therefore we decided to remove the collation part of the questionnaires to avoid misunderstandings and duplications, and also make the audit shorter. Instead we wanted an indication of: "*Type of collection tool for the data in the Data Set (tally sheet, tick registers, registers, forms, lists, other)*" The answers to the original question and our did not differ in any important way; "Name" of tool was never written out fully in the original audits (the formal name/version of a sheet for collecting TB for example), the answers were always just "*tally sheets*", "*register*", etc., so there was no loss of important information from this decision. The overview of the collection/collation process could instead be obtained by asking how information is used and where it is sent, etc.

What could be an idea here is to have the facility include/attach to the audit empty copies of the different forms they use for the data collection/collation process (for data before it goes on to the RMR, and for the separate data or programs), especially forms they have created themselves. This would clarify the data handling process within a clinic a lot more than having them *write* about the tools they use – something that might not be very describing. By checking the attached collection/collation forms, one can get a picture of the information handling process within the clinic, see if old and outdated forms are used, detect any duplication or unnecessary work, etc. Newer versions of forms can be distributed, ideally by having the district information officer personally bring it to the clinic and introduce it to staff, and at the same time remove old, outdated forms that still are being used. This can be a way to ensure that everybody keeps up with new changes and are not left behind, still doing things the old way.

Accuracy checks

Questions about accuracy checks were included in the facility information officer audit, not the facility manager audit. The questions that were asked was:

- Are Computerised Accuracy Checks of the Data done
- Are Manual Accuracy Checks of the Data done
- Who does the Accuracy Checks
- What percentage of the Data elements are considered Accurate

We used these questions in our version:

- How are accuracy checks done (manually or computerized) and by who?
- How accurate do you consider the data to be? (percentage)

Here we have the issue of having two questions in one. We underlined “how” and “who”, and allowed more space in each cell in the table for writing, and this proved to work adequately when we tested the layout on the interviews. This led to fewer questions and more space for several question in the same table.

Use of information

The same questions about use of information were included in both the original facility information officer audit and facility manager audit:

- Was Information derived from the data set used by Mx or Staff in 200x- Yes/No
- If Used: Provide an example illustrating the use of the information
- If Not Used: List the reasons why the Information was not used

In addition, the original facility information officer audit had some questions about production of reports:

- Were any Reports containing Analysed Information produced in 200x?
- Who were Reports containing Analysed Information sent to?
- Which groups discussed the Report containing Analysed Information that was produced?

We replaced the above questions concerning use of information with the following ones:

- Is information discussed by the staff at the facility? If so, how often and by who?

- Was any information used at facility level during the last year?
- If information was used, please specify how that information was used at facility level (E.g. tables/graphs/diagrams/written reports made, information used for decision making, other…)

The reason for this decision was that we experienced a lot of confusion about the previous questions. For example, we felt that the question "Was information derived from the dataset..." (and the additional two; if used/if not used) could much easier be replaced and understood by asking; "is information discussed..." and "is information used...". At several clinics, staff said they discussed the information, but they did not make any reports. Discussion qualifies as use in our opinion, so we felt it was important to highlight this by adding a question about only discussion without the involvement of reports.

The word "report" can also have several different meanings, everything form a long formal discussion and analysis to information summarized and presented in graphs or tables, or simply a few written words and thoughts for use within the clinic only. Staff kept asking us what qualified as a report; if it had to be made at their own initiative, if it had to be submitted to higher levels, etc. There was also some confusion about whether e.g. the RMR and data from other programs counted as reports.

We added a few examples in our question to make this clearer. There was also a need for underlining and highlighting the words "at facility level", because sometimes staff told us "yes, of course information is used!" When we asked how, they replied "at higher levels!" Good answer! But not quite what we wanted with that question...

We also avoided date and year in the questionnaires - to avoid a lot of extra work in updating the audit later. Year and date should be included only on the front page to avoid mixing up different versions.

Feedback

The original facility manager audit had no questions about feedback, and the only question in the facility information officer was:

- Have you received any Feedback or Reports from Province or National

We replaced that question with:

- What kind of feedback is received on the dataset and from whom?

The reason for this was that we saw the value of knowing what kind of feedback was received and where it came from. A yes/no answer about feedback gives no information about the data flow.

We think it is very important to cover the issue of feedback in the audit, because during the pilot many reported that the feedback from higher levels in many cases was insufficient, and that feedback was given only when someone made an error.

This field is important to explore, and it is important to make staff at facility level aware that they are entitled to meaningful feedback in return for the work they lay down in collecting

data and information. People at higher levels must be made aware of how the feedback situation is, and see that there is a wish and request for feedback at facility level. Good feedback is a necessary piece of a well-functioning information system.

To summarize the questions concerning data sets, collection tools, accuracy checks and feedback, here is what our final table looked like:

No	Data Set Type	Type of collection tool for the data in the Data Set (tally sheet, tick registers, registers, forms, lists, other)	How are accuracy checks done (manually or computerized) and by who?	How accurate do you consider the data to be? (percentage)	How often are the data sent away and to whom?	How is the data sent (electronically, floppy disk or by fax/post)?	What kind of feedback is received on the dataset and from whom?
1	RMR (provincial PHC essential dataset)				*Monthly to*		
Other information collected that are *NOT* captured on the RMR:							
2	Births						
3	Deaths						
4	Notifiable Infectious Diseases						

Figure 20. Facility audit questionnaire; data sets, collection tools, accuracy checks, feedback.

We placed all questions in one table, instead of the three different tables that were used in the original facility information officer audit.

Training

Our experience showed that the questions concerning training in the original audits were not very relevant at facility level. After just a few clinic visits, it was clear that almost none of the staff we spoke to had participated in any of the courses listed in the audits:

UWC's winter and summer schools:

• Introduction to Health Informatics for District Health Workers	• Using Geographical Systems for Analysing and Mapping Health Care Issues
• Using Health Information for Effective Management	• Using the District Health Information Software for Management
• Developing and Using an information system for Various Health Program	• Introduction to Epidemiology
• Using information systems to manage hospitals	• Epidemiology of Communicable Diseases
• Computerized District Health Information Systems: Intermediate Course	• Intermediate Epidemiology
• Computerized District Health Information Systems: Advanced Course	• Advanced Epidemiology for Health Management and Practice

Table 11. Winter and summer schools at UWC.

ESATI Summer Schools:

- District Health Management Information Systems
- Computerized District Health Information Systems: Intermediate Course
- Introduction to Epidemiology

In-Service Training received from HISP or CHESS or HST:

- Computer Training on Information Systems Computer Software
- Theoretical Training on Health Information systems
- Training of Trainers course on Health Information Systems

Hardly anyone had attended these courses, and to simplify the questionnaires and tables, we left out all the specific courses mentioned, and added some general courses to tick off and provide some details around (provider, duration, year):

- Basic computer skills
- Basic information handling
- More advanced courses on computer skills or information handling
- Other training

We also kept some open tables for them to fill in what additional courses or training they had attended, if any.

Other questions

In addition, the two original audits had some questions we included without any change or with just minor adjustments. These were the following:

Training:

- If you (FM/FIO) received any training, are you in a position to use the training received?

Mentoring and Support:

- Have you (FM/FIO) received any support or mentoring regarding computers or information handling?
- Is it easy to get support if you need it, and who would you contact?

Perceptions and achievements of the Information System:

- How well do you (FM/FIO) think the current Health Information System is functioning?
- What do you (FM/FIO) think is the greatest Achievement of the current Health Information System?
- What do you (FM/FIO) think is the greatest Failure of the current Health Information System?

Suggested improvements to the information system:

- What additional Human and Other Resources do you (FM/FIO) think are required to optimize the Health Information System?
- What information currently NOT being collected, do you (FM/FIO) think should be collected?
- What information currently being collected do you (FM/FIO) think is of NO VALUE (or very low value) and should not be collected?

- What do you think should be the Optimal Structure of the Health Information System in the District?
- Other comments

Additional changes

In addition to the mentioned changes, we also changed the order of the different topics.
The original order was:

- data collection tools
- accuracy checks, reports and feedback
- use of information
- training

This was changed to:

- training
- mentoring and support
- data collection tool, accuracy checks, feedback
- use of information

The rest of the questionnaire remained in the same order. The reason for this was to motivate the persons who are to complete the audit. Instead of starting out with the somewhat detailed questioning about all data sets in large tables, they start out with easier questions in small tables - questions we are more certain the staff have an opinion on, and something to say about. This will hopefully lead to motivation instead of discouragement, and make the experience with the audit a more pleasant one.

7.3 Computer specification audit

The computer specification part of the auditing process is ideally to be completed by the District Information Officer, or an equivalent, like District Secretary. This is because, although not at all complicated, the completion of this audit takes some technical skill, and it gets easier once it is done a couple of times. It would take much more time to teach people in every facility how to do this.

We designed the following two tables to provide an overview of computers used in the facility:

Computer	Location of computer	Group of Staff who mainly uses the computer	Number of Staff who uses the computer	What is the computer used for?	Network?	Intranet?	E-mail Access?	Printer connected?
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Computer	Operating System	Software installed (tick if installed)						CPU size/type	RAM size	Hard Drive size	Status (working well?)
		DHIS	Patient Folder Application	Office (Word, Excel, PowerPoint)	Logis	Group-Wise	Other (please specify)				
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Table 12. Facility audit questionnaires; computer specifications.

The original audits for the facility information officer and the facility manager had no questions regarding the computers in the facility. This part was only included in the district information officer audit and looked like this:

Table 1.C. Overview of Computers Used by Health information System staff, Line Managers and Programme Managers

No	Name of Staff Member who mainly uses computer	Staff Category	Main function of staff member	Is computer used for health Info Purposes Yes/No	E Mail Access Yes/No	DHIS Software Loaded? Yes/No	Computer Working? Yes/No
1							
2							

Table 13. Original audit questionnaire on computers; in the district information audit.

We felt it was necessary to get more detailed information about the computer resources at each facility (where the information collection takes place) to indicate what equipment the staff has at their disposal. One argument from Gavin Reagon against all the technical details (CPU, RAM, hard drive size etc.) was that one could just ask if the DHIS is loaded - and that would tell you that you had a computer meeting all requirements because this software requires more capacity than for example Office, or the other programs normally used. We did not agree with this, and were supported by Lorna Solomon from PAWC. This may be true in Local Authority clinics but not in Provincial facilities, first and foremost because the majority of Provincial facilities do not even run DHIS. Secondly, there will be other capacity requirements in the future. For instance, the Logis system might need just as much, if not more capacity than the DHIS. And even if the DHIS is loaded, it does not tell if the computer appears to be slow and that it cannot handle the required workload. With the technical specifications listed, supplemented by the opinion of staff, you have proof of whether a computer in fact is too outdated for some functions. If it is just slow, but otherwise in working order, it can be used for less demanding tasks like training or typing etc. If so, the computer should be kept for those purposes, either within the facility or moved somewhere else in the district where it is needed.

Based on our findings during the pilot, regarding performance of the computers, our recommendations are that minimum requirements for a computer in a critical workstation should be no less than: 130 RAM size and 10 GB hard drive size. If one is to move faster and newer computers within the facility to areas where they are more needed, computers that do not meet these requirements are inadequate and should not be placed in the critical workstations. They should rather be used for other purposes like training of staff e.g.

The table below can be used to summarize the findings from a facility, grouped differently than the tables we showed earlier. For example, one can mark a computer as inadequate if it does not meet the above requirements, and also indicate the status of the equipment and needs. We suggested using the terms:

[Number] = give the number of equipment needed at the workstation
0K = equipment ok or not needed
I = Inadequate at a critical workstation, but can be moved and used for training
B = broken, must be replaced and cannot be used for anything
S = needs service

Location/workstation	Status of computers	Status of printers	Status of faxes	Status of copy machines	Network connection?	E-mail?	Office space sufficient?	Other comments (e.g. software needed)
Critical workstations:								
FM Office								
FIO Office								
Reception Area								
Pharmacy								
Other locations:								
Total number of inadequate equipment								
Total number of equipment needed								

Table 14. Questionnaires for it-equipment summarization.

Concluding questions or general observations and recommendations that are asked at the end are:

- Add comments to your observations (to the equipment and/or any other observations) during the visit to the clinic
- Recommendations

Here, the district information officer can summarize her/his observations from the clinic visit; and give specific recommendations concerning the IT-equipment. If completed shortly after the visit, it is easier to remember the actual situation, comments and wishes from staff etc.

7.4 District information officer audit

Due to the relatively short time we had left after conducting the facility manager audit and the computer specification part, we did not have much time to work on the district information officer audit. What we did do was to make some minor changes to it (datasets, staff details and the computer part), had meetings and discussions about it with information officers and other members of the information management. At last, we presented it in a workshop we held at the end of our stay.

The district information officer audit has, unlike the facility manager audit, an introduction text and a manual attached for guidance. Connected to each table or questionnaire is a short explanatory text to help clarify how to complete the questions. Any terms that might lead to misunderstandings are explained.

The audit is meant to give results that describe the Information System. The issues to explore include:

- Structure of the HMIS
  - Availability/Existence of Datasets, Indicators, Storage of Data, and Reporting.
  - Resources
    - Human Resources
    - Computers and its Use
- Data Collection
  - Data Collection Tools
  - Data Flow
- Accuracy Checks, Production of Reports, Presentation/Discussion and Use of Reports
- Management, Finance and Career Path
- Perceptions and Achievements of the HMIS
- Suggested Improvements to the HMIS

The audit is organised in the same sequence.

The last part of the audit is a suggested summary format for results from the questionnaires. The results of the questionnaires should be compared with what would constitute an ideal/effective HMIS. Comments on what an ideal/effective HMIS constitutes are provided throughout the guide and specifically stated in the third column of this concluding summary table.

Changes made; Dataset

The changes we had made in the facility manager audit needed to be reflected in the district information officer audit as well.

The following table gives an overview of the changes made:

Datasets in original audit	**Dataset in revised version**
Provincial PHC Minimum Data Set	RMR - Provincial PHC Minimum Data Set
Provincial Hospital Information	Provincial Hospital Information
Population	*not included*
Births	Births
Deaths	Deaths
Socio-economic	*not included*
Notifiable Infectious Diseases	Notifiable Infectious Diseases
TB	TB
Chronic Diseases (all types)	*not included* (already included on the RMR)
Trauma (Violence, Accidents, MVA's)	*not included* (already included on the RMR)
STI and HIV	**AIDS/HIV**
Antenatal Survey	*not included* (already included on the RMR)
Immunisation	*not included* (already included on the RMR)
Mother and Child	**Prevention of Mother To Child Transmission (PMTCT)**
Mental Health	*not included* (already included on the RMR)
Rehabilitation	Rehabilitation
School Health	School Health **Programme Information**
Nutrition	Nutrition **Programme Information**
Oral Health	Oral Health **Programme Information**
Drug Management	Drug Management
Transport Management	Transport Management
Emergency Medical Services	*not included*
Health Promotion	*not included*
Finance	Finance
Personnel	Personnel
Environmental Health	Environmental Health
	Home Based Care
	VCT
	Other (specify)**:**

Table 15. Changes made to data sets. Bold text indicates the changes made.

The changes in the datasets were due to changes in different programs running at the time being, and that some information had become irrelevant due to other changes in structures and to customize it to the Cape Metropole, etc. For example, separate departments handle health promotion and emergency, so this did not need to be included in this audit. Other information like finance, personnel, transport and drug management is important to include, however. All over the country, information is hardly ever collected on this. By leaving the datasets in the audits (even though nothing is filled in), can be a reminder that one should collect data on it.

All ‘yes’ and ‘no’ columns were replaced with just one column to fill in if relevant/if data was collected.

Training

“Training of staff” was changed so that the information officer is to add relevant courses him/herself, without including a list of predefined, maybe outdated and irrelevant, courses.

Computers

The original table 1.B.2 in the audit on computers in the district were replaced by a new table:

Table 1.B.2.: Overview and status of computers and other equipment in the District
Please complete the following table. Use your findings from the "*Computer specifications*" audit.

	Name of Facility in the District	Number of functioning computers in the facility	Number of inadequate* computers in the facility	Number of functioning printers in the facility	Functioning fax machine? Y/N	Functioning e-mail access? Y/N	Functioning copy machine? Y/N	Other
1								
2								

Figure 21. District information officer audit; overview and status of computers and other equipment in the district.

The basis for this table is the completion of the computer specification audit for each facility, so the completion of the table above (Table 1.B.2) should therefore be very straightforward and easy.

To present the need for computers and other necessary IT equipment in a district (for budgeting, etc.) the results from all clinics can be summarized in table 1.B.3 that we added:

Table 1.B.3.: Number of equipment needed in the District
Based on your overview and status of equipment, please indicate the need for equipment in your District:

	Name of Facility in the District	Number of computers needed in the facility	Number of printers needed in the facility	Fax machine needed? Y/N	E-mail access needed? Y/N	Network connection needed? Y/N	Copy machine needed? Y/N	Other (equipment/software/service needed, office space e.g.)
1								
2								

Figure 22. District information audit; number of equipment needed in the district.

Data collection tools

“Name of data collection tools” was, as in the facility manager audit, left out, and just type of data collection tool was used.

Accuracy checks and production of reports

In the question about whether accuracy checks are done or not, we added “at district level“, so that the district information officer answers for her/himself, and not just assumes that accuracy checks are done at other levels.

Also the question about whether any reports containing analysed information have been made, was changed to “have you made any reports...?“ to indicate how information is used by the information officer at district level.

Instead of asking if feedback was received on the reports, we asked if any comments were made to them. People associate very different meanings to the word feedback, many believe it must be something formal and written to be categorized as feedback. In fact any comments, suggestions and follow-ups of reports, written or oral should be considered as feedback.

Reporting completeness

In addition to the two questions concerning the report completeness:

- Indicate the number of facility reports that you have received for the various datasets in the past six months
- Indicate the number of expected facility reports for the past six months

We added:

- Indicate the number of accuracy check feedbacks you have sent out
- Indicate the number of other kind of feedback (information reports) you have sent out

The reason was to get a picture of not only of the report flow from facility level, but also the feedback flow from the district level. It is just as important.

The conclusion part or the summary part was updated with references to the changes made throughout the questionnaires.

7.5 Summary of the changes made to the audits

In Table 16 we summarize some of the changes we made to the original information audits.

In Facility Manager Audit:	**Changes made:**
Data Set	Making the data sets more relevant for the situation in the Cape Town region.
Data collection tools	Left out collation tools, keeping collection tools. ‘*name of data collection too*l’ left out – just the type of tool included.
Accuracy checks	Joined and reduced number of questions.
Use of information	Made the questions more direct and clear, put together questions from the original facility manager and the facility information officer audit.
Feedback	Asked what kind of feedback and from whom (not just if any feedback were received at all).
Training	Got rid of all irrelevant courses nobody at facility level had attended, making the questionnaires shorter.
Changes the order of the themes and questions	Started with the ‘easiest’, quickest questions – hoping to make the tool look less frightening and time-consuming.
In Computer specifications:	**Changes made:**

Overview of computers used in the facility	Designed two new tables to capture more relevant information on the status of it-equipment.
Summarization of findings	Designed a table for IT-equipment summarization.
In District Information Officer Audit:	**Changes made:**
Data Set	Making the data sets more relevant for the situation in the Cape Town region.
Training	Removed irrelevant courses, the DIO can add courses
Computers	New table designed for registration of it-equipment at each facility within the district. A summary table for the total number of equipment needed in the district was designed
Data collection tool	As FM audit.
Accuracy an production of reports	Added '*at district level*' to where the accuracy checks were made, so that the DIO could answer on own behalf. About reporting; changed question to '*have you made any reports*?'. '*Feedback*' changed to '*comments'*.
Reporting completeness	Added the two questions: 1. Indicate the number of accuracy check feedbacks you have sent out 2. Indicate the number of other kind of feedback (information reports) you have sent out

Table 16. Summarization of the changes made to the information audits.

7.6 Example of answers given to different version of the information audits

On average, we experienced a degree of improved answers given in the facility manager audits – from the initial tests with the original audits with almost no changes made to it, to the new versions that developed over a period of time.

Here, we give some examples of how the answers given to a specific type of questions differ in different versions of the audits. We use one completed version of the original audit (fig. 23), and two completed audits (from clinic A and B) of later visions, to compare the results.

The original table in figure 23 were split into two tables. So, figure 24 and 25 show the new versions of the old table in figure 23. The same applies for table 26 and 27.

Answers given to an early version of the facility manager audit:

3. Accuracy Checks, Production of Reports, Presentation/Discussion and Use of Reports

Table 3.A: Accuracy, Reporting and Use of Reports

Please complete the table below.

Datasets (C1)	Are Manual Accuracy Checks of the Data done (C2)		Are Computerised Accuracy Checks of the Data done (C3)		Who does the Accuracy Checks (C4)	Do you think the Dataset is accurate (C5)		Were any Reports containing Analysed Information produced in the last year (C6)		Was the Report discussed by or in any workshop or meeting in the past year (C7)		Have you received any Feedback on the Reports (C8)		Has the information been used for decision making (C9)	
	YES	NO	YES	NO		YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Provincial PHC Minimum Data Set		✓													
Provincial Hospital Information															
Population															
Births						✓									
Deaths						✓									
Socio-economic						✓									
Notifiable Infectious Diseases															
TB															
Chronic Diseases (all types)															
Trauma (Violence, Accidents, MVA's)															
STI and HIV															
Antenatal Survey															
Immunisation															
Mother and Child															
Mental Health															
Rehabilitation															
School Health															
Nutrition															
Oral Health															
Drug Management															
Transport Management															
Emergency Medical Services															
Health Promotion															
Finance															
Personnel															
Environmental Health															

NB: Reports containing Analysed Information are broadly defined to include any tables, graphs, maps, diagrammes, or written reports produced.

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Figure 23. An early version of the facility manager audit; answers given to questions concerning accuracy, reporting and use of reports.

Figure 23 compared to clinic A using a later version of the audit:

3. Functioning of the Information System

3.A. Information Datasets, Data Collection Tools and Accuracy Checks

Indicate what Information Datasets you are currently working on and list the data collection tools used for each Dataset.

Dataset	Tick of the Datasets that are captured at the facility	Type of Collation tool (tally sheets, tick registers, registers, forms, lists, other)	Frequency of collation (daily, weekly, monthly, 3 monthly, etc)	Has all data collected in 2003 been collated and entered?	Who collects the data?	Are Computer-ised Accuracy Checks of the Data done?	Are Manual Accuracy Checks of the Data done?
Provincial PHC Essential Data Set (Facility based data) - RMR	✓	FORM.	Monthly.	Yes'	Facility Mx	MT level	Yes. Facility Mx.
Provincial Hospital Information Dataset							
Infectious Diseases	✓	Register	As necessary.		M.O. " "	MT.	
Births							
Deaths							
TB	✓	Register - L/A	Daily	Yes	L/A	Yes	Yes.
HIV/STI	✓	Register - L/A	Daily.	"	L/A.	"	"
Mental Health	✓	Register.	W Bly.	Yes.	Reg. Hunx	"	"
Rehabilitation	✓	Form -	W Bly Monthly	"	"	"	"

Figure 24. For clinic A: later version of the facility manager audit – answers given on data collection process and accuracy checks.

Continued; figure 23 compared to clinic A using a later version of the audit:

3.B. Accuracy Checks, Production of Reports and Presentation/Discussion of Reports at Facility Level.

Please describe the following activities in your Facility by completing the table below.

Datasets	Who does the Accuracy Checks?	How accurate do you consider the Datasets to be? (percentage)	Were any Reports containing Analysed Information produced in 2003?	Who were Reports containing Analysed Information sent to?	Which groups discussed the Report containing Analysed Information that was produced?	Have you received any Feedback or Reports from Province or National?
Provincial PHC Essential Data Set (Facility based data) - RMR	Facility MK.	95%	Yes.	DMT; ZEDA TIMM.	Staff-Meeting	Yes.
Provincial Hospital Information Dataset	NO.					
Infectious Diseases	Facility MK	60%.	Yes. Not L/A	Facility MK.	Not done.	Yes. L/A.
Births	N/A.					
Deaths	N/A.					
TB	N/A					
HIV/STI	Facility MK.	80%.	Yes NO.	N/A.	N/A.	Yes.

NB: Reports containing Analysed Information are broadly defined to include any tables, graphs, maps, diagrammes, or written reports produced.

Figure 25. For clinic A: later version of the facility manager audit – answers given to accuracy, reports, use of reports and feedback.

Figure 23 compared to clinic B using a later version of the audit:

1. Functioning of the Information System

1.A. Information Datasets, Data Collection Tools and Accuracy Checks

Indicate what Information Datasets you are currently working on and list the data collection tools used for each Dataset.

Dataset	Tick of the Datasets that are captured at the facility	Type of Collation tool (tally sheets, tick registers, registers, forms, lists, other)	Frequency of collation (daily, weekly, monthly, 3 monthly, etc)	Has all data collected in 2003 been collated and entered?	Who collects the data?	Are Computer-ised Accuracy Checks of the Data done?	Are Manual Accuracy Checks of the Data done?
Provincial PHC Essential Data Set (Facility based data) - RMR	✓	tick regis	monthly	no	Doctors, nursing management	no	yes
Provincial Hospital Information Dataset	✓	tick & forms	monthly	no	〃	〃	〃
Infectious Diseases	✓	forms	daily	yes	nursing	〃	〃
Births	✓	registers	daily	〃	〃	〃	〃
Deaths	✓	forms	daily	〃	〃	〃	〃
TB	✓	forms	〃	〃	〃	〃	〃
HIV/STI	✓	forms	〃	〃	〃	〃	〃
Mental Health	✓	forms	〃	〃	〃	〃	〃
Rehabilitation	X						

Figure 26. For clinic B: later version of the facility manager audit – answers given on data collection process and accuracy checks.

Continued; figure 23 compared to clinic A using a later version of the audit:

1.B. Accuracy Checks, Production of Reports and Presentation/Discussion of Reports at Facility Level.

Please describe the following activities in your Facility by completing the table below.

Datasets	Who does the Accuracy Checks?	How accurate do you consider the Datasets to be? (percentage)	Were any Reports containing Analysed Information produced in 2003?	Who were Reports containing Analysed Information sent to?	Which groups discussed the Report containing Analysed Information that was produced?	Have you received any Feedback or Reports from Province or National?
Provincial PHC Essential Data Set (Facility based data) - RMR		80 - 90 %	Yes	Top Management	Top management	Yes
Provincial Hospital Information Dataset		"	Yes	"	"	
Infectious Diseases		"	"	"	"	
Births		95 %	"	"	"	
Deaths		95 %	"	"	"	Yes
TB		"	"	"	"	
HIV/STI		80 - 90 %	"	"	"	

NB: Reports containing Analysed Information are broadly defined to include any tables, graphs, maps, diagrammes, or written reports produced.

Figure 27. For clinic B: later version of the facility manager audit – answers given to accuracy, reports, use of reports and feedback.

Comments to the difference in answers

Due to time limitation we were not able to visit one facility twice and test out different version of the audits at that one clinic. This would make the comparison of the completion of the audits easier. Instead we had to compare what we have on the same questions in different audit version and from different clinics.

In Figure 23 we see a poorly completed questionnaire from the facility manager audit. This is one of the earliest versions of it, where we had done minor changes, if any at all. The table includes questions about data accuracy, reporting and use of reports. Only the *Provincial PHC Minimum Data Set* (also known as the Routine Monthly Report – RMR) is answered for (which by the way is ok if the facility only collects data for the RMR and no separate programs, etc). However, even answers to questions for this one data set, is not done satisfyingly.

The questions about whether computerized accuracy checks are done, or who does the accuracy checks are not answered at all. Questions about report-making do not make sense either; staff have answered that *no* reports were made the past year, but then they say that reports made the past year in fact *have* been discussed… Something must be wrong with one or both of these answers.

The explanation here can be that the facility staff actually ticked off for the wrong columns. This led to us changing the format of these questionnaires; by removing the 'yes' and 'no' columns we hoped to reduce the error of wrong ticking.

We edited the accuracy of the dataset from '*do you think the data set is accurate*' to '*how accurate do you think the data set is*' – forcing staff to actually think this question more through and to give a more precise and measurable answer.

Including *where* reports are being sent, gives us a picture of the information flow from the facility, and asking '*what groups discussed the reports*' would tell us who within the facility is involved in the information use, and also perhaps be a reminder that reports actually *should* be discussed in the facility.

Measuring the effect

Did what we wanted to happen, as a result of our adjustments of the audit to the situation in Cape Town, really happen? Yes, in fact it did. We got the improvements we hoped for in the quality and number of answers given to the questionnaires in the audit. Whether it was just because of the changes in the audit design, or if there were other conditions that influenced this tendency is difficult to know. Only with several audit pilots without our presence we would be able to say something for certain here. Unfortunately, we did not have enough time to conduct such a pilot in addition to the one we did.

We could have counted up all answers given in the early version of the audits and compared them to the latest version to demonstrate a precise effect of how much better the tool became in the end. We feel that these numbers would not be very accurate nor give a good or justified picture, since as both versions of the audit changed rapidly and also due to the fact that some facilities might have been very unlucky about how the conditions were at the facility at the time of our visit. For instance that some had very little time for us, or that the right person was not available, etc. We just state that we experienced a steady improvement in the quality and number of answers given in the audit, without going more in detail on this.

7.7 Conducting the information audits in PHC clinics – in practice

When going about the auditing in Cape Town, we had to have a plan for how this was going to happen. Due to our close work with Lorna Solomon and the provincial administration (PAWC), and our wish to conduct an situation analysis on the IT equipment and what the additional needs are, we decided to start out with all the 24-hours units, 4 district hospitals and all CHCs in one or two provincial health districts. We would conduct and test out the facility manager audit in collaboration with the staff, and complete the computer specification part. In the end we would visit some local authority clinics as well, perform the audits there and do a comparison to make sure that the facilities in the two branches are so similar that the same audits can be used in both branches. If time permitted, final testing of a revised facility manager audit without our assistance, and discussion around and testing of the district information officer audit remained. Due to limited time and several key persons going on summer leave, etc., further piloting of the facility audit and the information officer information audit was limited.

7.7.1 Where were the audits performed

As mentioned above, provincial clinics became our focus area. We visited all the nine 24-hour units in the Cape Metro (under the provincial administration of Western Cape), the four district hospital they had recently become in charge of, and all provincial community health centres (CHC) in two districts; South Peninsula District and Oostenberg District.
All clinics and district hospitals visited are listed in following table:

DISTRICT	**COMMUNITY HEALTH CENTER**
ATHLONE	Hanover Park (24 Hours)
NYANGA	Guguletu (24 Hours)
BLAAUWBERG	Brooklyn Chest Hospital (District Hospital)
	Wesfleur Hospital (District Hospital)
OOSTENBERG	Kleinvlei*
	Kraaifontein (24 Hours)*
	Scottsdene*
	Eerste River Hospital (District Hospital)
COT SOUTH KHAYELITSHA	Khayelitsha (24 Hours)
COT WEST	Elsies River (24 Hours)
	Vanguard (24 Hours)*
COT EAST	Delft (24 Hours)*
SOUTH PENINSULA	Grassy Park

	Hout Bay*
	Lady Michaelis
	Lotus River
	Ocean View*
	Retreat (24 Hours)
	False Bay Hospital (District Hospital)
CTM SOUTH MITCHELL'S PLAIN	Mitchell's Plain (24 Hours)

Table 17. Facilities and district hospitals where the information audits were performed. *Combined facilities (PAWC and Local Authorities).

At the combined facilities (see clinics with * above), we often spoke with the Local Authority staff as well. In addition to the clinics and hospitals above, we visited the following local authority clinics:

- Langa clinic (Langa District)
- Spencer Road clinic (Cape Town Central)
- Landsdown Road (Nyanga District)

7.7.2 How were the audits performed

Meetings at the different clinics were booked in advance by the provincial administration. It was important to have support from the higher levels when conducting the information audits. We sent a formal letter to the head of the provincial administration for the Cape Town Metro explaining the purpose of our research and asking permission to perform the audits. When it came to the Local Authorities, it took a bit longer to arrange the facility meetings, but we had good help from a few information officers we came in contact with during our first weeks, when attending meetings and meeting different people. They were very positive towards what we did and interested in helping out. Here we were also given clearance from the Local Authority management.

We tried to set up as many meetings as possible, with a maximum of three per day. Due to the long distances between the different clinic and the fact that our Beetle just made 55 miles per hour (ca 90 km/h), more then three clinics in a day was not possible. It was sometimes hard to plan the days - one minute we were going to a clinic in South Peninsula, the next to a clinic at the other side of town. Even if we tried to keep visits on the same day within a limited area, it was not always easy to set up meetings and get hold of the right people. A lot of our work was also delayed because of all the waiting time at some facilities. A couple of times we had to re-visit clinics because the person that we were going to see was not there, or there were misunderstandings and they did not know why we were there etc. And sometimes we just got lost...

A couple of days we were lucky and were able to get a ride with some postmen that were going out to the clinics. In that way we could do one clinic each. But usually that was not so easy to arrange, and we went together. To some areas we were warned not to go alone because of crime, and someone would accompany us (district information officer, district manger, etc.).

In the beginning we spoke just with the person working on the RMR in a clinic. The facility manager was often too busy to help us. Later we specifically asked to set up meetings with the facility manager together with the clerk to be able to fill in the questionnaires more accurately and to get different points of view on the information system. Sometimes this worked out well and they completed to audit themselves with us just assisting and time allowed elaboration and discussion around different themes in the audit. Other times everyone was very busy and we literally ran after them asking the questions and filled out the audit ourselves. The majority of the experiences from the visits were positive, however; people were friendly and willing to tell us about their work and about how things did or did not function. We got the impression that they spoke very freely, and that they wanted us to really understand the situation they were in.

We usually started off a meeting in the facility manager office by introducing ourselves and the information audit. We then asked the facility manager to answer the questions in the audit, with us guiding her through it. Often (especially in the beginning with little changes done to the original audits), we had to clarify a lot of things. Usually, there was time to ask additional questions to those given in the audit, and we also encouraged the staff to speak about the things that concerned them, or whatever they felt important. In that way many of the meetings developed to some degree into open interviews. Our goal was however to at least finish all the questions in the audit, and to also complete the computer specification part.

After completing most of the manager audit, we were often (or we asked to be) showed around the clinic, especially the reception area to look at computers and speak to clerks about their work procedures. We checked out the status of computers and other equipment like printers, faxes, etc., and looked at the different data collection/collation tools used. An average visit to a medium to small clinic took between one and two hours. The auditing of the four district hospitals took a whole day to complete.

7.8 Qualitative and quantitative aspects of the audit

Qualitative and quantitative research can be used as opposites to each other, and suggest that quantitative researchers are only interested in numbers, and items where weight, length, volume and pressure can be measured, whereas the qualitative researcher is only interested in feelings and open ended questions.

However, in many research projects, it is necessary to make use of elements from both the quantitative and qualitative branch of research. This is often the case for information audits, and from our experiences holds true for our study as well. In our audit, there is counting (of number of computers, how much memory the computers have, how many different datasets a facility collects, etc.), as well as questions regarding what opinions the users have on the information system (in what areas the information system fails and what improvements should be done to the system, etc.). The open-ended, qualitative questions can in many cases be summarized in a quantitative fashion. For instance, it is possible to express what percentage of the staff said that a failure with the information system is that there is too little training and feedback – because in many cases staff in the different facilities will have much of the same opinions of where the system fails, and this makes categorization of the answers possible.

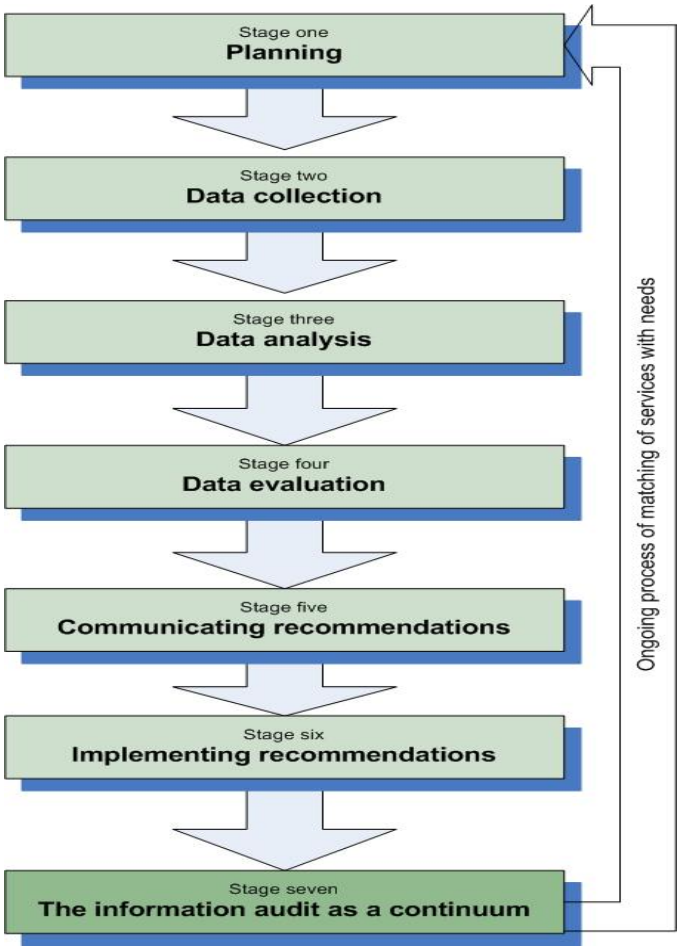
It is possible to construct all the questions to have a quantitative style, by using questions with this kind of essence: “Do you agree that there is too little training in the current information

system? Give a grade from 1 to 5, where 1 means *don't agree* and 5 means *strongly agree*". This kind of questioning would in one way be easy and swift for the staff to answer, but we would need a lot of questions to cover all the elements the staff might have an opinion about. With open ended questions, the staff is to a larger degree forced to think for themselves, and come up with their own views on what is important, instead of this being dictated by the questions. We also think that it can be useful that the staff make their own formulations on different aspects regarding how they experience the information system. There is, however, also the possibility that they do not answer anything at all to the questions.

7.9 Comparison of our auditing process with Henczels' auditing process

In this section, we will look closer at the process we used when piloting the audit in the Cape Town Metro. We will hold our process up against Henczel's (2000) proposal for the seven step model for performing an information audit.

The model is described in Section 3.8, and the details can be found there. We just repeat the figure of the model here:



This model is very similar to what we know from the field of system engineering as a water fall model [Skagestein, 2001]. System developers often experience the need to go back one or

more steps when working after the water fall model. Sometimes it is necessary to do one step over again a number of times. This gives a spiral effect on the model.

Our approach to the audit piloting has the same main elements as the seven step model. We did however not follow the same linear structure. In our process the spiral feature came strongly into play, particularly in the first two steps, as we continued to do planning and changes in the audit at the same time as we collected the data. It was never the point to follow a strict linear model, and since our project was a pilot, it was important and necessary to do adjustments to the audit as we went along, and experienced how it functioned as a tool. This has lead to some difference in what form our collected data has, but the elements remain mainly the same.

Also, regarding the next three steps, analysis, evaluation and communicating recommendations, we did not complete each of these steps before going on to the next, and to a certain extent, we have worked on these steps simultaneously. This has been a natural approach for us, but in addition, we were asked to present the results of the computer situation investigation in particular before leaving Cape Town. The management was working on budgeting at the time, and knowing what computer resources were needed was the most critical part at the time.

In the following, we describe how we used the steps in more detail.

Planning

There had been some attempts on performing information audits in HISP in South Africa before our arrival. This meant that much of the planning had already been done. There already existed suggestions for audits for different kinds of personnel, like district information officers, facility managers, facility information officers and line managers. From these existing audits, we got an accurate view of what kind of information the management wanted to get from the audit. We made few changes here, but structured the audit in another way. This was a process that went on for the entire piloting period. We also added some elements, in particular the computer specification part.

The audits were made by people with thorough understanding of the system and organisation, but our knowledge of the organisation was limited, so the time prior to the pilot we used to get to know the system. We did this through meetings and interviews with key information personnel.

Henczel (2000) stresses the importance of deciding why it is important to conduct an information audit, not least in order to gain management support, and to get understanding and support and thereby a more accurate result from anyone participating in the process. This point was established long before our arrival to the scene, and there were several reasons for why management wanted information auditing in the sector. The following points are from the original audit documentation, and were established by HISP information management personnel:

1) Developing or updating the District Minimum Dataset. This should include all routine data collection from PHC facilities, hospitals and programmes.
2) Integrating all datasets and storing all data and information derived from the datasets at a central point in the District (usually the District Information Office) where it will be easily accessible to everyone who requires it.

3) Improving the efficiency of the Information System

    i. User friendly data collection
    ii. Time Efficient data collection
    iii. Avoiding Duplication in data collection
    iv. Improved Data and Information Flow
    v. Improved analysis and Reporting

4) Assessing the Training and Support Needs of the staff involved in the Information System.
5) Assessing and improving the Use of available Information**.**

Whenever we were to describe in a few words why we were performing the audit, we said that the objective was "to keep a close track of the situation is in the information system. The audit gives indications on where improvements are needed, and it reveals the successful parts of the system that should be kept and built on."

In the planning process we had to determine the scope and resource allocation of the project. In close cooperation with the information manager of PAWC, we decided to focus on the facility manager and – at far as the post existed – the facility information officer, but using one shared audit for both of them. We also decided what facilities to focus on. Management had a need to know about the situation especially in the district hospitals and the 24-hours units. We therefore decided to concentrate on those first, and then take the districts in order, and see how far we would get (through two whole districts in addition to the district hospitals and 24-hours units, as it turned out). We also planned to do a couple of Local Authorities clinics, in order to find out if the audit was usable in these clinics as well without any major modification. We did the audit in three LA clinics.

This project was quite inexpensive for HISP, as our work was free. We brought our own computers, but were provided with office space at the University of Western Cape, and some fuel money. If the audit is to be performed on a regular basis, as it should, there will be a need to allocate some more resources than was done in this case, mainly with regards to staff and time.

Henczel (2000) stresses the importance of having a good communication strategy throughout the auditing process, and that ownership towards the audit should be nurtured – leading to a better overall result. In our communication, we had useful help from the close cooperation with the Metro information management, and the fact that there was great enthusiasm and will to carry out the audit. We managed to communicate our assignment out to the respondents, i.e. the facility managers and the receptionists in charge, and although in most cases very helpful, they did not always have the same enthusiasm as we experienced at the information management level.

The respondents were told that we wanted to speak to the manager and the one or ones mainly doing the information handling, and that we wanted to ask about the information system for an audit in PAWC in Cape Town. The respondents were not asked to be prepared in any particular way, though, but were requested to set aside some time to meet with us. Even so, how the respondents were prepared, and what impression they had of what we were doing varied a great deal on the different sites we visited.

Performing the audit was decided quite suddenly, as were the facilities in which we wanted to collect data. For later audits, it might be wise to give the respondents some time to get used to the thought of participating in the audit, and make the process more like a campaign. By that we mean that the auditing should be announced in good time before it starts, and through several different channels, like letters, meetings, postings on the web and informal, oral reminders when the facilities are in contact with the information management. The auditing should be done on a regular basis, and preferably occur at the same time every year. There are many other regularly occurring events in the health sector in South Africa, like special weeks or days assigned to the awareness of breast cancer or HIV, and it would probably be wise to arrange the information audit in a similar way. In doing so, it is important to give the participants a good understanding of the purpose and objectives before performing the audit.

Also, the communication during and after the auditing must by no means be neglected. During the process, the participants should know how to answer the audit – this will most likely be done more independently by the respondents than was the case in our pilot - when and to whom they should submit it, and who to turn to if they experience problems filling out the audit. After the audit, it is important that the participants receive the results of the analysis in an understandable and interesting format. The clue here is maybe to single out the most important and sensational findings, and present them, rather than give the raw data of the entire auditing, and all the elements. Also, anyone taking part in the process should get feedback about how the results were used, and which changes, if any, were implemented because of the audit. This will probably increase the feeling of importance and validity of the audit, and make future auditing processes even more worthwhile for the respondents.

In our pilot we had extremely high levels of support from the information management side, since they had a strong need to map the information resources that exists in the facilities. Information management in PAWC put down a lot of time and effort in order to accommodate our research. We also had good help from information management in Local Authorities and from the University of Western Cape. There were a couple of incidents where other kinds of management, like area managers, were a bit reluctant to have us roaming around in their facilities. This was an issue neither we nor the information management had predicted, and we had some small obstacles during our first facility visits because of this. But when we became aware of it, and took care of explaining the purpose of the audit to the area managers, they had no problems with us coming to the facilities.

This proved for us the importance of two of the points in [Henczel, 2000]; the importance of management support, and the importance of establishing a good communication strategy.

Data collection

Our main tool in the data collection process was the paper-based audit. As mentioned, we used previously developed audits, and did some tailoring to make it fit the situation better, and to make it more suitable for staff in the facilities. Henczel (2000) notes that data can be collected by questionnaire, personal interview or focus group interview. In our process we used elements from all of these methods, and mainly the questionnaire and personal interview – in some cases we interviewed two persons at the same time, most often the facility manager and the receptionist in charge. We also used focus groups, mainly in the district hospitals, since there are so many actors in the information system there, and the best way to get their views was to meet with a number of them at the same time.

For future audits, however, the questionnaire must most likely be the main form of data collection, because otherwise, there will be problems getting enough time and resources. An idea is that the facilities are encouraged to organise some form of focus groups themselves, and sit down together when filling out the audit, in order to capture the most accurate picture possible of the information situation, seen from different actors within information system in the facility.

In addition to the audit, we asked questions, and made observations. We tried to speak both to the facility manager and the staff member in charge of collecting data, and also any other members of staff that might have useful information, like clerks, pharmacists, heads of departments and so on.

We made personal visits to each of the facilities that participated in the auditing, a total of 24. Most places both of us went, but sometimes we split and visited facilities on our own.

Henczel (2000) points out that it is critical that the right questions are asked to the right people. Our understanding of who should be asked which questions got better during the process, but we found that often there were few clear distinctions between what questions the receptionist in charge could answer, and when we would get the best response from the manager. In some cases the facility manager did all the information handling, and had full control over what was going on, and sometimes the manager did not concentrate on data and information at all, and left all work of that kind with the a clerk.

Data analysis and Data evaluation

After having collected all the data, we started analysing and evaluating, two processes that were closely connected in our work.

We did not use any particularly sophisticated tools for the analyses, we mainly made use of simple spreadsheets, tables and graphs from MS Excel, along with written summaries.
We started by analysing and evaluating the computer situation, since this was the issue information management had the greatest urge to know. We reported on this before we left Cape Town. We summed up our findings in tables and as a written report.

When analysing the data, there are three different types of analysis pointed out in [Henczel, 2000]: (1) general analysis, (2) strategic significance analysis and (3) information flow mapping. We have mainly focused on the general analysis, where open questions are analysed generally. We have made tables, where the answers we got are categorised and expressed with graphs as well as in plain text. Questions included in the general analysis are the perceptions of the system, and what additional resources are needed at facility level in the view of the staff members.

We have also looked into some elements of the proposed significance analysis. One instance is the reporting of which tasks are supported by the different computers in the area. We have a detailed picture of what the computers in the computers in the facilities are used for – that is, mainly text processing and the patient folder system. Very few on facility level in PAWC uses the DHIS software for collecting and submitting data. This situation is different in the LA, where many makes use of the software, according to LA information officers.

The last analysis aspect from [Henczel, 2000] is the mapping of information flow. In the audit one of the questions was to describe and draw the information flow, so here we also have a

detailed picture, although only for a very limited fragment of the health sector, namely the route from the collection in the facilities to the information reaches the information management in the Metro. The information flow is one of the items that have been planned quite carefully in the restructuring of the health sector, and this works fairly well. It is, however, important to evaluate and revise the flow, not least since the process of restructuring is still going on, and this might interfere with the information flow. See Chapter 8 for more details on the findings on information flow.

Communicating recommendations

Again, the best example is the computer status in the Metro, as these recommendations were the ones we mainly worked on, and presented while still in Cape Town. In addition, we also give some recommendations in written form in the Master's thesis. These recommendations will be extracted and distributed to relevant personnel within the information management.

The presentation of computer recommendations in Cape Town happened in two different sessions. The first was aimed at decision-makers working on the budget. We made a written report with tables and an overview of how the situation is in the facilities at present. In addition, we gave some recommendations about how a facility should be equipped with regards to computers, and what is needed in order to meet these needs. See Chapter 9 for more details. We were prevented from attending this meeting, so the PAWC information manager made this presentation.

The second was aimed at information workers in both Local Authorities and PAWC, both on facility and district level. At this meeting we presented the results of the computer investigation, and explained what recommendations we had landed on. We urged the personnel to keep our recommendations in mind when motivating for resources. We also mentioned briefly other tendencies we could point out from the audits without doing a full analysis. In addition we talked about the process of auditing, and gave some suggestions about how they could perform an audit on their own.

Implementing recommendations

The implementation of the recommendations is out of our hands, as this is something that must be decided by the management in the health sector. Our recommendations are general, and in a few words it is about training, feedback and better equipment, but we have also given some thought to how these items might be distributed in a suited matter, refer to Chapter 9.

The Information Audit as a continuum

The bottom line is that whether the work with the information audit will be continued is beyond our control. We do, however, have a couple of ways of influencing this. First, we can provide a tool for the auditing that is easy to use and produces valuable information. We can also give recommendations as to how the audit can be modified and tailored to fit specific needs. Secondly, we can show that the information we obtained from the process really is of use, and makes the effort of auditing worthwhile. The computer situation in the facilities is one example of valuable information that can be used for something, i.e. budgeting and distribution of resources.

The information audit as a continuum depends on the will from management to make this an ongoing process. The will of the management is probably connected to the economy of the information section, and whether the workload of the information workers allows yet another

task. The audit can be performed in all of the country, or just parts of it, but in order to get the most complete picture, this should be a national event. This can also help make the planning of the information section on the whole more united. We also suggest that the audit is performed on a regular basis, preferably once a year.

8 ANALYSIS WITH DISCUSSION OF OUR FINDINGS BASED ON THE INFORMATION AUDITS

In this chapter we discuss our findings based on the information audits – mainly from the facility manager audit and the computer specification questionnaires conducted in the curative health service clinics (PAWC side). The auditing process and the audit as an evaluation tool are not discussed here; we only give the answers directly to the questions in the paper-based evaluation tool.

We give a qualitative presentation of our findings, where we try to give a detailed view of facility staff's opinions expressed, and we give some concrete examples of specific situations. We also present our findings in a quantitative way, where findings are categorized and summarized in tables and pie charts, etc.

We treat our findings from information audit as different topics;

- Status report for the IT-equipment in the Cape Town Metro
    - Overview of computers and IT-equipment
- Perceptions of the information system
    - Greatest achievements
    - Greatest failures
- Suggested improvements to the health information system
    - Additional resources needed
    - Are the right types of data items collected?
    - Optimal structure of the information system
- Feedback and support
- Equipment
- Staff
- Training
- Data collection and accuracy checks
- Information use in facilities
- Information flow

Under each heading, we discuss our own findings and also draw in and refer to other research on the specific topics. We compare what we have with what earlier research has discovered, and from this conclude if there has been any change in the situation of the information handling a facility level, or in the amount of available recourses at the lowest level of the health information system in the Cape Town region. From this we will also be able to say something of how well the evaluation tool captured the real situation, that is, if we discovered similar important problem areas as other have before us, not using the same tool. This will be discussed in more depth in Chapter 9.

About the analysis process

The major part of the analysis work has been done during the last four months, after finishing our field study in Cape Town. The paper-based audits were brought back to Norway, and analysed here. The findings from the computer specifications part of the audits, however, were presented and reported on while still in Cape Town, because of the urgent need for documentation on computer resources out in the facilities by the Provincial Administration of Western Cape.

After investigating the computer situation at all facilities visited, using the auditing questionnaires, we summarized our findings in different tables. First we made an overview of all computers and other equipment with detailed specifications within all facilities (See Appendix B with the computer report). This was the basis for further summarizations; we presented the data collected in several different ways – for different use. Some examples:

- Tables of what kind of equipment the facility staff say they need (Table 18)
- Overview of facilities and available equipment in critical workstations (Table 19)
- Our general recommendations for the small facilities (Chapter 9, Table 29).

When it comes to the other findings in the facility manager audit, we summarized all the answers given in the questionnaires and grouped them by facility in large tables (See Appendix D). Information from these tables was then re-grouped, presented and discussed under appropriate themes mentioned above.

8.1 Status report for the IT-equipment in the Cape Town Metro

The computer specification part of the information audit was summarized in a report; "*Overview of computers and printers in Cape Metropole November 2003*" (see Appendix B), that was handed over to the Provincial Administration of Cape Town (PAWC). This document gives an overview of computers and IT-equipment in district hospitals, 24-hour units and Community Health Centres (CHCs).

In our investigations, we found that most facilities were poorly equipped with regard to computers. 50% of the facilities do not have a computer in working order, and most of the PAWC facilities with computers have only one that is supposed to cater for all tasks.

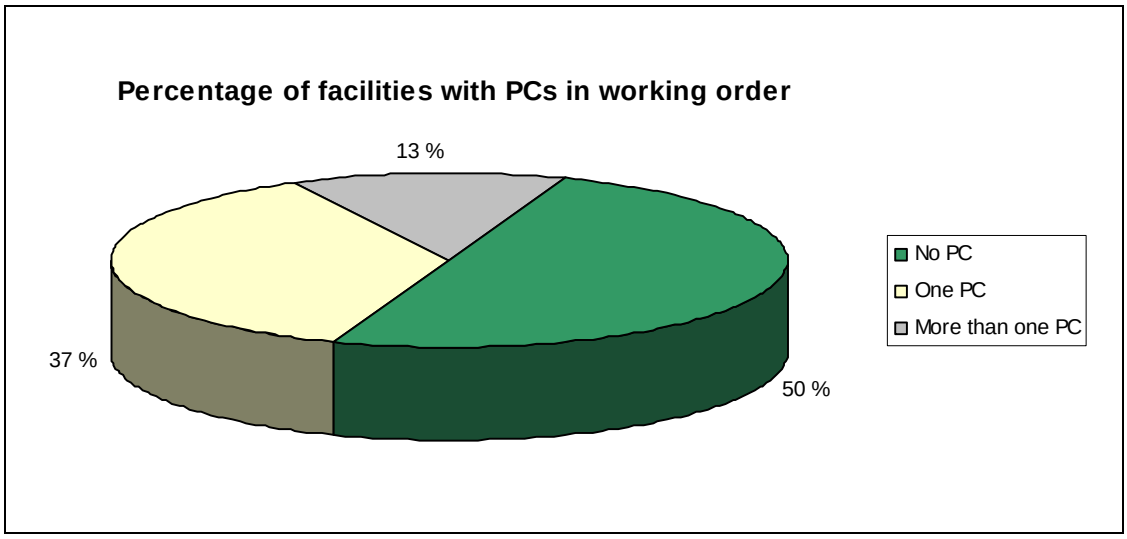


Figure 28. Half of the PAWC facilities do not have a working computer (derived from report).

Two of the facilities do not own a computer, but have access to computers nevertheless, because they are combined facilities, and can borrow computers that belongs to the Local Authorities (LA).

8.1.1 Overview of computers and IT-equipment

In Table 18, we have derived information from the audit and the report to summarize the actual need, as the facility staff sees it, for equipment in district hospitals, 24-hour units and CHCs.

Clinic	**Number of PCs needed**	**Number of printers needed**	**Other equipment/comments**
False Bay	4	1 network printer	
Wesfleur	1		
Eerste River	25	10	
Brooklyn Chest	8	4	
Kraaifontein	2	2	
Guguletu	2 (1)	1	
Hanover Park	4	1	
Retreat	2 (1)	1	Computer in reception needs upgrading
Mitchell's Plain	4 (3)	1	2 monitors + 1 keyboard is stored – don't know where rest is
Delft			2 new computers/printers in boxes must be installed!!
Vanguard	4	3	Fax machine broken
Elsies River		1	
Khayelitsha	2	1	
Grassy Park	3	2	New building needed!
Lady Michaelis	6 (3)	5 (2)	
Lotus River	3	3	
Ocean View	2	2	
Kleinvlei	3	2	
Scottsdene	1	1	1 copy machine needed
Hout Bay		1	
Total	76	42	

Table 18. The need for IT-equipment in health facilities; views from facility staff. Numbers in brackets indicate the minimum number of computers needed.

This table summarizes the number of computers/printers *the staff* wants. This can differ from what we think is absolute necessary. Therefore, we also presented our findings in a way where we both give an overview of the equipment that is actually in place at the defined critical workstations (see below) within a facility, and what we recommend is necessary of extra equipment.

Since this presentation is both an overview of the available equipment and a recommendation is belongs to both this chapter where we present our findings *and* the next chapter (Chapter 9) where we give our recommendations. Still, we chose to include the information in this chapter, because we want to show, at this point in the thesis, what kind of IT-equipment is out in the facilities. Our recommendations will, however, only be commented in the next chapter.

Definition of a critical workstation and inadequate equipment:

Critical workstation: To establish what areas within a PHC clinic where a computer would be especially beneficial and make certain task a lot more effective, we identified some places that we called *critical workstations*. They are critical in the sense that a lot of important information work is done here, and that the workload is often very high – implying that only relatively new and fast computers can handle the workload in these areas.

The defined critical workstations are:

- Facility manager (information handling and use, production of reports, etc.)
- Facility information officer (information handling and use, production of reports, etc.)
- Reception (patient interaction/folders)
- Pharmacy (stock control/ordering system)

Inadequate equipment: we use this term about computers and printers that are not performing their current task satisfyingly. For example, using a 95 Windows machine in the reception area, handling all electronically patient folders, etc., is extremely ineffective. A computer like that must be replaced.

Inadequate computers means computers that are unfit to perform tasks in critical workstations, but some of them can still be used. The ones that are not *too* old and slow can be used for training purposes, writing letters, etc.

Facility	FM *PC* | *printer*		FIO (*) *PC* | *printer*		Reception *PC* | *printer*		Pharmacy (**) *PC* | *printer*		Total number available *PC* | *printer*		Inadequate equipment *PC* | *printer*		Equipment needed *PC* | *printer*	
24 Hours:														
Delft	1	1			2	2	The need unknown		3	3			2 computers/ printers must be installed!	
Elsies River	1	1			4	2	The need unknown		5	3	1	2		1
Guguletu					2	1	The need unknown		2	1	1		2	1
Hanover Park			1 *DMT secretary	1	1	1	The need unknown		2	2	1		4	1
Khayelitsha					1	1	The need unknown		1	1	1		2	1
Kraaifontein	1				1	1			2	1	1		2	2
Mitchell's Plain							The need unknown		1	2	1	1	4	1
Retreat					1	1	The need unknown		1	1	1		2	1
Vanguard					3	2	1	1	4	3	3	2	4	3
CHCs in South Peninsula:														
Grassy Park						1			1	1	1		3	2
Hout Bay	1 *at DMT office for installation				1	1	Pharmacist can share with FM		1	1				1
Lady Michaelis					1	1			1	1	1		3	2
Lotus River					1	1			1	1	1	1	3	3
Ocean View					1	1			1	1			2	2
CHCs in Oostenberg:														
Kleinvlei	1	1							1	1			3	2
Scottsdene	1	1					The need unknown		1	1			1	1

Table 19. Overview of facilities and available equipment in critical workstations.

(*) At some facilities a FIO (facility information officer) has been appointed. This person, however, almost always has other tasks besides handling information (RMR), and she usually never has her own office (and therefore no room for a computer, even if the need is there). The impression is that the FIOs uses whatever room/space available at the time for collating information, and that this task is not prioritised due to a heavy workload.

(**) Not all of the facilities mentioned the pharmacy as a critical workstation where a computer is needed. If, besides from being a small facility, the number of patients is not too high, the pharmacist can probably manage as well with the manual system, or share computer with e.g. the facility manager. But our overall impression is that the pharmacy would benefit and increase the standard of service with a computerised system installed.

Other Computers in the Metro

We only had the time to check the computers in a limited number of facilities. However, some months earlier, Lorna Solomon (PAWC) had sent out an (earlier version of the) information audit to all the facilities, asking about the status of the computers. The data from this audit is not complete, but at least it gives an indicator of how many PCs there are at the facilities.

On the following page, we give the overview of the number of computers as given by the facilities. The same suggestions as listed above apply for these clinics.

No PC:

District	Clinic name
Athlone	Athlone Youth Clinic
Athlone	Dr. Abdurahman CHC
Central	Cape Town Station Clinic
Central	Maitland
Central	Queen Victoria CHC
Cot South	Nolungile
Cot west	Bishop Lavis CHC
Helderberg	Strand CHC
Nyanga	Brown's Farm CHC
Nyanga	Cross Roads CHC
Nyanga	Uluntu Reproductive Clinic

1 PC:

District	Clinic name	Computer location / other comments
Athlone	Heideveld	
Central	Green Point CHC	Sisters office
Central	Woodstock CHC	School health room
Cot East	Belhar CHC	
Cot East	Belville CHC	Reception
Cot West	Parrow CHC	Reception
Cot West	Ravensmead CHC	Reception
Cot West	Ruyterwacht	NOT WORKING
Helderberg	Macassar	

2 PCs:

District	Clinic name	Computer location / other comments
Cot East	Volks centre Bellville	Offices
Cot East	Reed Street	Reception + Pharmacy
Cot West	Dirkie CHC	Reception

No data has been submitted from the following:

District	Clinic name
Central	Robbie Nurock

Central	Hope Street Dental
Central	Kensington
Nyanga	Nyanga
Nyanga	Nyanga Junction RCH
Blaauwberg	Goodhope
Blaauwberg	Mamre
Helderberg	Ikwesi
Helderberg	Rusthof
Cot South	Michael Mapongwana
Cot East	Durbanville
Cot East	Mfuleni
Mitchell's Plain	Polka Square

Table 20. Number of computers as given by the facilities in an earlier audit.

New equipment needed

Of all the facilities we visited, there is a total need for a minimum of 32 new computers, and 24 new printers. Counting the district hospitals, one gets a higher number. In addition some copy machines and fax machines are needed.

Almost half of all computers and a fourth of all printers out in the clinics are old, outdated and therefore inadequate for the task they are used for today (e.g. too slow). More than 36% of all the computers run a Windows 95 version or even older.

The following figures illustrate the amount of inadequate equipment in the health facilities.

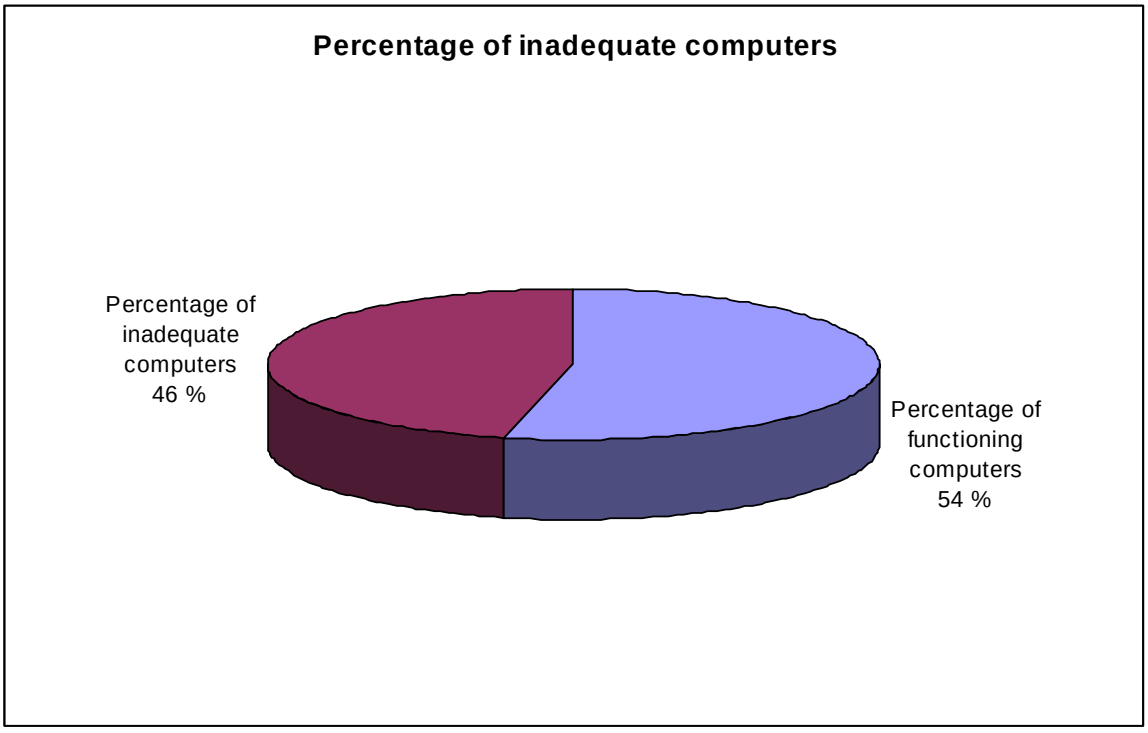


Figure 29. Percentage of inadequate computers.

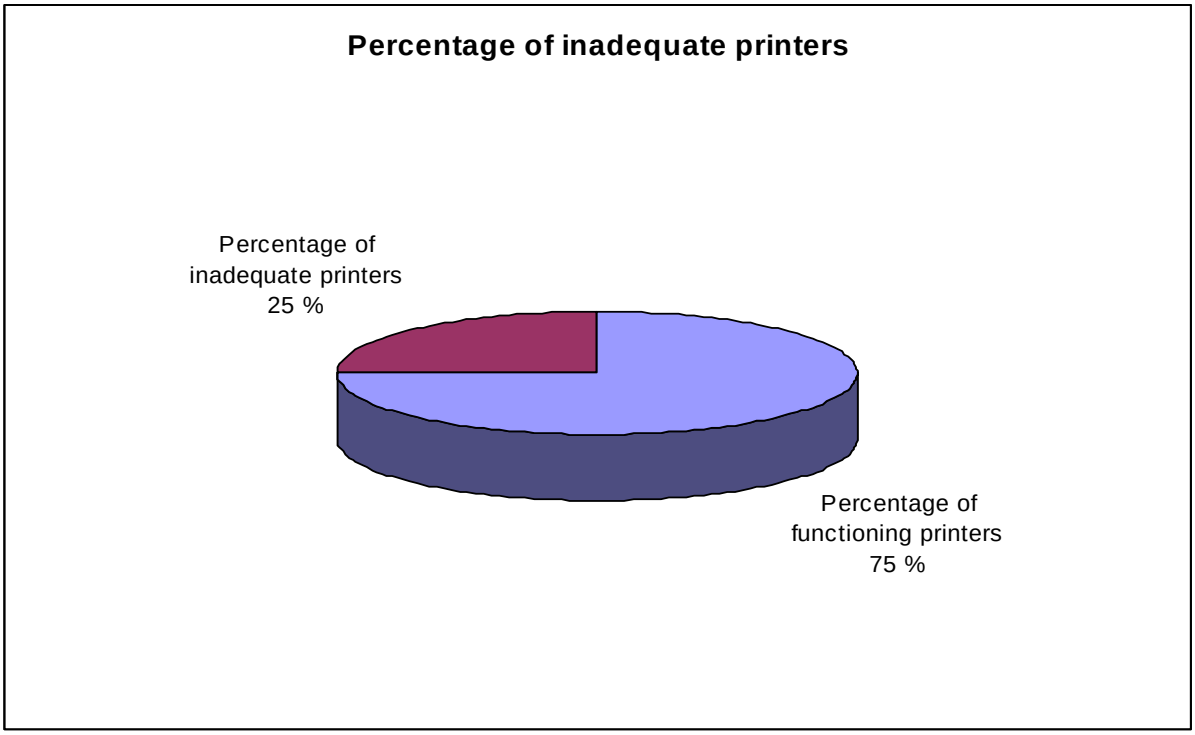


Figure 30. Percentage of inadequate printers.

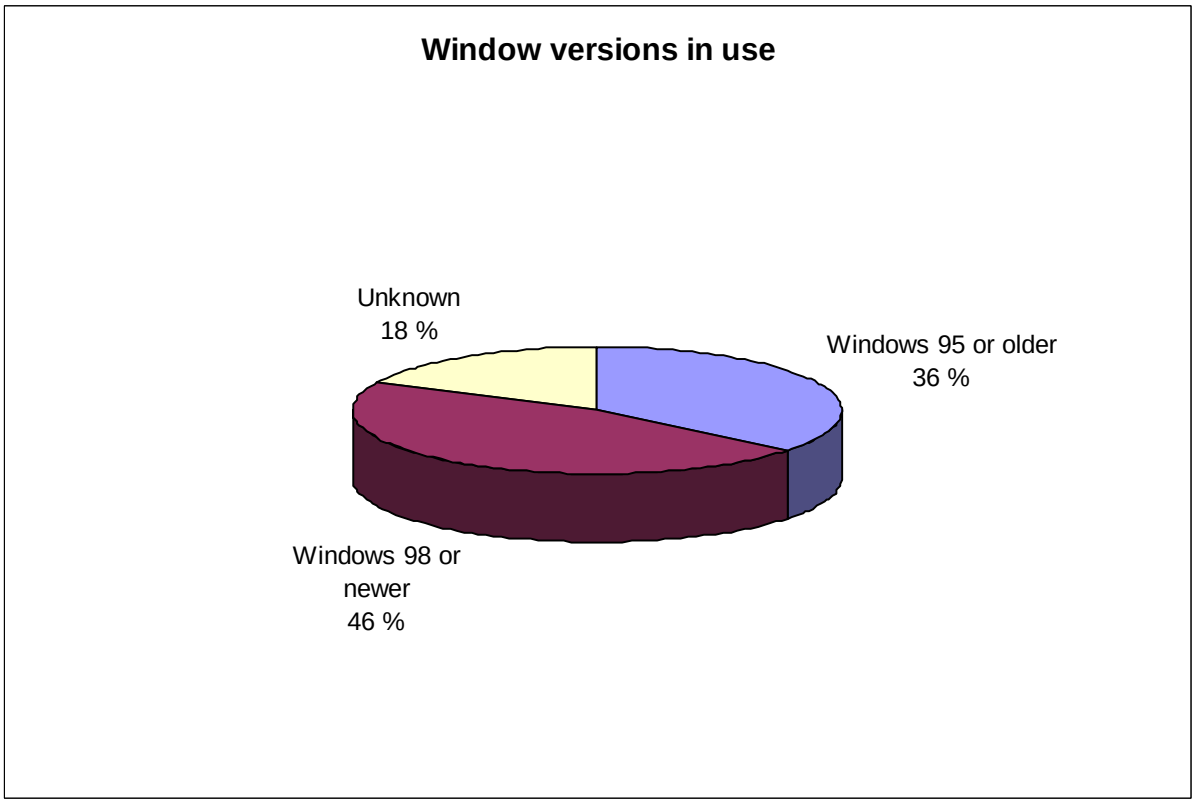


Figure 31. Percentage of computers running old versions of Windows.

Can we generalize based on our findings?

Even though we did not have the time to visit all PAWC facilities, we found we could generalize based on our results, and predict results for the rest of the Cape Town region.

If one looks at what the clinics have reported themselves in an earlier conducted version of the information audit, one see that a total of 23 facilities have said something about the number of working computers within their facility. 11 say they have no PCs (approx. 48%), eight say they have 1 PC (approx 35%) and three say they have more than one PC (approx. 13%). Compared to Figure 28, which shows the percentage of facilities with working computers, which are numbers from the investigated clinics, one can to a certain degree apply these numbers to the rest of the region, and make a rough estimation and say that these numbers are representative of the whole area. However, we have not taken into consideration the 13 facilities that did not report anything on their computer status, so care must be taken. All clinics should ideally be investigated individually.

8.2 Perceptions of the information system

In the audit, we wanted to explore what perceptions the users had of the information system they are a part of. The audit included the questions:

- How well do you think the current health information system is functioning?
- What do you think is the greatest achievement of the current health information system?
- What do you think is the largest failure of the current health information system?

We have audits from 20 clinics and hospitals. The interviewees used their own expressions to describe how well they thought the system was working. We can, however, divide the perceptions into three groups – those who thinks the system functions well, those who have no strong opinion, and those who think it is mainly a failure. The opinions are distributed like this:

- Positive: 12 (60%)
- Indifferent: 5 (25%)
- Negative: 3 (15%)

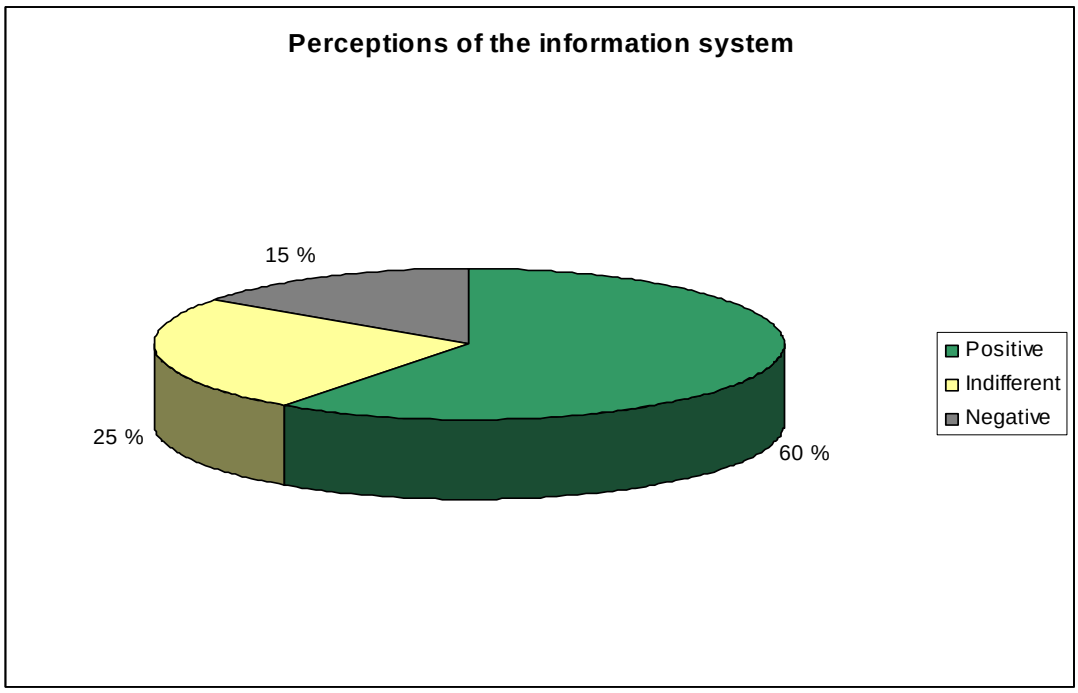


Figure 32. Perceptions of the information system.

In more detail, a couple of the answers reflect that the system is still new, and people are still working to get accustomed to it. One of the respondents wrote that the system works well, but staff are "*still going through the phases of understanding health information*". Another stated that the system is "*better now*", and that there is a considerable improvement compared to how the system functioned earlier. On basis of this, people seem to be more pleased with the current system, than the system used earlier, especially prior to the reformation of the health sector in 1994.

Those more negative to the system explains their dissatisfaction by stating that they are not really taking part in the system, everything happens above their heads, and they know little or nothing about what happens with the data they submit. Some also feel that the DHIS software system is somewhat off target, and that the facilities should have a patient-based system, instead of a 'district-based' system such as the DHIS (any data can be entered into it without being able to follow the data back to a certain patient).

The question about how well the system functions might seem like an easy, straight-forward question, but we experienced some confusion connected to it. The term "*information system*" is vague for some, and not all are sure if the "system" is only the computer software, just the RMR, or everything that has to do with the information handling.

Also, it was not too easy to make a distinction between the intentions of the information system, and how it works in reality. A number of people expressed that the system in the theory is a good one, but that it does not all work as smoothly as one could hope for. Some are optimistic, and believe that it is a matter of time and training before people get used to the system, and learn to use more of its potential. Others have a more gloomy perspective, and do not see that the system will ever be functional and useful. Those with this view explain that it is mainly due to the lack of equipment in the facilities, and the lack of training among the staff. Some of the people we interviewed do not think that the situation will change

considerably, and that the training and equipment needed, will never be made available for facilities and staff.

8.2.1 Greatest achievements

We also asked what staff regarded to be the greatest achievements and largest failures in the system. These questions provided us with a large variety of answers, and most had some opinions on this field. What people were concerned with varied from smaller, very specific details with the system, like new RMR forms, to more universal aspects of the system, like being able to compare themselves with other clinics, and see how the facility improves.

The questions were formulated in an open ended manner, namely "*What do you think is the greatest achievement of the current health information system*?" and "*What do you think is the greatest failure of the current health information system?*" Even so, many of the apprehensions of the system are alike, so we are able to group the answers into the following categories:

Achievements	**Number of answers**
Better services to the patients/ easier to evaluate the services	7
Collection and accessibility to statistics	5
Computerisation/ software/ tools for collecting statistics	3
Better management of stock	2
The system is flexible	1
Get feedback	1
Get more staff	1
General improvement	2
Nothing/ don't know	3

Table 21. Achievements of the information system.

Adding the numbers will give a larger number than the number of clinics visited, but the some of the interviewees mentioned more than one great achievement with the system.

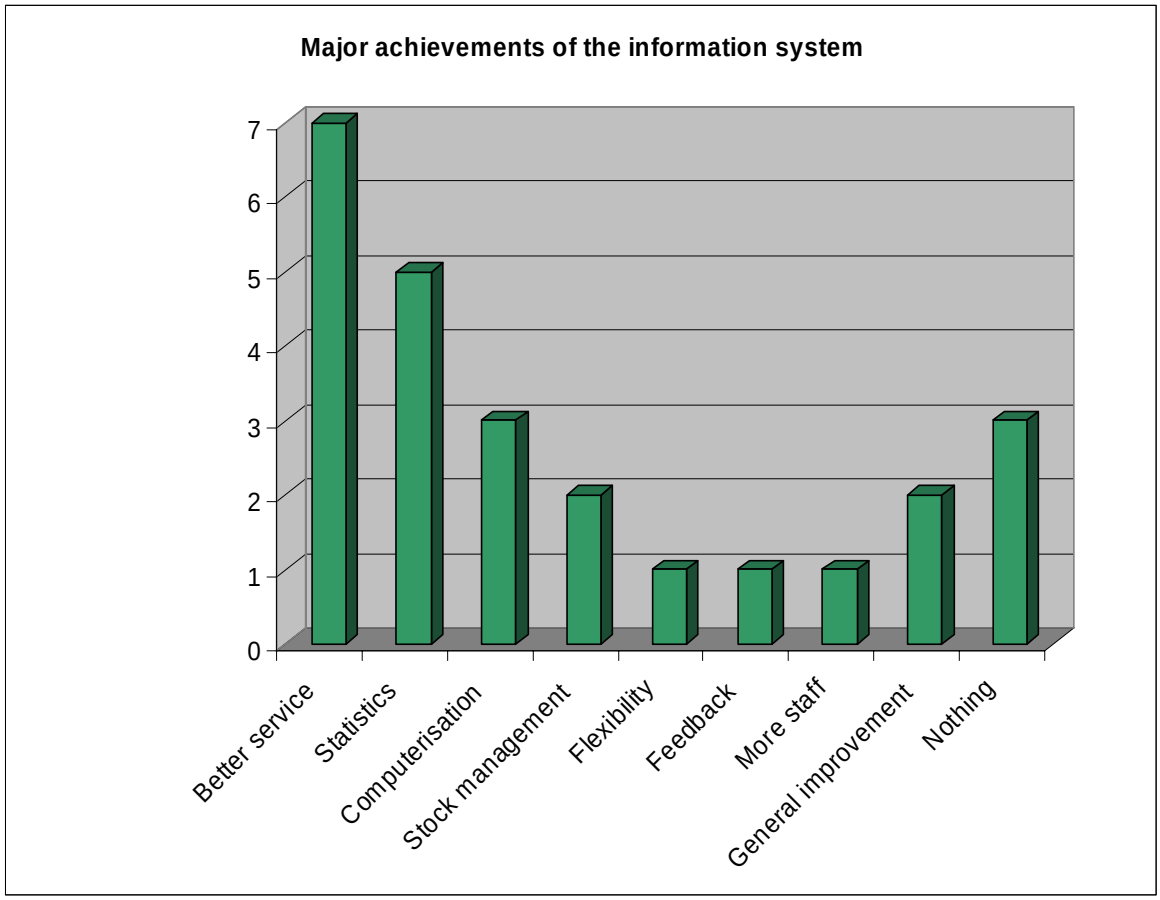


Figure 33. Many respondents said that better service to the patients was the greatest achievement of the information system, but some also said that there is no achievement.

Better service to the patients

Most answers fall under the category "Better services to the patients/ easier to evaluate the services". This is, however, a broad category, and there were different formulations.

A couple of the interviewees expressed that the best thing with the system is that it is useful in daily planning, and that the planning makes it possible to get through more patients, and give the patients more adjusted care, according to the patient needs. One example of this is that some facilities map what chronic diseases, like diabetes, are most common and most problematic for the patients, and then dedicate special days for these patients. In some cases they also manage to provide the patients with specialists in the field of question on these dedicated days.

Other elements about the system that are regarded as valuable, is that it is "easy to identify where to make improvements", and each facility can see how their improvement is. Also, they appreciate the opportunity to compare themselves with other facilities.

Also mentioned were the *possibility to detect over-admission*, *rendering of the amount of service in the facilities* and *the correlation of patients*.

Collection and accessibility to statistics

Under this point, different aspects were mentioned – some said that the fact that general statistics are collected, available for use, and not least that staff to an increasing extent understand the statistics, are positive. Others mentioned specific types of statistics that are now being collected. One interviewee appreciated the collection of HIV statistics.

Others said that the forms for collecting statistics are the main benefit of the information system.

No achievements

A couple of the people we interviewed could not see any achievements or benefits with the system. One called it a "total failure". Another expressed that she did not know what the major achievements are, because she gets no feedback on how information is used at the higher levels, and she did not really see any great achievements being accomplished at the facility she belongs to.

8.2.2 Greatest failures

Most of the people we spoke to had more opinions and stronger feelings connected to this question than the former. The answers were also to a larger extent focused on the same themes. Again, we summarize the responses into categories, and again, the respondents were allowed to mention several different issues.

Failures	Number of answers
Too little feedback	8
Lack of equipment	6
Not enough staff	5
Increased workload on specific personnel	3
Too little training	5
Quality of data not satisfactory	4
Lack of motivation among staff	3
Bad collection tools	1
No major failures with the system	2

Table 22. Failures with the information system.

The issues:

- feedback
- equipment
- staff
- training
- data collection tools

are presented as separate topics later.

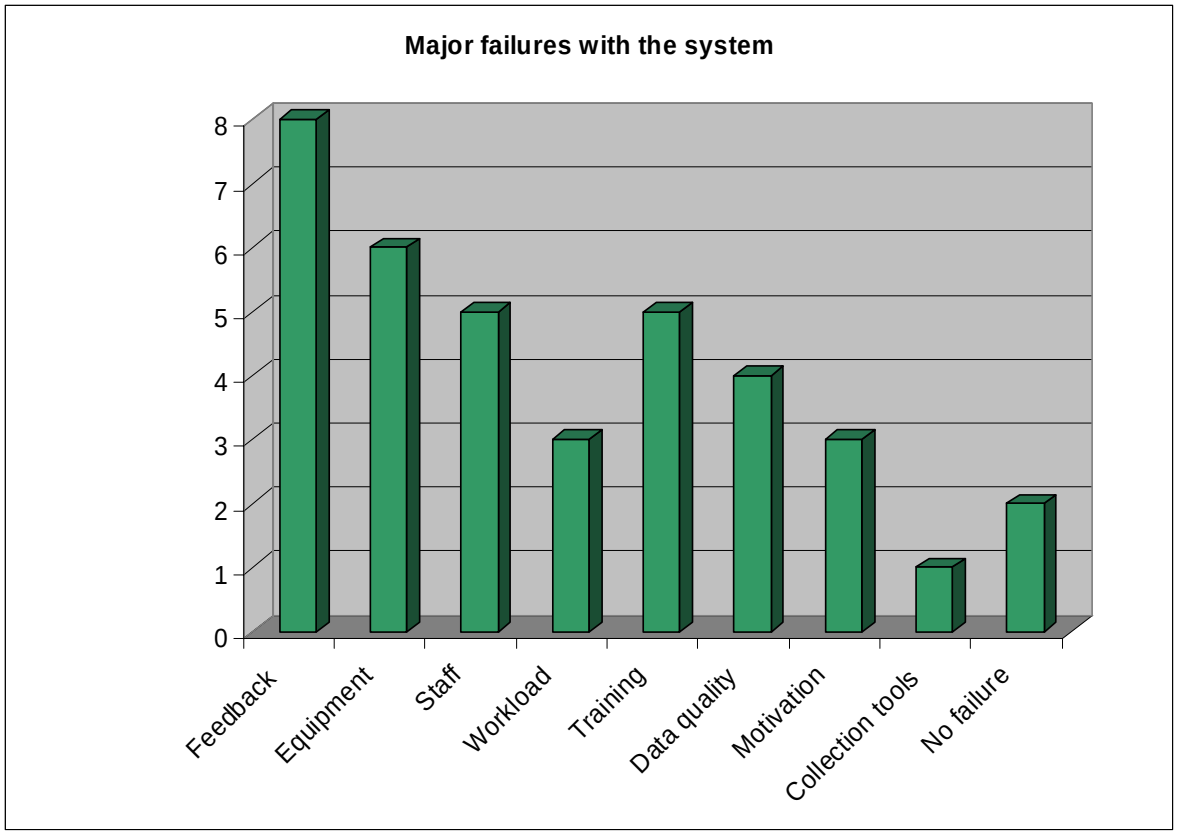


Figure 34. The graph shows the issues the respondents said had failed in the present information system.

8.3 Suggested improvements to the health information system

8.3.1 Additional resources needed

When we asked about what other recourses the interviewees feel are needed in order for the information system to be more functional, there was a much more unison and complete response. The answers were almost equally divided between the three categories *Computers*, *Training* and *Staff*. The question we asked was again open-ended, and the following table summarizes what the staff regards as necessary additional resources:

Additional resources needed	Number answered
Training	13
Computers	12
Staff	10
Feedback	2

Table 23. Additional resources needed.

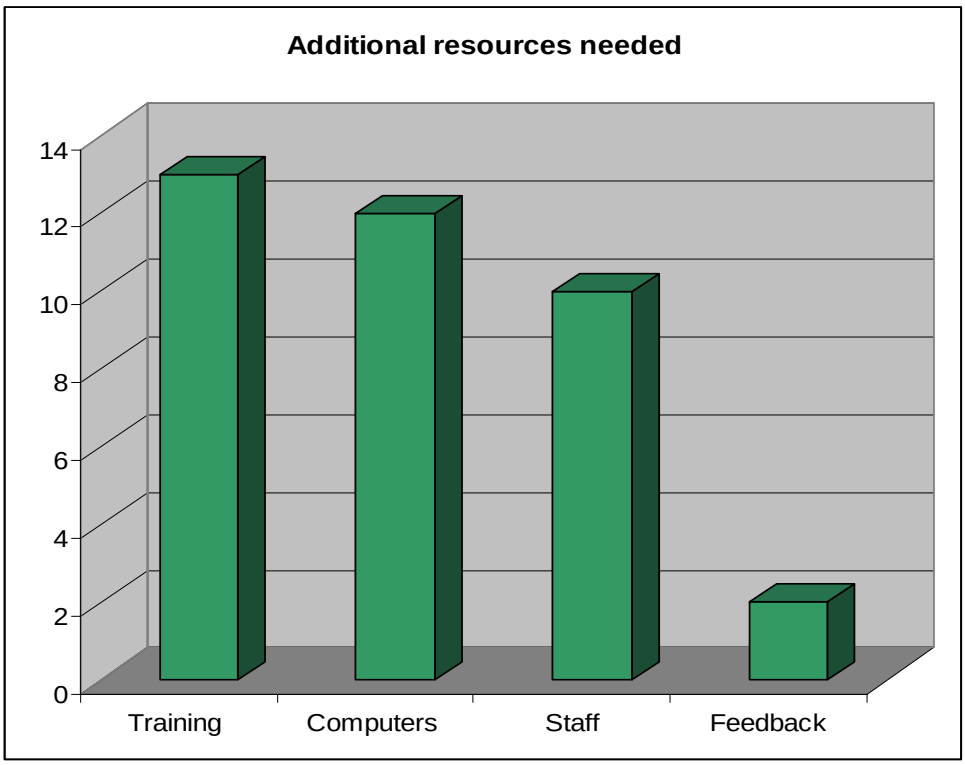


Figure 35. Additional resources needed.

We see that in this case, all the answers fall into four clear categories, and there was a considerable increase in number of responses compared to the question about optimal structure.

8.3.2 Are the right types of data items collected?

Under the category "*Suggested improvements to the information system*", a couple of questions concerned the data/information collection:

- What information currently NOT being collected, do you think should be collected?
- What information currently being collected do you think is of NO VALUE (or very low value) and should not be collected?

Health personnel mentioned these data elements as the ones that should be collected:

- Patient/ staff ratio
- Maternity Obstetric reboarding
- Disability grant form
- Workload (not just patients per nurse, but also other tasks that take up a lot of time; telephone calls, TB test etc)
- Communicable disease
- Deaths
- Death related to trauma
- Child abuse
- Patients on district service
- School health
- Health promotion officer

- Data from health educator
- Treatment
- Dressing
- More patient based information
- Cost of particular drugs
- Use of telephone
- Time spent talking to patients

Data elements that should not be collected were:

- Mental Health; "*Stable chronic patients devolved to PHC*" – closely related to "*Visits Old Clients*" (see RMR).
- "Other services" covers too broad (see RMR).

Eight people answered that all relevant data was collected, and that they therefore did not want to collect any additional elements. 15 people answered that none of the data currently being collected was of no value, and should be removed from the RMR. Two facilities did not answer any of these questions at all.

Overall, the staff seemed pleased with the data elements that are currently being collected. Very few want to remove any of them, rather add some elements to cover a broader health information area by including data from more services than today.

8.3.3 Optimal structure of the information system

In the audit, we asked our respondents to draw and describe what they think the optimal structure of the information system is. This was once again an open-ended question where the respondents expressed in their own words how they would like the structure to be. And again, the categorisation is ours, and we made the categories in retrospect of the auditing.

The issue of structure was, however, clearly something the facility personnel had not given a lot of thought, and many did not have any opinions about what in the structure should be changed.

Optimal structure for the information system	Number of answers
No answer given	8
Dedicated information personnel	4
More facility based, computerised information	3
Clearer hierarchy structure	2
More or other kind of feedback	2
Structure fine as it is today	2
Better timing on computer training	1

Table 24. Optimal structure of the information system.

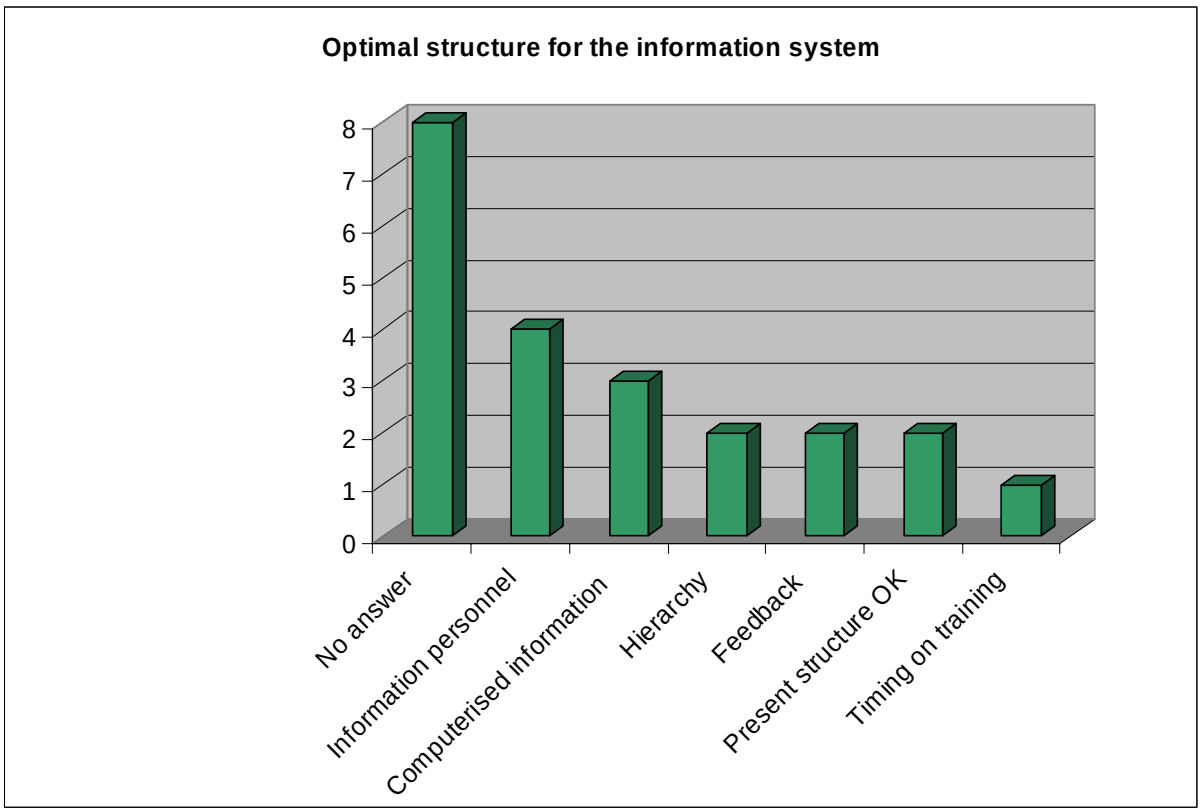


Figure 36. Optimal structure of the information system.

As the graph shows, as many as eight of the respondents did not have anything to say about the structure. This indicates that the facility personnel do not have a very strong feeling of ownership towards the information system, and that they feel that they do not have sufficient overview to suggest changes in the information system on the whole. In section 8.3.1, we saw that the responses are fuller when we ask the more concrete question of what additional resources are needed in order to make the system function better. We also see that there is some overlap with the answers in this section.

As for the actual suggestions for improvement, the most frequent is to have dedicated information personnel. Presently, the facilities have been asked to each assign one person to do the information work, especially the RMR. This is typically the facility manager or the clerk in charge of the reception. But, in most cases, when the information work was added to the workload, nothing was subtracted, and there are many different tasks to concentrate on. Four of the interviewees suggest that there should be dedicated personnel only taking care of the information handling. Two of the respondents wanted this kind of personnel to be connected to the facility, whereas one thought information personnel should be located at district level. The last one said that information personnel could be either at facility or district level. Even though request for dedicated information personnel was the most common response, one could have expected even more to have the same opinion. Local Authorities has several dedicated information officers at district level (PAWC has two), and this is an arrangement that works very well. It is a little surprising that not more of the PAWC staff has observed that information officers are an asset in obtaining more useful information.

A couple of respondents wanted to computerise more of the information in the facility, especially information regarding patients. In the current system, some facilities, but not all,

have the patient cards in electronic form, and use the computer to find the patient folder, which is on paper. A system for making electronic patient folders is currently under construction. One respondent also pointed out the importance of access to patient information for the pharmacies.

Two respondents saw the need for a clearer hierarchy in the system, and better communication regarding how the hierarchy is structured at any given time. Frequent changes in the system have been confusing for many, and people are not always sure where to send data, where to turn for different kinds of inquiries, and what units they have directly above them. The confusion is present in many facilities, but it is especially difficult for units that are not completely mainstream, like the hospital specializing in tuberculosis. They had been moved around in the hierarchy, and were starting to get dizzy from all the changes. “We are not really sure where to send our statistics, so we send them to a couple of different places, just to be sure”, the manager told us.

8.4 Feedback and support

Feedback

The lack of feedback is an aspect many of the interviewees pointed out. This is also the element that was requested most often, and the element most often pointed out as the major failure of the system. The majority of the respondents agreed that the feedback came too seldom, only once or twice a year some told us, whereas others said it came monthly, but in a form they could make little use of, namely raw data. Many also say that they do not know at all what happens to the data after they have sent it away.

Two of the district hospital managers wanted feedback for the hospitals to have a different form. Presently, the feedback comes together with the feedback for the three other district hospitals in Cape Town, creating a typical incident of information overload (e.g. [Nelson, 1994]) where it takes a lot of time to find the pieces that are relevant for each separate hospital. One of the managers said that if she got any feedback at all, it was on a huge spreadsheet that is not user friendly at all. “The only thing I can do with it is to check that the data that has been registered is the same as we sent out”, she said. The other manager suggested that the feedback should be divided, so the hospitals received the information specific to them. An additional summary could be given if something happened somewhere in the sector that could be of use to others.

“There are too many cases of non-communication between the levels. The management operates with a non-open-door-policy, and we do not see them or any of the work they do”

– Facility manager

Many also expressed that they are dejected because the only times they get feedback are when they have done errors in collecting the data, and that this is bad for the motivation.

Under this category we also find several remarks on the lack of contact with higher levels. One facility manager stated that “*There are too many cases of non communication between the levels. The management operates with a non-open-door-policy, and we do not see them or any of the work they do.*” Staff also expressed that they do not know what management at higher levels do with the data submitted from facilities.

Even if the general opinion is that there is too little feedback, and that it is not suited for use in the facilities, most gave positive response when we asked if they had received any feedback during the last year. Two told us that they had not got any feedback at all, and one said that "*we only see statistics when it is time for budgeting*". Many underlined that the feedback had the form of raw data, and that they were not able to make any use of if.

Below, we have included an example of how the feedback is given to PAWC facilities.

Routine Raw Data For **Sub-Dis: wc Blaauwberg Health District**
Facility: wc Good Hope CHC

Manager: Mr Mohamed Street Address: Justin Street
Postal Address: As Above Postal Code: 7405
Postal Area: Ysterplaat Phone: 021-511-8606
Cell: _____ Fax: 021-5113059
Email: _____

	No	Aug 02	Sep 02	Oct 02	Nov 02	Dec 02	Jan 03	Feb 03	Mar 03	Apr 03	May 03	Jun 03	Jul 03	Aug 03
Attendance														
under 5 years of age before 1 pm	1													
under 5 years of age after 1 pm	2													
5 years of age and older before 1 pm	3													
5 years of age and older after 1 pm	4													
Triage and deferred	5													
Mental Health														
Mental health repeat visits (Old clients)	27	62	48	52	34		50	66	4		60	52	79	76
Mental health client - new	28	3	1	3							2	1	1	2
Mental health clients referred to 2nd level	29											1	1	0
Mental health clients referred to 3rd level	30		1									0	0	0
Chronic patients on register total	32													
Stable chronic patients devolved to PHC	33													
Relapsed chronic patients	34													
Curative Services														
Curative patients seen by doctor in this fa	35	1327	1650	1553	1538	1198	1467	1256	1489	1309	1696	1521	1583	1341
Folders seen by MO to reboard medicatio	36													
DG and DOC	37													
Curative patients seen by Professional N	38				252		170	121			11	0	706	146
Referred to doctor (this or other facility)	39													
Curative cases under 5 years	40	15	12	10	11	6	5	5	12	12	4	5	2	8
Diarrhoea under 5 years - new	41											0	2	
Lower respiratory infection under 5 years	42											0		
Cases treated as STI using the Syndromi	43											0		
Male (penile) urethral discharge - new	44											0		
STI contact slips issued	45											0		
TB Case Detection	47													
Rehabilitation Services														
Under 13 clients seen	52													
13 and above visits	53													
Psycho Social Rehab Clients	54													
Reproductive and Women Health														
Contraceptive users	55							0						
Condoms distributed	60	350	400	300	450	450	550	250	125	220		250	150	400
Emergency contraceptions	61													
Referred for Termination of Pregnancy	62													
Cervical smear 30 - 59 years	63													

Figure 37. An example of the feedback given to a PAWC clinic; raw data on the RMR data elements.

This feedback presents only raw data, which is not processed further. We say more on the issue of feedback in Chapter 9.

Support

We also asked some questions about the support available in the system, either for the use of computers or for information handling.

We asked:

- Have you (FM/FIO) received any support or mentoring regarding computers or information handling?
- Is it easy to get support if you need it, and who would you contact?

In the first question the staff member is asked to clarify what kind of support or mentoring they have received, if any, or, if they did not receive any support or mentoring, what they think the reason for this was.

The general mood is better when it comes to support and how easy it is to get support, than for the feedback issue. Although many say that they have not received any support, most know where to turn if they need support for the computers, filling out the RMR, or other kinds of information handling.

Can get support from	Number answered
District Information Officer (DIO)	11
District Management Team (DMT)	6
Other Colleagues	4
IT department	1
No Support, never easy to get	1

Table 25. Who can staff get support from?

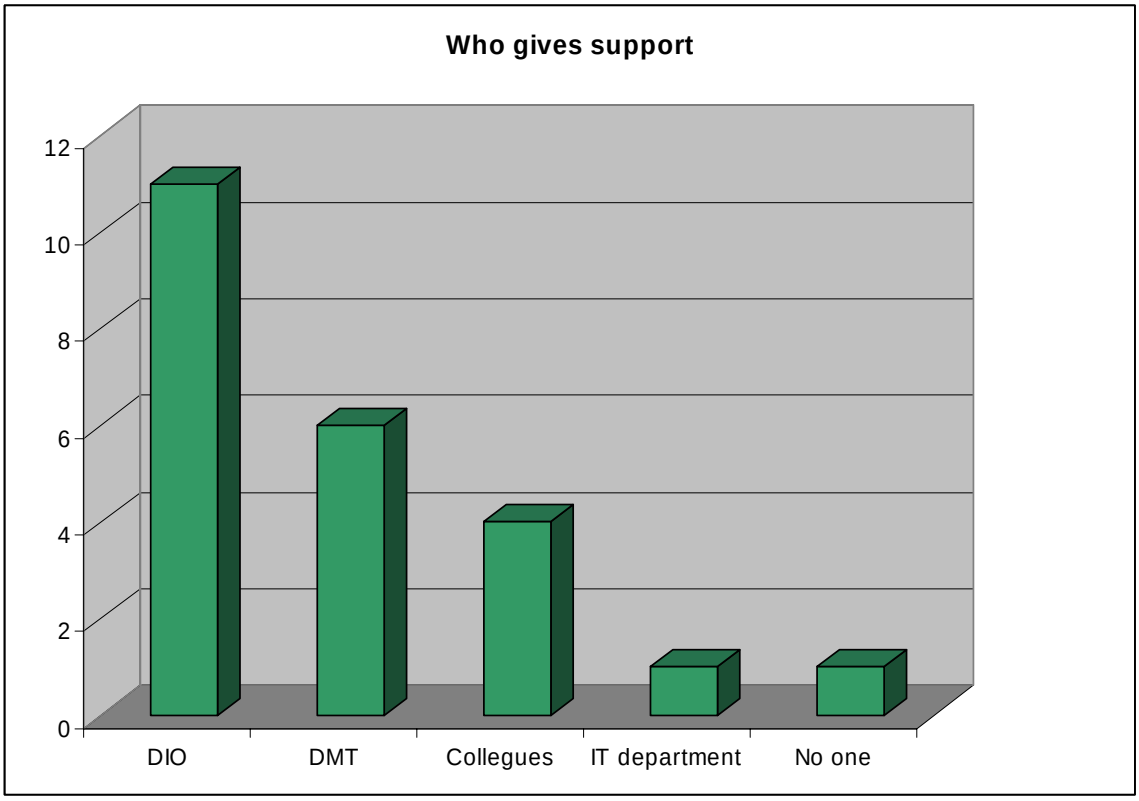


Figure 38. Who gives support?

The District Information Officers (or the people functioning as a DIO, because PAWC has no such person appointed as an information officer for each district) and members from the District Management Team are those most commonly mentioned as people it is possible to ask for support. Most express that they feel welcome to call anytime they need, even though the supporters, especially the two PAWC District Information Officers, are often very busy. Some also mention that they can ask other colleagues for help, or say that they can call the IT-

department. For instance, staff at Brooklyn Chest Hospital feel that the IT-department is efficient and helpful as long as you have the right telephone numbers and know what people to contact for the various kinds of problems. Just calling the switchboard and asking to be put through to someone that might be of assistance is of little use. Staff at this hospital was satisfied with the help they got. People from the IT-department come out to the hospital if a problem cannot be handled over the phone.

Others are not so satisfied with the IT-department; one clinic had received new computers and printers, but the workers were not able to install the equipment themselves. Facility staff had asked the IT-people for help, but nobody came. The result was that the brand new computers had been lying in their boxes for two years without being touched.

One person said that there was no support available, and that it is never easy to get support.

8.5 Equipment

12 respondents pointed out the need for more computers when asked what additional resources are needed in the system. This corresponds well with our findings from the computer specification audit, in section 8.1.

Many of the employees, 30%, also regard the fact that the facilities are not equipped enough to perform the information work in a satisfying manner as the major problem with the information system. Most often they point out that the problem is that there are too few computers, or that the ones they have access to, are too old and slow. (See Section 8.1. and Appendix B about computers in the facilities for more details.)

In addition to too few computers, many of the existing computers do not have the software needed for them to be fully functional for the health information tasks, or the facility is not connected to the intranet, which is a major disadvantage, especially after the implementation of the Logis ordering system.

According to one respondent, the lack of sufficient equipment “creates a backlog, which again leads to internal delay in the system”. Many believe strongly that their work would be a lot more effective if they had the sufficient equipment and tools, and they also stress the importance of training in order to be able to use the tools in a proper way.

In the chapter about our investigation on computer specifications, we found that only three clinics were satisfactory equipped with computers, according to the model we in cooperation with information management made. The model states that there as a rule of thumb should be a computer at all the critical workstations – facility managers office, reception and, where it exists, in the pharmacy. In order to reach this goal, there is a need for 32 more computers in the facilities we visited. In addition, investigations made earlier by the Metro information management shows that there are eleven more facilities with no computer, and nine with only one. In other words, it is understandable that our interviewees request more computers.

Other equipment

Although most of the personnel we spoke to were most concerned about the computers, some also mentioned other kinds of equipment. One told us that is was a problem that they did not have a copy machine in the clinic, so they were dependent on other facilities or the district

management office any time they needed new copies of forms, like the RMR form. New buildings were also mentioned a couple of times.

8.6 Staff

"*The high workload makes it impossible to sit down and interpret the information*", one manager said.

"The high workload makes it impossible to sit down and interpret the information"

– Facility manager

When we combine the two categories about staff shortage and high workload in the question about what the largest failures with the system are, we find that this is an issue that staff is highly concerned with. Eight of the interviewees said that there are too few employees to handle the information properly, and that the workload placed on some of the staff members is too heavy with regards to the information work. This is typically pointed out to be a problem for the facility manager and the receptionist in charge. The staff criticize the fact that the work with information simply has been added to all the other tasks they already are obliged to do. They state that even if the time spent on information handling has increased, there is no additional personnel appointed to help out with the work. It is also a problem that there is too much information to process in a short span of time.

In some of the facilities we witnessed the consequences of the high workload and the shortage of staff. In a couple of clinics we had to perform the interviews while the manager did other tasks, like finding patient folders in the shelves.

Ten of the respondents said that staff is a needed resource when asked about additional resources needed. Most facilities experience a very high workload and the number of patients is constantly increasing as a result of the increasing number of immigrants to Cape Town. Most of the immigrants come from other parts of the country but some are also from abroad, according to "A socio-economic profile for the Cape Metropolitan area".

Brain drain

Not only is the number of patients increasing, the number of staff is also decreasing. From all over South Africa, all kinds of educated personnel leave the country for better salary and working conditions overseas, mainly in Britain and North America. Their good English skills make them particularly attractive on the international work marked. According to the National Health Trust web pages, 300 nurses left the country monthly in 2000. And according to health personnel we spoke to, this problem has only become worse during the last years.

Several of the respondents stressed that any new personnel should have good training in the fields of computer training and information handling and other relevant subjects. This is in order for the facilities to be relieved of using a lot of resources in the training of new staff.

8.7 Training

Many of the interviewees, 65%, say that training is an important additional resource that is badly needed in the information system.

The number of courses attended was limited, whether it was on computer training or health information handling. Staff always mentioned the need and wish for more training, and that this training should be available for all staff within the facility. A large percentage of the staff are not computer literate, that is, they do not know how to work a computer, and without any training the computer cannot be of any use or advantage in their work situation.

Brooklyn Chest (TB hospital) is in a special position when it comes to training. Regular courses (elementary to advanced) are offered to staff in a school in town (Blue Chip). Most of the staff (clerks, nurses, doctors) get the training they need there.

Mitchell's Plain CHC was an exception, where the dentist also sat in on the audit meeting. He had attended several UWC Summer/Winter School courses and In-House courses on both theoretical aspects of information systems and computerized information systems. This did, however, not apply for the rest of the staff.

Staff members have rarely attended advanced courses, because so few have even attended to basic courses.

Training of other staff, like nurses, was hardly ever mentioned. The facility managers or clerks that were interviewed often knew little about who had gotten what kind of training, and therefore answered mostly on behalf of themselves.

One can assume some of the staff have taken private courses and also have computers to practice on at home. This was, however, outside the scope of the audit. A few of the interviewees mentioned that they had some private experience with computer use, but mainly people expressed that they did not have access to computers at home or in their spare time.

Application of training

No one in the facilities knew the extent of training the staff members had received, but what had been offered were mainly basic computer courses and basic information handling courses. Instead of listing the incomplete numbers of what courses staff members have attended, we will present a table showing how the workers felt they had made use of the training they had received. The categorisation has been done by us.

What has training been used for	Number answered
Information handling	6
Teach other colleagues	5
Planning and evaluation	4
Basic computer use	3
Nothing	8

Table 26. What has training been used for?

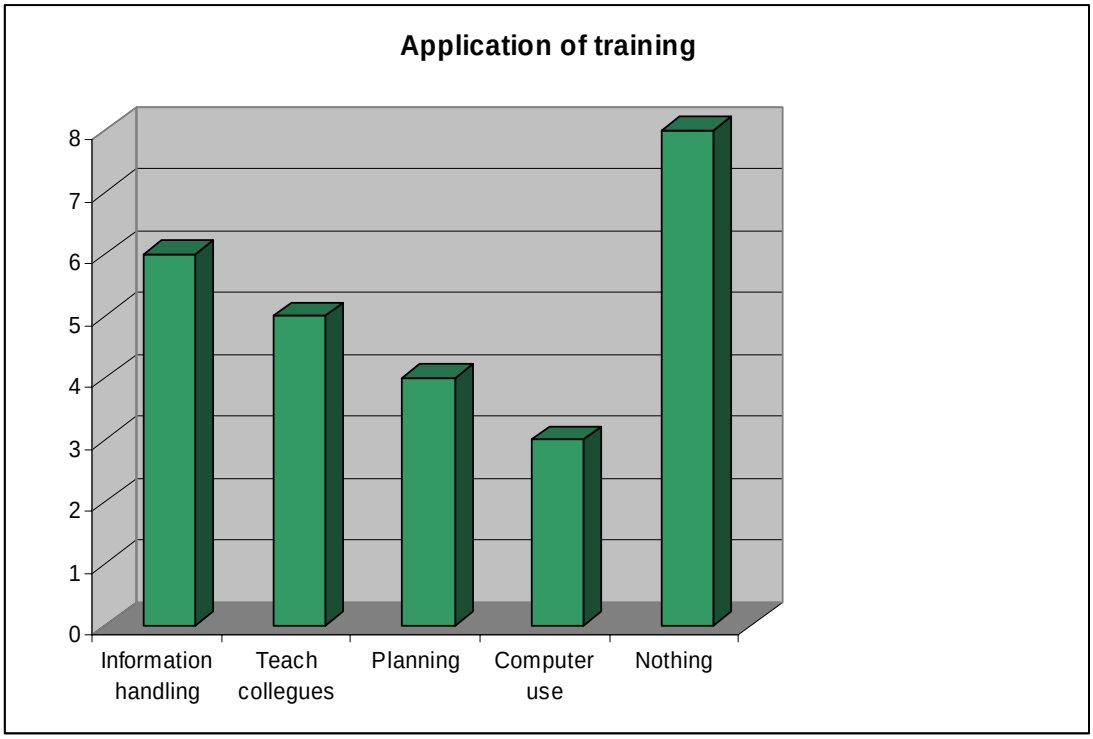


Figure 39. Application of training.

Here we see that many of the interviewees, 40%, feel that they have not been able to make use of the training for anything at all. And of the eight who said they had not used the training, six, or 30%, said that it was because there are no computers or other equipment in the facility where they work. Many pointed out that it is a problem that computer training is given years before there are any computers in the facility and in the meantime staff forget everything they learned on the course.

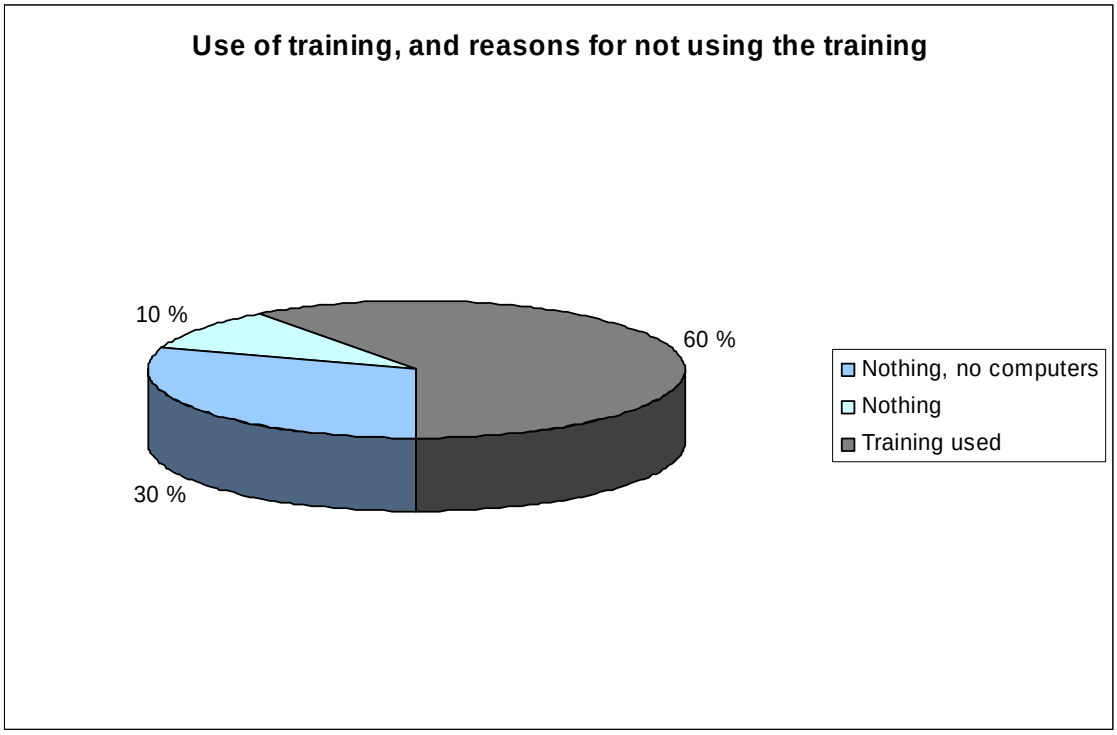


Figure 40. Use of training, and reasons for not using the training.

For those who had used training, most had used it for information handling, including collecting statistics, doing accuracy checks and analysing data. Many also passed their skills on to other colleagues after having attended a course. “I’ve managed to show my colleagues how to use computers and also how to do the RMR stats”, one of the clerks said. Some mentioned basic computer use as their usage of the training, and stated that they had learned to write letters and e-mail, make graphs and so on. One of the facility managers had got a lot out of the training, and listed these ranges of application; “Manual accuracy checks, Diligence in collating of data, Attention to detail of definitions of data, Designing of data forms, Staff workshops - integration meeting“

Another case that stood out here was Eerste River District Hospital. Here, a few of the doctors had an interest for computers that was out of the ordinary. They had some computer training, but were also to a large extent self-taught. They used their skills to set up databases, and they even designed their own programs to assist in data capturing. For instance, they had made a program that made the transmission of lab results easier.

Types of training needed

We also asked a question about what kind of extra training the respondents think is needed for the personnel. Here, the answers mainly fall into two categories, namely computer training and training on information handling. The respondents point out that there is a large demand for basic courses in both these fields. In more detail, the distribution looks like this;

What training is needed	Number answered
Computer training	17
Information handling	11

General follow-up training	4
Motivation talks	1

Table 27. What training is needed?

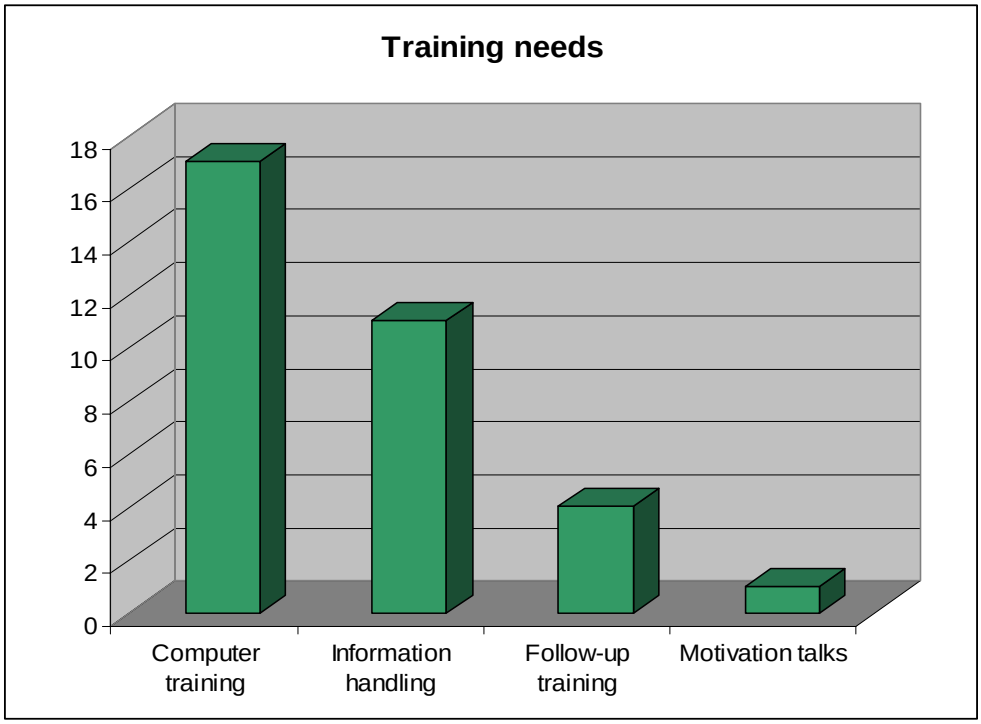


Figure 41. Training needs.

From this table, we see that respondents want more computer training in particular, but they also see a strong need for training on information handling, such as how to use the RMR and assessing of information. Some specifically mention the need for follow-up training and ongoing training.

In the question about what training is needed, we also asked what groups should be trained. The answers here were similar for all we spoke to – the wish is that in time all staff becomes computer literate, and understand the information handling process within the facility. But first and foremost, managers and clerks should receive computer training. Information handling should be taught to the same groups, but here it is also important that the nurses who collect the data in the first place have a good understanding of information use.

One respondent said courses on motivation should be provided. It is maybe too demanding to give courses fully dedicated to motivation, but motivation talks could and should be an element in any other course, be it on computer training or information handling.

Worth to notice in this section is the fact that all the respondents wanted more training for the facility staff. There was only one, located at a district hospital, who said that the amount of training offered was sufficient, and that there were only needs for updates on the training. All the others strongly expressed that there is not enough training available, and that not enough people get the opportunity to attend courses. The last issue is not only connected with the number of courses, but also with the shortage of staff experienced in the facilities. This shortage makes it difficult for staff members to leave their regular work to attend courses.

Five of the staff members we interviewed felt that the main fault with the information system on the whole is that staff has not received enough relevant training. They point out that computer literacy in particular is far too low among the staff. But also the importance of understanding the information and receiving training on information handling is focused on.

Some of the respondents mentioned that staff often has a very low motivation for doing information work, and that many do not really put much effort into these kinds of tasks. Managers see parallels between the amount of training and the low motivation. They believe it is likely that the information work will be more motivating if the staff has a higher level of understanding of the data and the information, and also that the motivation will rise if the feedback is better.

When to receive training?

Regarding *when* staff members told us they had received training, we see that this concern is real, as many told us that they had received some computer training years before there was a computer in the facility where they worked. When a computer was finally installed, they had forgotten all they had learned, and there was no course available to them since they had already attended one a couple of years ago. One of the respondents also made a point of this when talking about the optimal structure of the information system. She said that the timing of the training should be better, and that facility members should receive computer training *after* a PC had been installed in the facility, not several years before. The timing aspect also goes the other way, however, and personnel should receive computer training shortly after their facility has been equipped with new computers.

8.8 Data collection and accuracy checks

8.8.1 Difficulty with data collection analysis

Because our audit changed during the development process, some of our findings are difficult to present. This especially applies to the different data sets that were collected. Since we started out with datasets that were not fully adapted to the context, there are irregularities in what was really collected in the different clinics. The answers given in the audit would change a lot according to what datasets were mentioned and how they were mentioned. Take for example:

In the RMR	**Separate vertical program**
Oral Health	Oral Health Program
Under Chronic Care: HIV/AIDS Stage 1-2 and Stage 3-4	HIV/AIDS
TB DOTS	TB

Table 28. Difference in data set names.

Statistics on the examples given in the table: oral health, HIV/AIDS and TB are collected as data items in the RMR, but data are also collected on these datasets as a separate vertical program. Not all clinics are part of these programs. Facility staff misunderstood the questionnaires in the beginning. The data set "RMR (provincial PHC essential dataset)" were meant to capture everything included in the RMR. We felt it was unnecessary to ask detailed questions about what datasets were collected in each facility's RMR because this was information that could be found just by checking a previous report that the facility has sent in,

or looking it up in the DHIS at district level. But to capture the amount of different data and reports the clinic sent and where it is sent (to capture the current data flow) we asked questions about other datasets in addition to the routine monthly report sent to the provincial administration (Woodstock) or district information officers (Local Authorities).

The problem with the first versions of the facility information audit was that people ticked off the RMR and then continued to tick off data elements that were in the RMR, but which actually represented separate programs that they were not part of. This led to duplication of collected data elements for us and a lot of mess. So, we chose not to present which facilities collect the different data for the vertical programs. We just state that all facilities visited collected stats for the RMR.

We changed the table concerning which data sets were collected, and explicitly added the sentence, "*Other information collected that is **NOT** captured on the RMR*:"

The clarity of the data collection would perhaps be improved further by separating the RMR completely from the other data sets, and instead asking if the clinic collected separate/additional data for some of the vertical programs mentioned. We chose however, to keep the table the way we did in order to ask the same questions about accuracy, the way stats are sent and feedback for all data collected. It seemed to give a reasonably clean and understandable layout.

Our presentation of the findings from the data collection within facilities evolves therefore mainly around the RMR, and the answers to questions concerning the accuracy, how it is sent, feedback, etc., as this is information that can be presented more accurately than the other stats.

8.8.2 Tools used for the data collection

The respondents were asked, for each data element, to say what type of tools (form, tally sheet, etc.) that they used for that specific data element. Since most of the clinics only answered for one data element, the RMR, many answered that they used the RMR form. Of course they used the RMR form – this was they form they had to sent to district/regional level, so this question did not give any interesting answers. What would be interesting was the type of tools that were used *prior* to entering the data on to the RMR sheet; what type of forms was used by the nurses and doctors in the treatments rooms, etc?

So, we did not really get any useful answers on what type of tools were used, and there were some misunderstandings about what to name the different forms, etc. As we pointed out in Chapter 7, about the development, testing and how the audit took shape, we recommended that each facility send in an example of each paper-based tool they use together with the completed audit. The person who then goes through the audit and the attached forms used for data collection can evaluate if the clinic uses the forms they have been told to use, if they have new updated versions of it, if they in fact have developed something for themselves that seems to function well and that other should benefit from also etc.

Below we include some of the most common forms to collect data, which we encountered during our facility visits.

ROUTINE MONTHLY REPORT: PHC SERVICES CAPE METROPOLE REGION (15/10/03)
(MDHS)

DISTRICT: FACILITY: MONTH: Completed by (Print Name):

Data Category	Data Item	No	Week1	Week 2	Week 3	Week 4	Week 5	Total
Total Attendance at Facilities and on outreach visits	under 5 years of age before 1:00 p.m.	01						
	under 5 years of age after 1:00 p.m.	02						
	=>5 and < 60 yrs before 1:00 p.m.	03						
	=>5 and < 60 yrs after 1:00 p.m.	04						
	Triage and deferred	05						
Growth Monitoring	< 3rd%ile & = >60% EWA <5 yrs (new)	06						
	<60% EWA <5 yrs (new)	07						
	Growth faltering / failure <5yrs (new)	08						
	Children under 5 years Weighed	9						
First Contact with Health Service	Babies' exam. 1st time up to and including 6 weeks	10						
Development Assessment	Children under 2 years who had developmental screening done	11						
	Children under 2 years with suspected developmental delay	12						
Immunisation	*BCG (first dose under the age of one)*	13						
	TOPV (at birth)	14						
	DTP-HIB, TOPV, HEPB (1st dose)	15						
	DTP-HIB, TOPV, HEPB (2nd dose)	16						
	DTP-HIB, TOPV, HEPB (3rd dose)	17						
	Measles 6 months (high risk areas)	18						
	Measles 1st dose (9 months)	19						
	Measles 2nd dose, TOPV, DPT (18 months)	20						
Prevention Care	Children <5 years seen for prevention services ONLY	21						
TB DOTS Attendances	Daily TB DOTS Attendances	22						
Mental Health	Visits Old Clients	23						
	New clients seen	24						
	Clients referred to 2nd level	25						
	Clients referred to 3rd level	26						
	Psychiatric discharge patients seen	27						
	Chronic patients on register	28						
	Stable chronic patients devolved to PHC	29						
	Patients relapsed/referred back to mental health	30						
Curative Services	Seen by MO	31						
	Folders seen by MO to reboard medication	32						
	DG's and Documents	33						
	Seen by PN for curative	34						
	Seen by PN/CNP and referred to MO	35						
	Children <5 years	36						
	Children <5 years diarrhoea (new)	37						
	Children under 5 years with lower respiratory tract infection (new)	38						
	STD (new)	39						
	Males with PUD (new)	40						
	STD Contact Slips Issued	41						
	Number of STD Contacts Treated	42						
	TB Case Detection	43						

Reproductive and Women's Health	Family Planning Clients Seen <18	44						
	Family Planning Clients Seen ≥18	45						
	Oral Contraceptives Issued	46						
	Depo Provera given	47						
	Nuristerate given	48						
	IUCD's	49						
	Condoms issued	50						
	Emergency contraception	51						
	Referred for TOP	52						
	Cervical (Pap) smears 30 – 59 yrs old	53						
	Sterilisations #	54						
	Vasectomies #	55						
Trauma & Emergency Services	Trauma	56						
	Medical	57						
	Admitted to hospital	58						
	Rape cases < 14 yrs	59						
	Adult Rape Cases => 14 yrs	60						
Domestic violence	No of women referred for domestic violence intervention	61						
Maternal	Booking visits < 20 weeks	62						
	Booking visits => 20 weeks	63						
	Antenatal follow-up visits	64						
Chronic Care	Total chronic cases	65						
	Diabetes mellitus	66						
	Hypertension	67						
	Epilepsy	68						
	Asthma	69						
	HIV/AIDS Stage 1 - 2	70						
	HIV/AIDS Stage 3 - 4	71						
Other	Seen for any other services	72						
Medication	All prescriptions issued	73						
	All Items dispensed per script	74						
Medication dispensed outside of the pharmacy	All prescriptions issued at the facility but not dispensed at the dispensary	75						
	All Items dispensed per script	76						
PAM Services	Seen by physiotherapist	77						
	Seen by social worker	78						
	Seen by radiographer	79						
OT Services	Under 13 years seen	80						
	13 years and above seen	81						
	Psycho Social Rehab	82						
Oral Health	Pre School Children	83						
	Scholars	84						
	Adults	85						
	Extractions all	86						
	Fillings all	87						
	Scaling and polishing	88						
	Fissure Sealants for children in Gr 1	89						
	Fissure sealants all	90						
Pharmacy	All prescriptions issued by the pharmacist	91						
	All items dispensed per script	92						

COMMENTS:

Figure 42. The newest version of the RMR (date 15/10/03). Most of the facilities we visited used old RMR forms (from 2000).

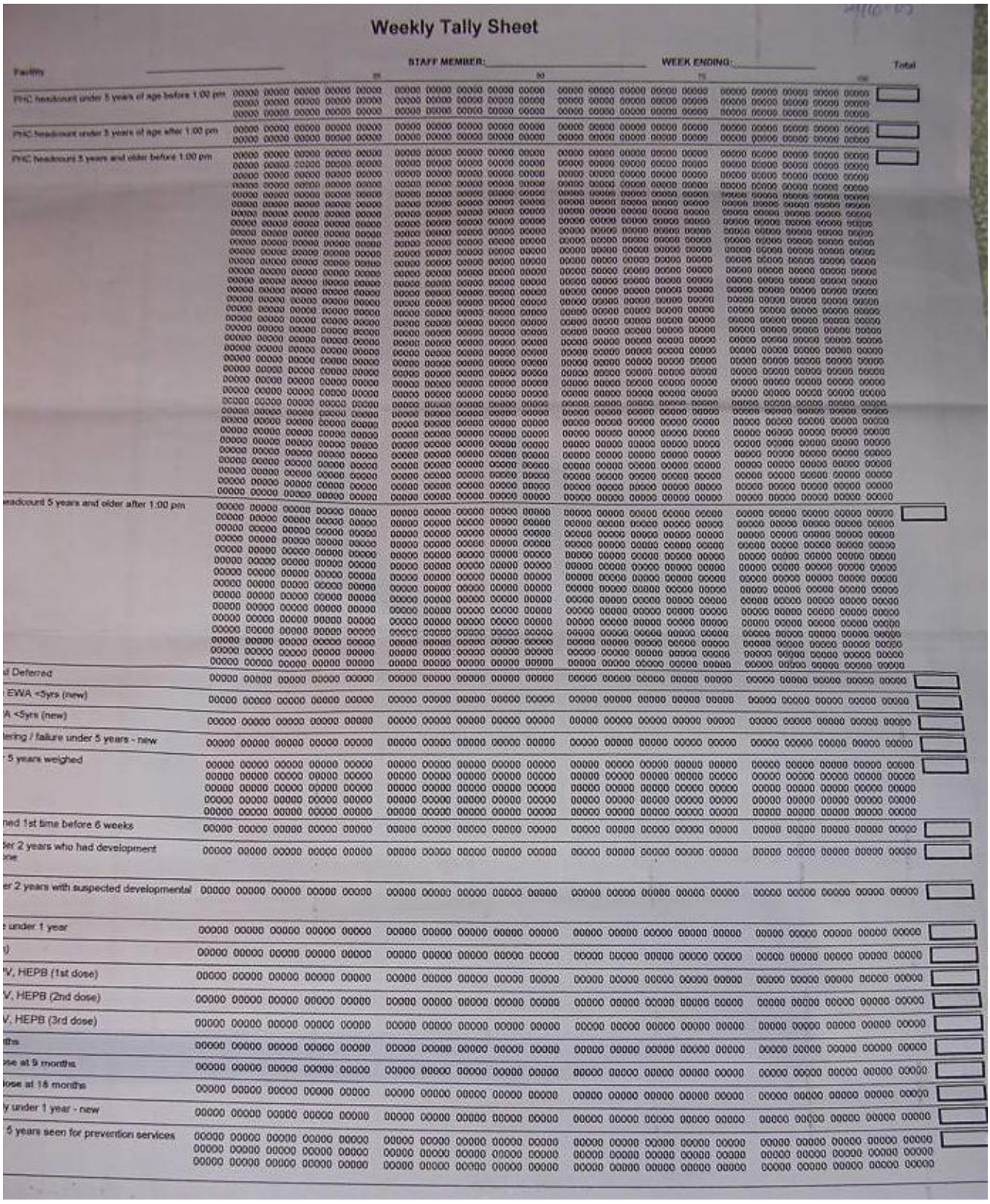


Figure 43. This weekly tally sheet in A3 format is used by some clinics, but not all. The first encounters we had with it was that staff were satisfied with this sheet – it gave enough space to count everything on one form, and the format of it made the risk of losing it smaller. However, after visiting just a few clinics we saw that very few in fact used it. They felt it was way too big and unpractical, and took up all the space on the desk. Instead, they used other, smaller forms.

Figure 44. A4 tally sheet used for headcounts. Facility staff has added relevant data elements by hand on the sheet.

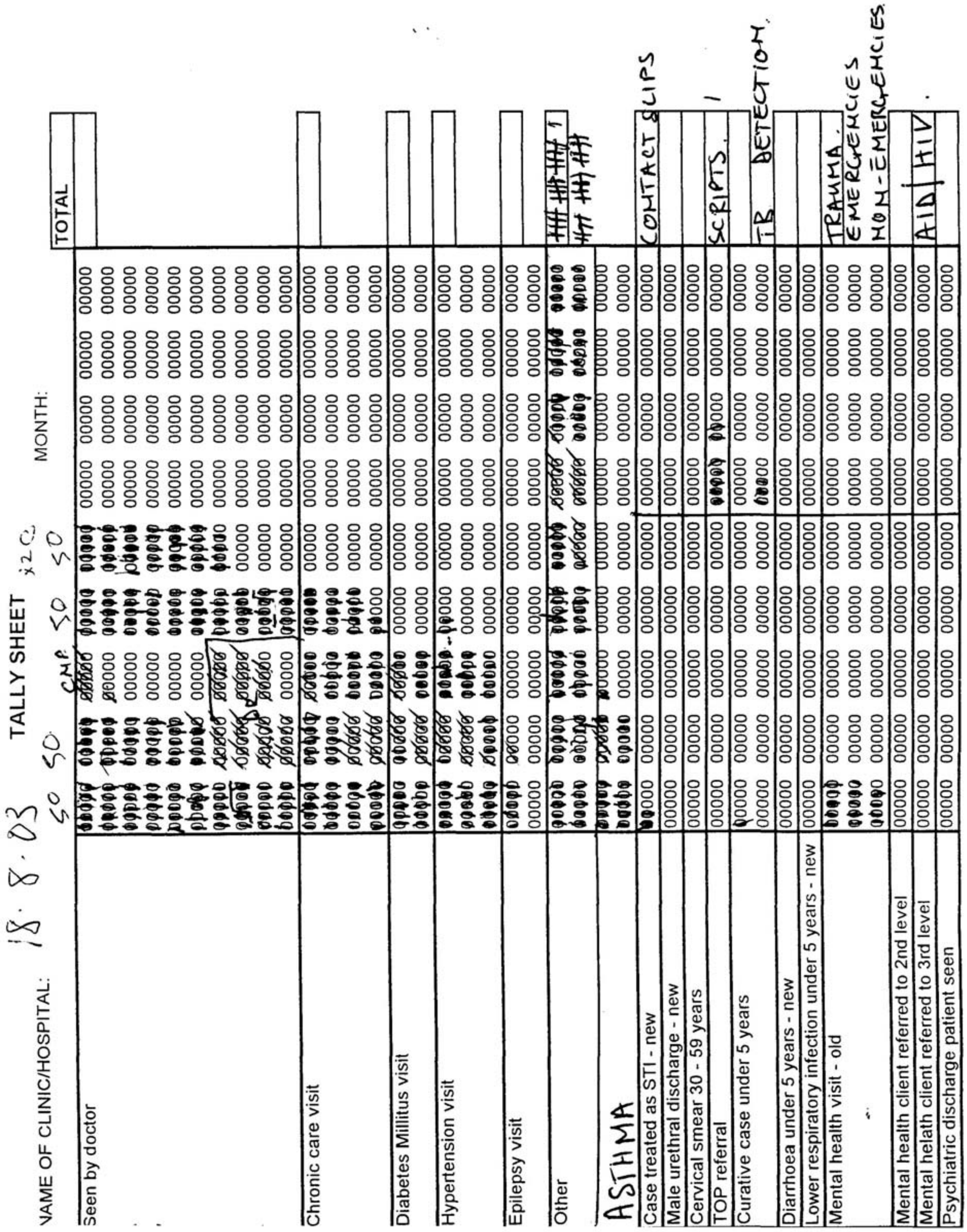


Figure 45. Another tally sheet for counting patients.

CHSO: 126

COMMUNITY HEALTH SERVICES ORGANISATION

..... C.H.C. DATE: _____

Folder Nr.		Folder Nr.		Folder Nr.	
1		31		61	
2		32		62	
3		33		63	
4		34		64	
5		35		65	
6		36		66	
7		37		67	
8		38		68	
9		39		69	
10		40		70	
11		41		71	
12		42		72	
13		43		73	
14		44		74	
15		45		75	
16		46		76	
17		47		77	
18		48		78	
19		49		79	
20		50		80	
21		51		81	
22		52		82	
23		53		83	
24		54		84	
25		55		85	
26		56		86	
27		57		87	
28		58		88	
29		59		89	
30		60		90	

Figure 46. The most common form we saw for counting patients at the PAWC facilities. Clerks write down the type of treatment given next to each number, and counts it all up at the end of the day.
They seemed to prefer this type instead of the tally sheets.

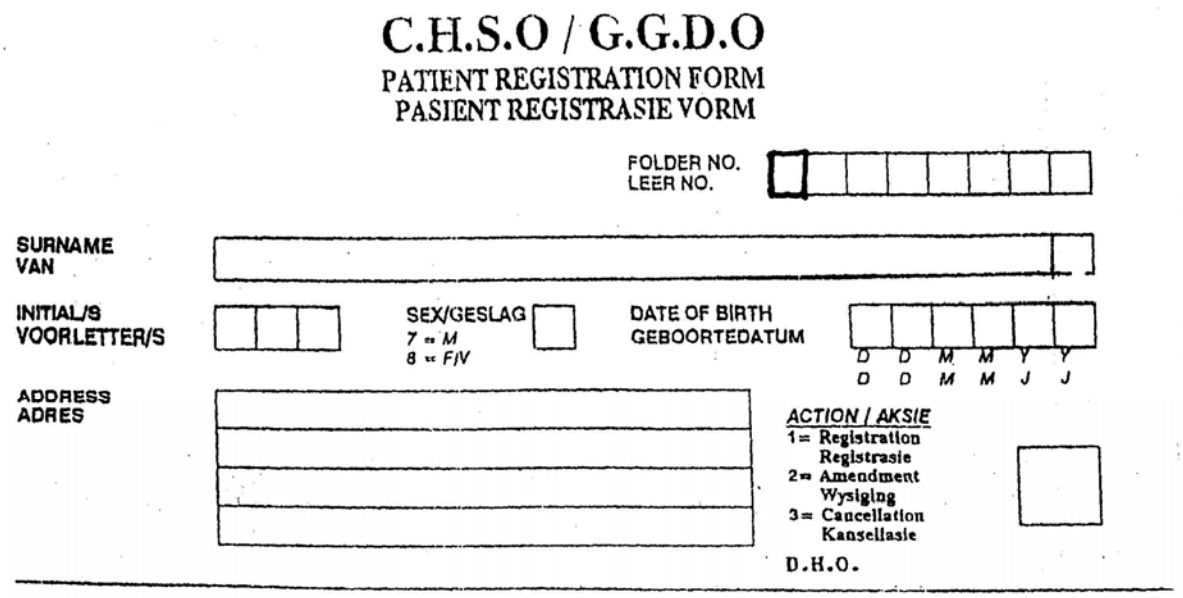

C.H.S.O / G.G.D.O
PATIENT REGISTRATION FORM
PASIENT REGISTRASIE VORM
FOLDER NO.
LEER NO.
SURNAME
VAN
INITIAL/S
VOORLETTER/S
SEX/GESLAG
7 = M
8 = F/V
DATE OF BIRTH
GEBOORTEDATUM
D D M M Y Y
D D M M J J
ADDRESS
ADRES
ACTION / AKSIE
1= Registration
Registrasie
2= Amendment
Wysiging
3= Cancellation
Kansellasie
D.H.O.

Figure 47. Patient registration form.

8.8.3 Accuracy checks on the data sets

The staff members in the facilities are supposed to do accuracy checks on the data they collect before they submit it. In PAWC facilities, all the information work is done manually, and so are the accuracy checks, whereas LA clinics most often use the computer as a tool when checking accuracy.

Three PAWC clinics state that they do no or very little checks on the accuracy, whereas the rest say they do manual accuracy checks. These checks basically involve looking through the data, look for missing values, mathematical errors, and otherwise see whether the data make sense and are within normal ranges.

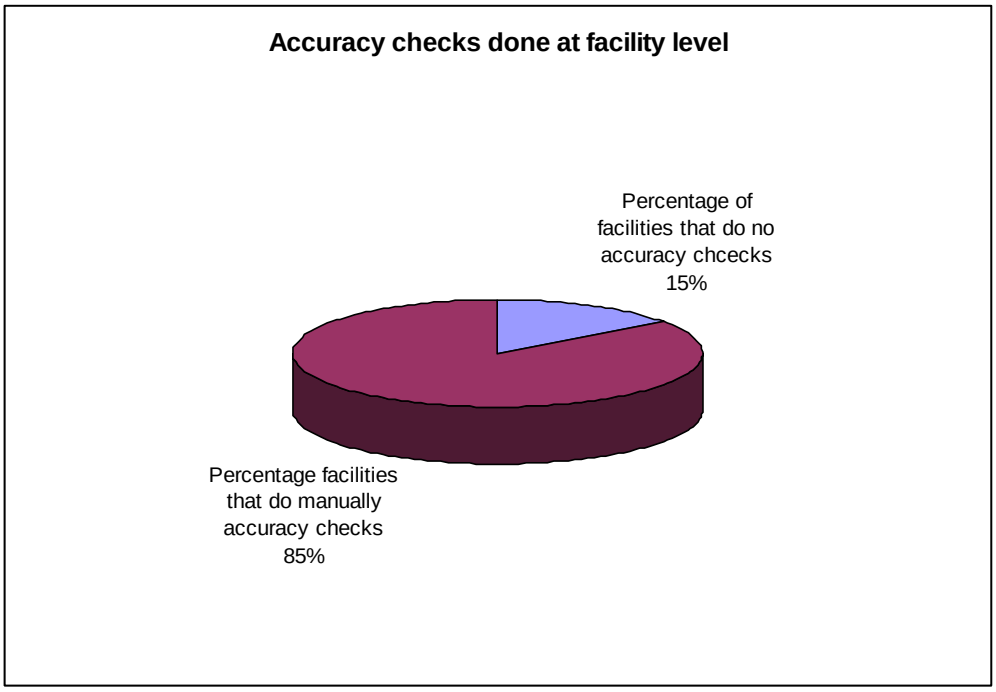


Figure 48. Accuracy checks done at facility level.

Facility workers have good faith in the accuracy of their data, and the majority, 82%, regard the accuracy level to be above 80%. Almost half of the respondents think their data is very accurate, with an accuracy level above 90%.

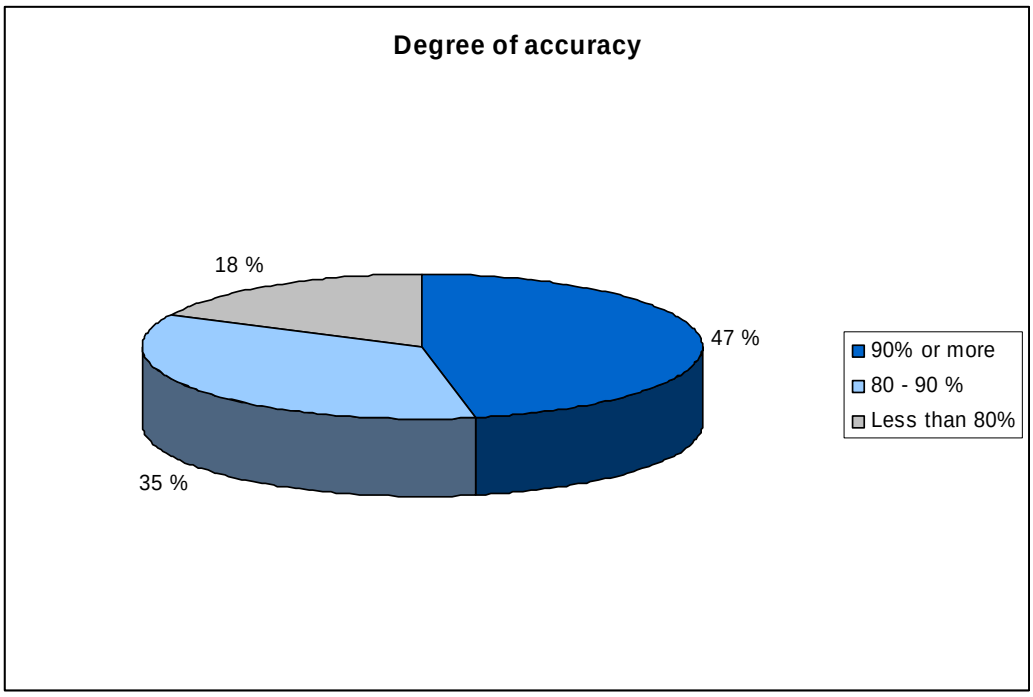


Figure 49. Data accuracy.

8.9 Information use in facilities

We wanted to explore how data is used within the facilities, and asked the following questions for each data set the facility collected statistics on:

- Is information discussed by the staff at the facility? If so, how often and by who?
- Was any information used at *facility level* during the last year?
- If information was used, please specify how that information was used at *facility level*?

As many as 61% of the facilities stated that information had been used and discussed during the last year. However, very few facilities were able to provide examples of *how* the information had in fact been used, so one can question whether the degree of information use is really that high.

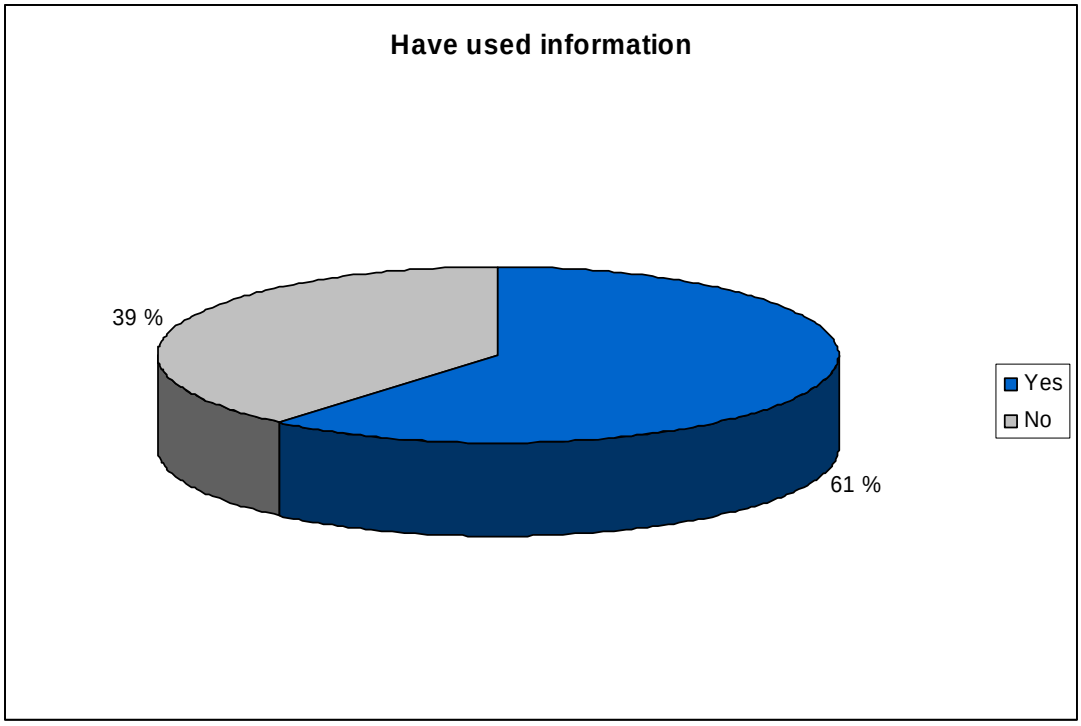


Figure 50. Facilities that have used information.

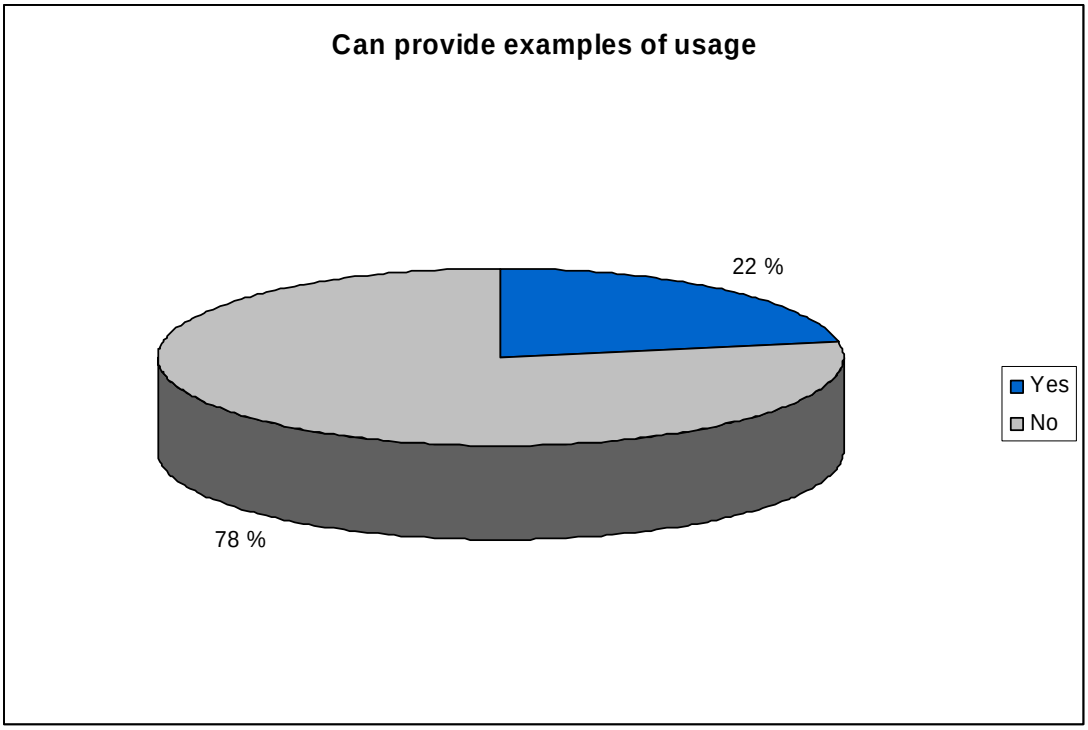


Figure 51. Facilities that can provide examples of information usage.

The few that could actually provide examples of how the information had been used mentioned they that they tried to base the budget on the information, and that they had used it to compare the data with data from other months to see changing tendencies, and that information had been used to increase the insight into different issues like condom distribution. For other examples of information use see Section 8.9.1

It is important and good that information is discussed even if there are no concrete examples of how it has been used, but the goal should be that more facilities actively use information for different tasks and decisions. One of the respondents stated that she did not feel that she had the authority to make decisions based on the information collected at the facility, and another regarded the information to be for use at higher levels and not in the facilities.

8.9.1 An example of information use at Ocean View CHC in South Peninsula

As an example of how some facilities *actually* use information, and that good management due to good information handling/use it is very much possible and can improve both staff's working conditions and health of the patients, we here give an example from one of the clinics we visited.

Ocean View was the clinic that really stood out. We can say off hand that this was the most positive visit we had when it comes to good management and information handling. The facility manager seemed to have full control of the data collection process. She collated all data for the PAWC side of the clinic herself (this was a combined facility), so she really knew what was going on.

Staff hold regular meetings where collected data and information are discussed. They arrange staff workshops and integration meetings so that everybody gets involved and understand the data collection process, its use, what different indicators mean, and how to use information for decision-making. The manager herself does accuracy checks, she pays attention to details of data definitions and she designs forms for the data collection process within the facility herself. She completed the information audit without any hesitation or questions; she understood all questions well and expressed herself clearly in all of her answers.

"It was easy to gain support for the request, once we had the figures to prove the actual need"

– Facility manager, Ocean View

The following information is from the answers in the facility manager audit, and additional information that was given to us after our fieldwork was completed. We requested some additional information to be able to highlight this clinic's use of information even more.

The facility manager at Ocean View mentioned several examples of where use of data had helped them improve their services. Using the statistics they could for instance see that they had got over 140 mentally ill patients. They motivated for a psychiatric registrar that now comes once a week. "*It was easy to gain support for the request, once we had the figures to prove the actual need"*, she said.

In March 2003 Ocean View clinic started with a project called NAFCI (National Adolescent Friendly Clinic Initiative), which is run in partnership with the Department of Health and the NGO loveLife, due to the high rate of teenage pregnancies in the community as well as a quality assurance project. This project's target age group is 10 – 18 years.

The following figure shows that the Ocean View clinic in South Peninsula district has had high teenage pregnancy rates compared to other clinics over the last six year, and has therefore been chosen for the NAFCI rollout.

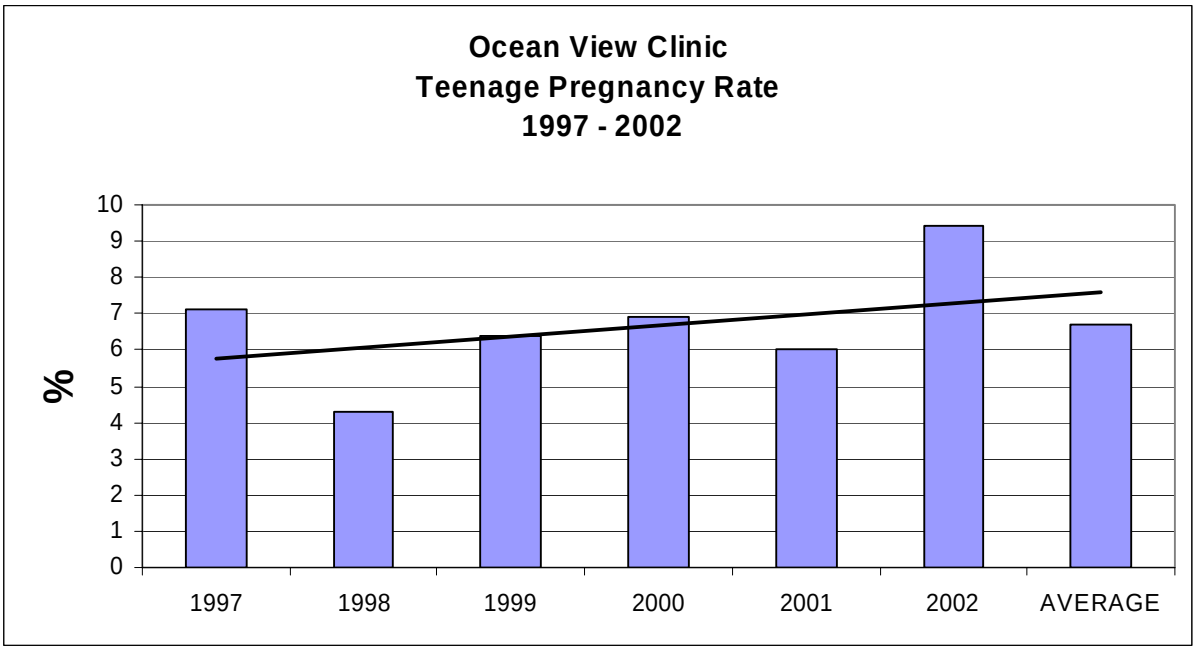


Figure 52. Ocean View shows a high teenage pregnancy rate and this clinic has been chosen for the NAFCI rollout.

This project enables a groundBREAKER (a young person aged 18 -25 years who has matriculated and lives in the community, and is appointed on a 1 year contract post) to be placed at the clinic to run outreach programs in the local schools. These programs focus on Positive Sexuality and Positive Lifestyle (Motivation) as well as a new component called Destination Imagination. Unfortunately the clinic does not have the funds to enclose an area for the youth (a chill room) for these activities to run at the clinic after school hours and during school holidays so the groundBREAKER only runs these programs during school hours at the local high school.

Other example of use of data:

- Stats collected on infectious diseases showed 7 cases of meningococcal meningitis in the month of October 2003 in the Southern Suburbs. Because of this data registration and the awareness it has led to, all facilities now do thorough screening to keep the situation under control.
- TB awareness has increased in the community through word of mouth as well as posters and pamphlets in the clinic waiting areas.
- The dataset proved a TB endemic in Ocean View. Thorough screening/TB detection is done.
- Clients for voluntary HIV counselling and testing (VCT) was firstly minimal, i.e. 20 per month. This was seen on the dataset/RMR; therefore all departments were encouraged to increase VCT by testing all Sexually Transmitted Infection (STI) patients, contraceptive services and relevant dermatology patients, etc. Now VCT has increased to 45 per month.
- Statistics collected on drug management show that the number of items issued to one client is +/- 3-4. Very few clients are issued less than 5 items.

- Oral health: presently they are putting together a report to show the need for a satellite dentistry service. Numbers seen are far too high for one dentist, and the dentist is working overtime (until six every day). The proposal has been put forward to employ a full-time dentist and dental assistant at Ocean View clinic – this has been discussed at provincial level and the clinic is currently awaiting a reply as to the commencement date for these services.

Other initiatives started by the clinic are:

- All TB clients are required to have a HIV test.
- O.T (Occupational Therapy) is offered to clients in groups only.
- Rehabilitation: all stroke clients referred to O.T. on a weekly basis.

8.10 Information flow

The information flow for the RMR is, with few exceptions, the same for all PAWC units. Figure 42 shows how information flows in the system.

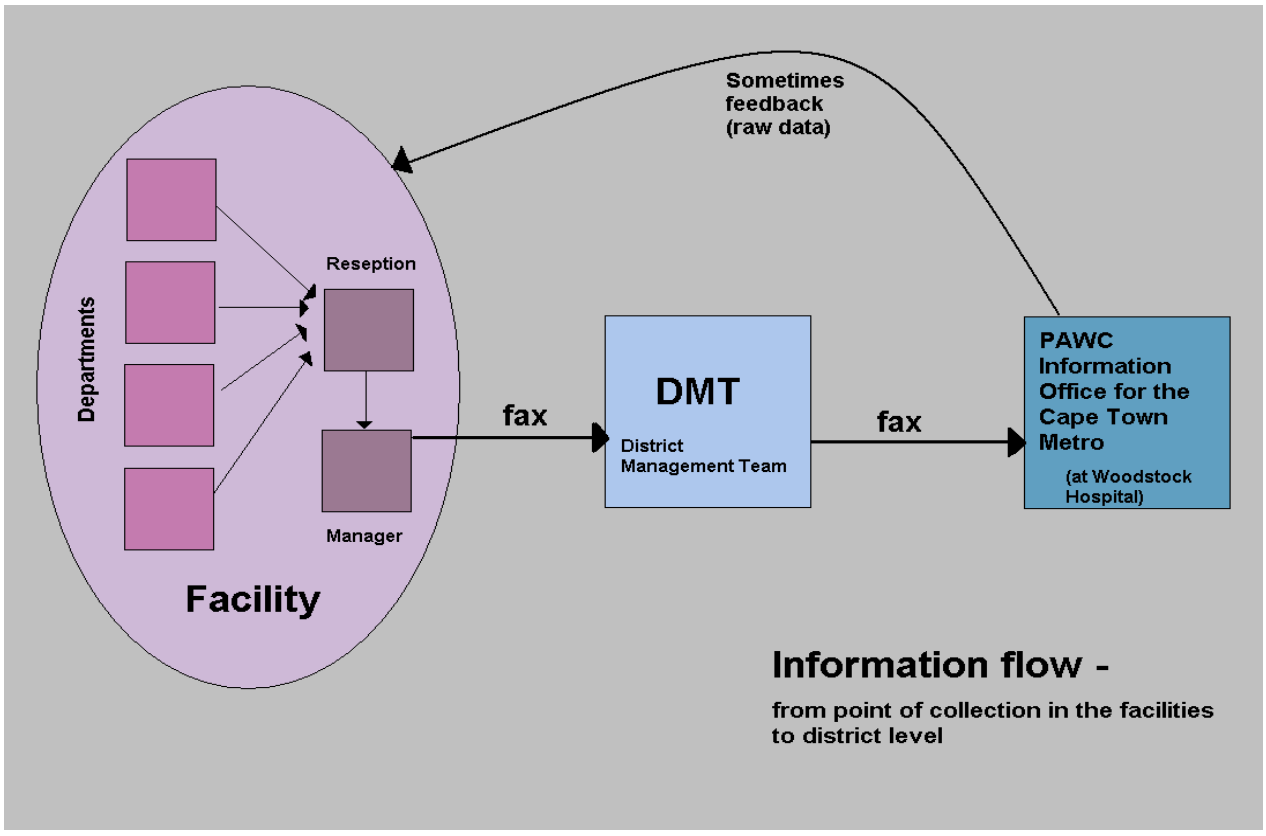


Figure 53. Information flow – from point of collection in the facilities to district level.

The large majority of facilities stated that the information comes from all different departments within the facility, goes to the reception, where it is collected and gathered, and then to the facility manager who checks the data. The RMR sheet is then sent to the District Management Team (DMT), who in turn sends it to the District Information Officer located at Woodstock. This communication goes by fax.

There are a couple of variations from this setup. The manager is not always involved in the process. In some facilities all the work with information, including accuracy checks, is delegated to one of the clerks, and the communication goes directly from this person to DMT, without stopping by the manager. In other cases the manager is the person doing all the information work. If so, the reception step is skipped, and all data goes directly from the different departments to the manager.

Another variation is whether the data goes by the DMT office. In some cases the facilities send the data to both the DMT office and to the DIO themselves, and in some cases the data is only sent to the DIO, and not to DMT.

9 DISCUSSION AND RECOMMENDATIONS

In this chapter we summarize and discuss our findings, and based on this give some general recommendation that hopefully can be helpful in the process of improving the situation of the health information system within the facility level in the Cape Town area. Some of our findings can also prove to be applicable to other regions as well.

The themes we discuss are related to our empirical findings from the facility manager audit, interviews with health information management, notes and observations from attendance to meetings and facility visits, and general impression of the health information system in Cape Town.

Fist, we briefly present the HISP situation analysis that was performed on South African provinces in 2002, which we will use to compare with our own findings to see if there have been any changes in the functioning of the health information in Western Cape. We then give our recommendations to what IT-equipment is needed in a facility.

Issues from the audit are discusses under different themes:

- Training, education and support
- Staff shortage
- Feedback
- Data accuracy
- Information usage
- Structure of the health information system
- Data collection, tools and software systems
- View from the staff on perceptions and suggested improvements on the health information system

As from Section 9.12 onwards, we discuss the audit as a tool, other alternative evaluation methods and future use of the information audit within the health sector in Cape Town.

It is worth repeating that the majority of our informants, 60%, in general were positive towards the information system. The commitment and willingness to make things work is also stated by Mbananga and Sekokotla (2002). According to their study, information personnel say they "generally feel that a lot of work has been achieved and ground has been covered, considering where health information started from five years ago" [Mbananga and Sekokotla, 2002]. Studies like the HISP Situation Analysis (2002), Mbananga and Sekokotla (2002) and ours seem to represent a change of attitude compared to e.g. Haga (2001), where a higher degree of resistance is reported.

9.1 The HISP situation analysis performed in South African

districts in 2002

In Chapter 6 we introduced briefly the situation analysis done by HISP staff in 2002. We will use the findings presented in their report to do a comparison of our own findings, in order to:

1. See if there have been any improvements changes? in the health information systems with regards to the information handling and resources.
2. To make conclusions of how well our version of the audit capture the situation within the health information system.

Some of the HISP situation analysis from 2002 presented on the South African Department of Health website includes two major parts:

- Part A: General information about the health district, by the Rural District Health System Project [RDHS Project, 2002].
- Part B: Health and management information system, by HISP and Health System Trust [HISP situation analysis, 2002].

Part A, the general information about the health district, is referred to as the "RDHS Project health district report".

Part B has been conducted (more or less) with the original information audit that we started out from. At least some of the same issues are addressed, but are presented differently. There seemed to have been no agreed standardized way to perform/present the situation analysis (something that correspond to what we were told; see Section 4.6.1.)

Og hva fant de ut?

Alt til hit I 9.1 burte ha stått tidligere I oppgaven

We have only used the data for the Central Karoo District, which was the only situation analysis from the Western Cape Province, and commented on and compared it to our findings in the Cape Town area (in the same province). Central Karoo District is a rural district, but we find the same challenges with the health information system there as within the city area of Cape Town. We refer to this situation analysis (Part B) as the "HISP situation analysis" in the further sections of this thesis.

9.2 Equipping the facilities – what is needed and where?

9.2.1 Technical requirements and placement of equipment

Based on the observations and experiences from our visits in four district hospitals, fifteen day hospitals and 24-hour units and interviews with some of the key persons within the health information system in the Western Cape Province, we came to some specific conclusions about what kind of IT-equipment should be in place at facility level. This is equipment that we think will ease the data collection process, and improve the working situation of the health personnel, which again can lead to collection of updated data of good quality.

We wrote a report (see Appendix B) for the Provincial Administration of Western Cape (PAWC), where we summarized our findings after conducting the computer specification part of the audit at the previously mentioned PHC clinics and hospitals. The report gives an overview of the status of computer, printers, software and other equipment at each facility visited during our fieldwork.

The purpose of this report was to give the administration an overview of the actual resources in the clinics. This will make it easier to prioritise the areas that need new equipment the most, and also help motivating when it comes to budgeting. The provincial administration of Western Cape now uses our findings in budgeting meetings and as a look-up when new requests for equipment are made by facility personnel to see what is already in place.

In the report we also give some general recommendation based on our experiences. This is presented in the following table.

Staff member who need a computer / area where it's needed	**Number of computers needed**	**Number of printers needed**	**Software**
Facility manager (FM)	1	1	LOGIS system, Office, DHIS
Facility Information Officer	1	1	LOGIS system, Office, DHIS
Reception Area	At least one – more if a large reception/many staff and patients	1 (label printing and other)	Patient Folder Registration, Intranet connection between computers in reception
Pharmacy	1	1	Overview of stock, e-mail for orderings

Table 29. Our general recommendations for the small facilities.

The primary concern in equipping the facilities is that every facility should have at least one computer with access to e-mail, mainly because of the Logis system (for more on the software see below). Patient registrations are also an important task, so if a clinic has only one computer, it should be placed in the reception area. Preferably not at the front desk, where the patients are registered, as it is often a very busy and crowded area. This will make it difficult for anyone apart from the receptionist at the front desk to use the computer. The computer should rather be located a bit out of the way, where anyone who needs it can access it easily. Another advantage with having the computer in the reception is that this often is a fairly secure location, maybe the safest site in most clinics, in terms of risk of theft, because staff mostly see to it that the door to the reception is locked at all times, and security personnel often keep the reception under surveillance.

It would be useful to have a couple of PCs for administrative purposes. These could be placed in the facility manager's office and the reception, but it might be just as well to have them somewhere else, where others of the staff members can access them if they need to.

Thirdly ingen first og second, if there is a pharmacy at the clinic, another PC should be located there, to facilitate ordering and stock keeping.

Minimum requirements for a computer in a critical workstation are no less than 130 MB RAM and 10 GB hard drive size. When buying new computers, the question about size is not

likely to cause a problem, because the speed and size of new computers will exceed our recommendation to these requirements.

If one is to move faster and newer computers within the facility to areas where they are more needed, computers that do not meet these requirements should not be placed in the critical workstations, they should rather be used for other purposes like training of staff e.g.

When it comes to the need of cabling, one can assume that if a new computer is to be installed where there have not been any computers before, full cabling is needed. This must be budgeted for and supplied together with the new equipment.

It is necessary for the computers in a reception area to be connected through a server. This can be expensive.

In the long run, the aim should be to give all units and wards within a clinic or hospital their own computer with printer. At the moment the main priority is, however, to make sure that every clinic gets at least one computer. It should also a priority to give pharmacies and other units with a large degree of independence, such as dental offices, their own computer.

We mention pharmacies here because there is a movement towards doing the ordering and stock keeping in the clinic pharmacies electronically. Because of this, it should be a priority to give pharmacy staff easy access to a computer with network access. Ideally, each pharmacy should have at least one computer of their own, but it would be of some help if the pharmacy staff just had access to a computer with the specific software in the clinic.

Other equipment needed

- Telephones
- Copy machine (a least one)
- Fax (a least one)

The need for telephones is obvious. Fax machines are needed to fax in RMR reports for instance, and equipping the facilities with copy machines will allow them to be self-supplied with different data collection forms.

9.2.2 Software requirements

Table 29 shows, in additional to the hardware needed, the type of software that should be installed on the facilities' computers. Now, we go deeper into the reasons for why especially these applications are relevant.

Logis

Recently, a new system for ordering stock has been implemented in the Cape Town Metro. The system is called Logis, and is computer-based. As the ordering is done by mail, the system requires that the clinics have a computer connected to the net. Several clinics have no PC at all, or there is a PC, but it is not connected to the network. In these cases, someone, often the facility manager, has to go to their District Manager Team (DMT) office or to Woodstock (PAWC, regional admin. office) to get the ordering done. This is extremely time consuming, the manager must often use one whole working day to get this done. Because of password problems some have even reported that they had to use two full working days.

This way of carrying out the ordering is in no way acceptable. A much more flexible backup for ordering has to be in place for those with no computer in the clinic. A backup plan is also important since it is likely that computers or network will break down from time to time.

We are not familiar with how the ordering was done prior to the Logis system, but one possibility might be to let the facilities without computers, do it the old way until they are able to do it electronically. Another possibility might be to make a new standardized paper-based form where it is possible to tick off which items are needed in the clinic, and indicate the number of items. This form could then be faxed or posted trough to the DMT or Woodstock, where the orders would have to be entered into the system as usual. It is, however, very important that this capturing is not added to the already heavy workload of the staff at these locations. Either the staff doing this must be relived of other tasks, or, as there is a dire need of more information personnel in the Metro, this could be one of the tasks included in such a post.

The ultimate goal, of course, must be that every clinic is connected to the network with a stable and working PC. This will not happen over night, though, and it is an unacceptable option that the facility manager meanwhile must spend so much time getting the stock ordering done.

When we started out with the audit, we were not aware of the problem with the Logis system, and also, the system was implemented almost at the exact same time as we started our investigations. Therefore, it was not until some time had gone that we begun to be aware of the problems staff experienced with Logis. This is why we do not have the complete picture of how many clinics that have encountered problems specifically regarding Logis and the procedure of ordering. The ones we do know have been struggling, and have stated so explicitly, are Kleinvlei, Scottsdene, Hout Bay, Oceans View and Grassy Park. Other clinics that did not say anything about Logis, but are bound to have problems because of lack of computers or E-mail access, are Khayelisha, Vanguard, Mitchell's Plain and Retreat. The DMTs should be able to provide an accurate overview over which clinics have encountered problems, since they are the ones that have had to help out with the stock ordering.

Microsoft Office

Most of the users with some degree of computer literacy are familiar with Office (Word and Excel in specific). All courses held for health personnel seem to have been on Windows, not Unix or Linux which have the benefit of being free and open software compared to the expensive licences on Microsoft Windows and Windows applications. The health sector uses a lot of money on these expensive licenses, and there should rather be a movement towards using free and open software within this sector. In the meanwhile, Word and Excel are applications that must be installed on facility computers, because they are used for a multitude of purposes (letters, reports, graphs, DHIS, etc.).

DHIS

A major benefit with the DHIS is that it is free and everyone can use if. This application should be installed within the facilities for use with the RMR – the facilities can enter the stats into the application themselves, and send the generated RMR electronically, instead of on paper, to the district/regional level. It would save a lot of time for the managers at the higher level, not having to enter all data from every clinic in the area. They could then focus on other things, like data accuracy, feedback and training of the facility staff.

However, if this task becomes too demanding for a clinic; say nobody has the right training, there is no extra personnel for doing it and that it would take up a lot of time compared to completing the paper-based RMR – the clinic should not yet be required to carry out this task.

Patient Folder Application

Each clinic should have the Patient Folder Application (or any other software for electronic storage of patient data) installed and in use at the reception area. Having the patient data electronically would save time and space. Clerks spend a lot of time looking for patient folders in overfilled shelves. Being able to just look up a patient on the computers is much faster (if they know how). Many of the reception areas we saw were almost completely full, and staff members worry about where to put folders next. Electronic versions of patient folders would solve this problem. However, a reliable and effective backup system must be in place, so that no data get lost and that patients can get treatment even if there are computer problems!

Extra staff must be put in when clinics go over from a paper-based system to an electronically one, as the amount of patient data that must be entered into the computer system is enormous. Facility staff is already busy enough with everything else, and this task cannot be added to their workload. One clinic we visited had a relatively new computer, and we asked if they wanted an electronic patient system installed on it. They answered that it would not make a difference since none of them would have time to enter in all the data anyway. They would just go on with the old system.

If in fact the Patient Folder Application (latest version) is implemented and used successfully, there are other benefits with it than the ones mentioned. One can for instance automatically produce monthly reports, instead of doing it all manually. If done right, this would be very timesaving for both facility personnel and management at higher level. If the latter is put into practice, the District Health Information System (DHIS) developed by HISP is likely to be redundant, as the Patient Folder Application would take over the monthly reporting.

Software for the pharmacies

Because of the movement towards doing the ordering and stock keeping in the clinic pharmacies electronically as mentioned above, the pharmacy staff should have easy access to a network computer with their own specific software.

9.2.3 Installation of equipment and software

With the equipment there must also be someone to install everything so that it is ready for use. We have seen some extreme examples, where computers have not even been taken out of the boxes and just collect dust for months, even years. Nobody at the facility had the skills to do this themselves. Some argue that if the facility staff really wanted too, they would have gotten the equipment up and running, by pushing harder for someone to come and install the equipment for them. However, we feel that the facility staff should not be punished for not trying harder. Instead the conditions should be made easier, and the staff should be able to focus on their most important tasks, namely the patients. There can also be several reasons for why the staff is not more eager to get new computers running; they might lack computer skills and would not know what to do with the new equipment anyway, heavy workload etc.

The right software should be installed with the computers so that they are ready for use right away. In Ocean View clinic they had a functioning computer with network access. Still, the

facility manger had to travel quite a distance to do her stock ordering on the Logis system, because nobody had installed the system on the computer in her clinic.

9.2.4 Comparison to other research done on IT-equipment status in Cape Town

As we do not know of any other detailed situation reports on computers and other equipment within the Cape Town area or Western Cape, and the fact that the earlier conducted HISP situation analysis did not include a detailed summary of equipment status at facility level, we have not been able to discuss our findings on this issue in more depth. sammenlikning

The only comment to the situation on equipment and the computer situation that was made in the HISP situation analysis was:

"It is clear […] that there is a need for at least one computer in each of the local municipalities for capturing data. The computers will allow for greater accuracy of data and easier accessibility to information. Other equipment needs can be attended to during the course of time. These needs must not however be perceived as irrelevant because they add value to the functionality of information systems."

"[…] equipment needs […] must not […] be perceived as irrelevant because they add value to the functionality of information systems."

– HISP situation analysis, 2002

[HISP situation analysis, 2002, p.5]

From our findings in Chapter 8 we saw that 46% of all computer and 25% of all printers we investigated were inadequate, meaning not fit to handle the workload. 36% of the PCs run a Windows version 95 or older. We conclude that there is a relatively poor standard within the majority of the PAWC facilities.

9.3 Training, education and support

To have an optimal data collection process, information flow and feedback one needs to have the right support functions in place throughout the information system.

We conducted information audits in both local authority clinics (preventative) and in provincial administrated clinics (curative), and early on we discovered some advantages with the local authority system. Each district has a district information officer who handles the information flow between facility level and the regional level. Amongst their responsibilities are data collection, data analysis, feedback of the routine monthly report (RMR) that they receive from all clinics each month, and training of staff on information handling. They are available for facility staff whenever they need support and help. They report to and get feedback from the regional level.

In the provincial administrated clinics (PAWC) there is no such person in place at each district. Two persons cover the whole Metro region (52 clinics and 4 district hospitals) when it comes to training on information handling and collection, entering and feedback of the RMR. Consequently the facility personnel do not get the training and feedback they need. This result in un-motivated and frustrated staff with little or no owner relations to the data they collect. This does not improve the quality and local use of collected data.

Local Authorities also have regular meetings where they discuss the monthly results, give each other credit for good performance and motivate each other. Courses in information handling and computers skills are offered to all staff. Such arrangements are few and far between for staff at the provincially administrated clinics.

There is a substantial need for training among the staff in the facilities. In the audit piloting the vast majority of the people we spoke to asked for more training in everything from basic computer skills and information handling to more advanced courses. In fact we counted 17 out of 20 facilities who said they wanted more computer training (see Section 8.7).

The training is needed in all areas of the information work. These areas can roughly be divided into four:

- computer skills
- handling and interpreting information and turning data into information
- using specific software programs
- general updates

We talk a lot about computer training here, because this was what facility staff stated to be the highest need for. During our auditing process, facility staff did not request training on health management as much as computer training and we think the reason for this is that most staff feel that it is up to higher levels to use the health data that they collect. But in order for the facilities to be able to use the data collected, either on paper or with computerized tools, they need additional training on health management. This should be the next focus area. Provision on health management training from higher levels indicates that facilities should use information locally, and that they are given the power to do so.

The South African health review plan from 1998 states that the National level has a clear policy which says that "*health managers should be supported in acquiring the skills required to manage a decentralised health service*" [SAHR, 1998].

The South African health review plan further states that "*over the past four years* [1994-1998] *the number of health personnel undergoing management training has increased significantly. Particular emphasis is being placed on providing management development training to middle level managers who are – or will be - responsible for running district programs and health facilities*".

The Health Review states that an emphasis has been put on training managers who are responsible for running health facilities. However, we have not seen concrete evidence or any fruitful results from this initiative during our fieldwork in the Cape Town area. The general opinion among facility managers was that they were left out of the process towards district/local management, and that almost no one had attended specific health management training courses. This was also the case when HISP conducted a situation analysis for the rural Central Karoo District in Western Province in 2002 (see Section 9.3.2.).

Therefore, with regards to management training at the grass root level, one does not seem to have come far the last 10 years, at least not in the PAWC facilities. Large turnover in staff, staff shortage and long ongoing restructuring processes that have led to demoralization of staff can be some of the reasons why this is the situation today, in addition to that the

government has not provided enough resources for training needs within the health information system.

Who should provide the training and when?

Who should provide the training, who should receive it, when should it be given, and what form should the education take?

We recommend that training should be performed by personnel at district level, as is done and seems to function well at the Local Authorities' side of the health system. At the moment, this task will often fall on the District Information Officer (DIO). Depending on the size of the district and the workload of the DIO, this might be appropriate. But in Cape Town, where only two people function as DIO, this is far too extensive.

Another alternative could be to have a dedicated trainer in the district, or have a couple of districts share one trainer. This solution requires extra resources since more people must be hired and trained for the training. The benefits are that the workload on the DIOs and perhaps also district managers will decrease, and trainers will become experienced in knowing what the training needs are, and how to put together different training arrangements and sessions.

As we move towards a more and more computerized world, the goal should be that all facility staff should be computer literate. Whether all members of the staff should be trained at the same time, depends on the size of the facility, as well as the resources allocated for training. Most importantly, the facility manager and the receptionists/clerks should receive computer training.

The timing of the training is important. When it comes to new equipment, and when the equipment is up and running perfectly, staff training and continued follow-ups (e.g. workshops) must take place as soon as possible, so the staff can start to use it as soon as possible immediately. This applies to all types of training – staff must practice what they learn shortly after attending courses.

Training and new computers

It is important to have working, updated computers in the facilities, but it is equally important to make sure staff get the necessary training in order to make use of the computers and software. It is also essential that the staff get help on setting up new computers and printers. We have seen examples where new computers have been stored away in boxes for months and even years, because no one has provided help in setting them up. Repetisjon Before assigning PCs to the facilities, it must be ascertained that the resources to set them up are in place as well.

Therefore, when new computers arrive at facilities, there should be some contact between trainers and the staff to make sure that the computer is working, and the staff know how to handle it. In facilities that earlier did not have any computers at all, the staff should with no exception get training as soon as possible after the PC has been installed, and no later than two weeks after. The training should take place at the facilities, with the specific PC that has been installed. It does not matter if the staff recently has been trained in computer use elsewhere, because there is a big difference between attending a course and having to work a PC in the facility. In some cases the computer might be so different from what the staff is used to (newer versions of applications/programs etc), that a short training session in the

facility with the computer in question, would be beneficial for facility staff. If the staff already are computer literate, that is fine, and the training does not need to be very extensive, but at least the clinic needs to have someone visiting them, making sure that the handling of the computer runs smoothly.

So, it should be considered a rule that any facility that gets a computer for the first time gets in-house training on the computer. This is to ensure that the staff are able to use it, because in many cases the staff have not been taught computer skills in years, and if they have not worked regularly with computers, it is very likely that most of what they learned has been forgotten over time.

All this means that there has to be available training resources. At the moment, this is not the case. It might prove difficult to change or decrease the workload of staff in the IT-management, so the best solution might be to hire one or more persons for a short period of time, or on a more permanent basis, to do the training with the staff at the clinics.

More computer training in health education would improve health facility staff's skills and make the introduction of computers a lot easier on all parts; on themselves; on trainers as training would not need to focus just on basic computers skills but instead on more advanced training; and on the health sector as a whole because less recourses will be needed for this type of training. In fact, specific courses on computer literacy are now being offered during nursing school, so the next generation nurses will have had more experienced with computers.

The point of having proper training and support can not be stressed enough. Resources must be allocated to this, because only buying computers is of little or no use if people do not know how to handle them. *If training cannot be provided along with the computers, the money spent on the computers might very well be wasted!*

Training and new software

The flora of software in the public health sector in South Africa is still quite young, and still there are functions in clinics and hospitals that are not covered by the computers. Also, it still remains to be seen whether the health information system in the future will consist of a few large software systems, or several small ones.

Nevertheless, there will be needs for training in specific software programs, and this training must be continuous, both since members of staff come and go, and because the software in many cases will develop and change. In addition, there will often be a wish that the users become more advanced in the use of a software system, and this requires further training.

What is extremely important is to remember to allocate enough training resources whenever a new kind of software is to be implemented. Staff that will use the software must get training prior to the implementation, and there should also be a system in place to follow up and pick up any difficulties *after* the implementation. Smaller workshops might be required once it is discovered where the challenges with a new system lies.

Training because of staff turnover

The training needs are increased because of the large turnover in staff. It happens very often that members of the staff take the opportunity to seek better conditions and higher salary overseas – mainly in Europe or in the US. At facility level, these people are often well educated and work within management, like facility managers etc. When they leave, they take

with them a lot of experience and knowledge. When they are replaced, the new people must get the necessary training as soon as possible, and the more training the person has *already* received, the less problematic the replacement will be.

The large turnover in staff nurses only? is also a reason why it is important to give extended training to as many of the staff members as possible. If it is possible, a couple of other staff members should go along with the facility manager to advanced courses, and by doing this, making the manager less invaluable.

In addition, there should be focus on making incentives for keeping the staff in the country, and finding means to avoid this so-called brain drainage. Mechanisms for keeping staff could for example include promises of specific training and courses if they stay for a certain period of time, and arranging an interesting, individual career-path.

At the same time, one has to recognize the fact that a lot of well educated staff members leave, and the ones who replace them need to be educated as well.

Becoming electronic

More and more information is kept electronically, for instance patient folders. In the time to come an important task will be to type folders, which currently are paper-based, into the computers. Most likely, this typing will be the responsibility of clerks, and it is very important to make sure that the clerks have a good understanding of medical terms, to eliminate errors when submitting data into patient folders. It might also be wise to have a doctor or a nurse look through at least some of the electronic folders, to minimize the chance of errors.

Health workers in Norway have reported the problem of errors in electronic patient folders, and believe an important part of the reason is that the typists know too little about health terms to recognize errors before they type them. Johnson (2001) points out that data errors have become a more relevant issue as more patient information is collected and stored electronically. The health sector in South Africa should aim at limiting this problem by making sure that the clerks have a good understanding of and training in medical terms, and that they are given enough time to type the folders (lack of time will increase data errors). In addition there should be a system in place for ensuring the quality.

9.3.1 Documented need for training in Cape Town

That there is a huge need for more training on all aspects of the health information system, as our auditing showed, is nothing new. There is a substantial awareness within the management at the highest levels of the need for training amongst all groups of health workers.

In the business plan for the Western Cape Province [Business Plan WCP, 2000] the need for training is documented in a proposal for a strategy to strengthen the overall district health system; "*For the information system to work, trained staff are needed at all levels of the health system*". For the rolling out of the District Health Information System (DHIS), training currently needed is identified:

- General orientation of staff to the DHIS

"For the information system to work, trained staff are needed at all levels of the health system."

– Business plan for Western Cape Province

- Training of district and hospital management teams on the DHIS
- Training of facility information coordinators and their sub-district/local authority supervisors
- Each district will have a core of "super users who will be used for a day to day trouble shooting".
- Intensive training of staff will also be needed in basic computer literacy.

The stated need for intensive computer training in this report applies well with our findings. As we do not know the future of the DHIS and the fact that it was not operative in the major part of the facilities we visited, we have not made any recommendation on specific training of this data collection tool.

The training need in the business report is general for all levels of the information system, and gives no detailed plans or suggestions on the types of training that should be offered to the facility staff in specific. It is therefore difficult to do a more thorough comparison of our recommendation to the strategy of the management within the health sector in Cape Town. However, we feel we have emphasized the need for training on information *use* at facilities more than what this reports does.

It seems to be a repeated focus within the whole health sector on improving the data collection at facility level by training the staff on specific data collection procedures. Training on the use of health data, however, is reserved the higher levels.

9.3.2 The HISP situation analysis on training needs

The situation analysis made by the HISP staff showed, like our analysis, that "*none have attended any structured information systems courses presented by UWC at Winter and Summer School, or the ESATI Summer Schools. Furthermore, HISP, CHESS and HST have not been active in this District to date*."

The additional types of training needed were mentioned to be (some answers in Afrikaans);

Type of Training Required	**Group who should be trained**
Information Systems Training - Computer Literacy	Management – Head of Health Manager of clinics
Theory in HIS computer Literacy	Program managers Clerks Sisters in Clinics
Computer and theory	2 Klerke by Klinieke Hoof van klinieke verpleegkundiges Sekretaresse Inligtingsklerke

Table 30. HISP situation analysis on training needs.

These findings show that facility staff first of all want computer training. This applies with what we discovered, and that sufficient training is still not offered to this date, and HISP and

other support teams do not seem to have been very active in the Cape Town region, as with the rural Central Karoo District in 2002.

It is stated in the report that the presentation of training later will be expanded "*once more facility and administrative support staff complete the questionnaires*." We have, however not found any more updated information on this.

9.4 Staff shortage

There is no doubt that the health sector is struggling because of shortage of staff. This applies to all divisions – nurses, doctors, clerks and administration personnel. In the election campaign in South Africa, Thabo Mbeki and the ANC promised to create one million new jobs in South Africa [ANC Manifesto, 2004], a nation with an unemployment rate of 28,2 percent in September 2003, according to Statistics South Africa. We can only hope that this election promise turns out to be true, and that the health sector gets a decent share of these new jobs – and according to the election manifesto, there is reason to believe so, as it states that one of ANC's priorities for the next period is to:

"Improve services in health facilities staffed by adequate well-trained and caring staff, with new funds added to the budget to recruit and retain health personnel, improve infrastructure, enhance health promotion and nutrition, promote awareness on, and provide comprehensive care, management and treatment of HIV and AIDS."

[ANC Manifesto, 2004]

Great care must be taken when deciding what kind of personnel should be hired, since there is a need for personnel all over. It might be tempting to mainly go for more nurses and health care providers when seeing the endless queue of patients lined up in the facilities. If one wants to make the choice to build a stronger and more vigorous information division, there is, however, a need for more personnel working specifically on health information.

High workload and plenty of interruptions and disturbances prevent the managers from handling and using information properly. *"I am a clerk, I do photocopying, I fax, I am a messenger, I do filing, I type I do everything and when do I become a manager and make decent plans and decide carefully? Look at my files! They are on the floor I do not get time to file them."* [Mbananga and Sekokotla, 2002]

The Mpumalanga study specifically mentions that if nurses do not see that the data they collect is used and they are under high pressure, they just change dates and use previous statistics. "Who can blame them?" Mbananga and Sekokotla (2002) ask.

Trained staff do not have the time for the tasks they are trained for [Haga, 2001]. This is still the case, according to our study.

Hire DIOs!

We think that a good place to start to deal with the staff situation and improve the information handling is to hire more District Information Officers (DIOs). An approach like the Local Authorities in Cape Town have, with one DIO in almost every health district, seems to be successful. It might not be possible to hire the same amount of DIOs for the PAWC side instantly, but anything helps.

A DIO should be qualified for handling information, and should also have good computer skills. An understanding of what goes on in the health sector and knowledge of different health-related terms is necessary, so the demands on a DIO are very high. Providing that new facility staff are hired, one place to recruit new DIOs might be among today's facility clerks or managers, as they have many of the qualifications mentioned. But we strongly underline that this is provided that new clerks and managers are hired, as no facilities can afford to lose any of their workers.

In our interaction with a few District Information Officers at the Local Authorities, we got a picture of their responsibilities, and a description of a DIO's work is also included in the health workers manual [DHIS manual]. Here, we mention some of the tasks we think should be included in the work of a PAWC DIO as well:

- Collecting the RMR from the facilities every month, and also assist the facilities in their collection of the RMR.
- Give feedback, first and foremost on the RMR, but also on other fields concerning information. The feedback must be useful and understandable, so raw data is of little value.
- Provide basic training in computer use and information handling for facility staff, and have an overview and plan of what kind of training is needed where.
- Assist the facilities in finding ways of using information, and ensuring that they use the correct information for the purpose, and use the information correctly.
- Assist anyone who needs tailored information within and outside the health sector – facility personnel, district management, researches, media, the community, and others.

More clerks

With regard to information work, there is also an additional need for more clerks in the facilities, not only at district level. As the situation is today, we got reports that facility managers were forced to do clerk's work instead of her own tasks because of the shortage in staff. Other places, information work piled up, making huge backlogs that were very difficult to push down later.

Another problem, as we se it, is that the facility manager, in addition to being a manager (and a clerk as mentioned above), is also a nurse being responsible for treating patients. Jamfør legene I Mozambique - Humberto We think her role should be more administrative and she should see to it that the facility operates at its fullest potential at all times, leaving patient treatment to her other nurses. These two tasks should be separated to a larger degree than the situation is in many facilities at present.

9.4.1 The HISP situation analysis on the staff situation

The HISP situation analysis states that *"given the number of health facilities, the population and geographical distribution, it would not be realistic to appoint information officers for each Local Municipal area. It would probably be more cost effective to identify a staff member currently involved in data collection, who is interested in information and committed to the process. This person could be given time to co-ordinate local information related*

activities, such as capturing data, improving data accuracy and use of information. A further responsibility could include training of staff and initiating Information Team Meetings".

We disagree with the suggestion to *"identify a staff member currently involved in data collection, who is interested in information and committed to the process"*. This would just be to push more responsibility over to facility staff, who already has too much work on their hands. We think it would also be difficult to find a person amongst current staff that would be really interested and committed to this process. They have had very little training on data collection, and first of all they have other tasks of importance to take care of. We think that if a person within the facility should be appointed; this person must be replaced with a new clerk to do this person's former tasks. So, if the choice is to hire one new clerk for each facility or one person or a couple of persons for the whole district we choose the latter. Hiring a clerk to do all information handling within a clinic would not improve the information collection and accuracy either if the facility manager is not strongly involved and use the collected data for local action. We think the best would be to have the facility manager in charge of the data handling in the facility, with one or more clerks having special responsibility for data collection, and then have a district (area) information officer responsible for reporting to regional level, and being responsible for training of facility manager/clerks, give feedback and encourage information usage and joint meeting for facilities within the district to discuss information and learn from each other.

RDHS Project's health district report says the following about the staff situation:

"One of the main problems facing the health services is the shortage of trained PHC staff. It is difficult to attract staff to the rural areas and difficult to retain them. The district has suggested that there should be incentives for PHC nurses staff in the rural areas and or contract posts with higher salaries. They also suggested bursaries and recruitment for locals to study nursing".

[RDHS Project, 2002, p.34].

9.5 Feedback

Due to high workload and shortage of staff, feedback from district information management to facility level has been limited and random at the PAWC side. More feedback is something many of our interviewees requested. They also asked for feedback in a more useful and understandable form, since feedback at present mainly consists of raw data (See Section 8.4., Figure 37). Several facility workers stated that they could not do anything other than check that the feedback data had the same numbers the facility had submitted.

We are aware that good feedback is time consuming and complicated, but we think some adjustments should be made in the feedback provided to the facilities.

One should for instance be predictable in how and when feedback is given. Facilities should expect feedback to arrive at the same time, in the same manner on a regular basis. Since the RMR is a monthly procedure, it would be logical to also provide monthly feedback. If feedback is only received now and then, often with several months in-between, it is very likely that staff would not be very interested in it, and have no procedures for the use of it.

One idea for how feedback might be given is that information management write a short leaflet with some statistical focus points every month. The leaflet could be a mix of regular

text, diagrams, and graphs, and should not be longer than a few pages. This can be done for the whole Metro, or, if more DIOs are hired, for each district. There is no point trying to cover all areas in the RMR every month, this will only lead to information overload, and be too much to consume for both the information management and the facilities. If this is done for the whole city, it is not even advisable to include every facility in every graph, but rather pick out some examples, and encourage the other facilities to compare with their own numbers and performance.

Another idea is to hold regular information meetings or workshops, and present the same type of feedback, with some focus points every month. A problem with this approach is that facility staff often has too little time to be able to leave the facility and the work there. Maybe a combination is possible, with both meetings – maybe not every month – and written summaries.

9.6 Data accuracy

It is hard for us to investigate whether the data collected is as accurate as the facility staff say (about 50% stated that the data they collected was over 90% accurate). This degree of accuracy seems very high – implying that the facility staff thinks well of the quality of data they collect. However, in reality it is a well known fact that the quality of routine PHC data remains problematic, and that the "*challenge is to ensure quality data at point of collection*" [Health System Trust, 2003].

This implies that answers to this kind of question in the audit does not necessary reflect the real world. The issue of accuracy should ideally be investigated by an outside, objective actor, or get people from several levels to compare their opinions. This was done in a Health Information Satisfaction Survey for the City of Cape Town [Morrison], and the results are presented below.

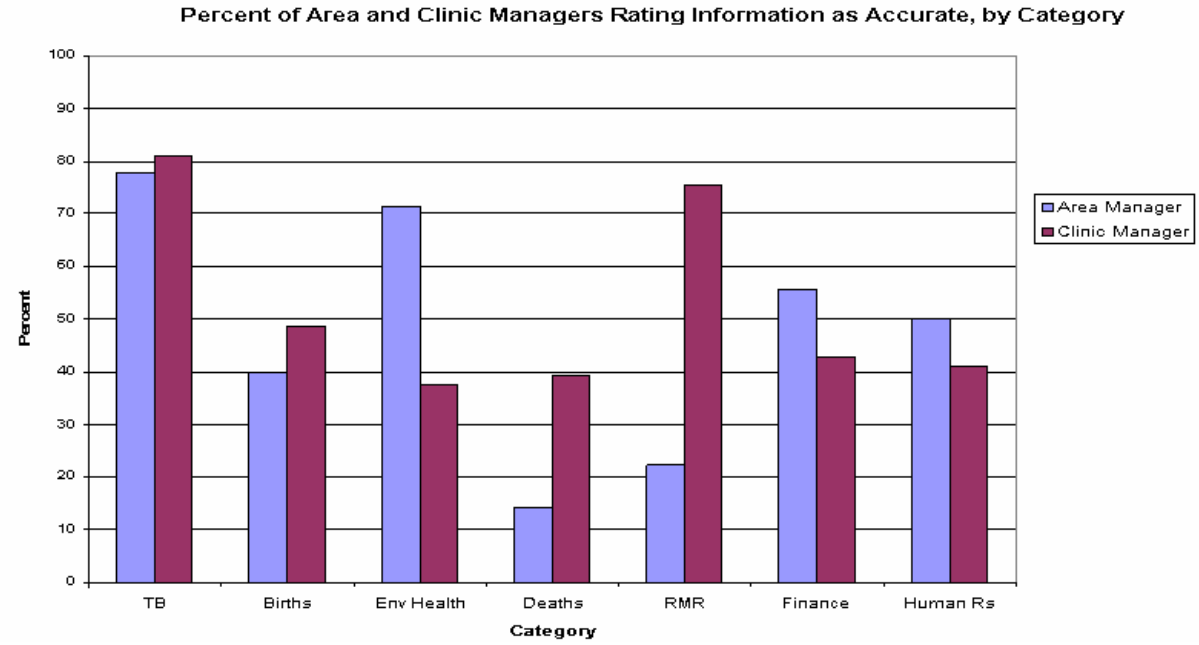


Figure 54. Results from a satisfaction survey for the City of Cape Town [Morrison].

Our findings on the accuracy on the RMR data correspond with what the facility (clinic) managers say in this satisfaction survey. The facility workers' estimated degree of accuracy seems a bit optimistic compared to what district/area managers think. From figure 54, for the RMR category, we see that there is a huge gap between what the facility managers say about the data accuracy (approx. 75%) and what the area managers think (approx. 22%).

This example shows that there is disagreement between the levels on how the accurate the data is, and that several sources must be taken into consideration to measure this more precisely. We conclude that the information audit does not capture the degree of accuracy very realistically, but it gives a picture of the inconsistencies between the levels when it comes to communication and feedback, for instance.

The study performed in the Mpumalanga Province finds the data quality too poor to base decisions on. "The quality of health management information has been described as inaccurate, incomplete and inadequate in informing all the decisions they needed to make. Routine data and level of aggregation appear to be a constraint in concrete decision-making at some levels." [Mbananga and Sekokotla, 2002]

Haga (2001) reports a high degree of erroneous data, data duplication and also different definitions of data items. This tendency is steadily changing towards the better. There are implications that there has been an improvement in the data accuracy. A survey done by the Health System Trust[14] shows an increase in both data input coverage and data completeness within a region in Free State Province, South Africa [Health System Trust, 2003].

Quality Assessment	**2000**	**2002**
Data Input coverage	94.5%	99.7%
Data completeness	78%	94%
Missing records	255	72
Rule violations	726	115
Outliers	43	2

Table 31. Table shows a degree of improvements in data accuracy within a province in South Africa [Health System Trust, 2003].

The general opinion is that there is a tendency of improved data accuracy in the major part of South Africa. Even so, the challenge with further and continued increase in accuracy remains.

However, one must be careful not to rely completely on an investigation such as the one above. It does not necessarily fully discover whether the data quality has actually improved, or whether those entering data have just learned how to fool the system by entering numbers that do not violate any set limits. Information personnel we spoke to pointed out this issue and other studies have also discussed this tendency, e.g. [Haga, 2001].

9.6.1 The HISP situation analysis on data accuracy

When it comes to the data accuracy, we strongly agree with the HISP situation analysis' view that a "*centralized control of a DHIS does not lend itself to promoting accuracy of data*".

"The further data is captured from the data collection source, the more susceptible data is to errors and the less likely that these errors will be corrected."

- HISP situation analysis, 2002

[14] Health System Trust; www.hst.org.za.

"*The further data is captured from the data collection source, the more susceptible data is to errors and the less likely that these errors will be corrected. The cumulative effect is that inaccurate data will form the basis of management decision- making*".

The HISP situation analysis, gave no indications on how accurate the health data elements could be, not even an approximation. It was just concluded that the facility staff would need more training in the process of checking accuracy, along with some general suggestion to improve the situation; for instance validation rules in the DHIS software. However, since most PAWC facilities do not use the computer based DHIS, they would not benefit from this. The main data accuracy checks would then still be done at district/regional level (further away from the data collection source), whereas we think it should be done closer to the data collection source.

RDHS Project's health district report [RDHS Project, 2002] concluded that there were inconsistencies with the data found in the DHIS and the data received from the regional office. This example shows at the DHIS can be used to reveal inconsistencies in health data.

9.7 Information usage

Our conclusion on information usage is that information is used very little or not at all at facility level in PAWC. Others have pointed out before us that the use of data is scarce, and that information seldom is analysed and used for decision making. Our findings on this issues correspond with the findings in for instance [Braa, Heywood, Sunking, 1997], [Braa, Nermunkh, 2000] and [Braa et al, 2001].

This is by no means surprising – most efforts to facilitate the use of information have been directed towards higher levels than the facilities. One example is a research project (see Appendix G; "*Use of Info by Mx research*", by Institute of Informatics at University of Oslo and School of Public Health, South Africa) aimed at discovering why information is used to a limited extent at district level, and finding ways of increase the level of usage.

Due to lack of management experience and knowledge, as well as lack of authority and power, information is seldom used at district level [Haga, 2001]. Earlier research has discovered that workers on facility and district level regard the information system as nothing more than an upwards reporting system [Braa et al, 2001]. This view was represented in our research as well.

It seems that the facilities have not been prioritized in the guidance of how to use information. The limited amount of training and guidance in how to actively use information in a facility is also an important reason why we cannot expect the facilities to use information to a large extent. Sauerborn (2001) claims that good quality data leads to information usage, but we see that this issue is much more complex, and also includes elements such as training, motivation and proper tools.

Even so, some facilities have made use of the information of their own accord, and have obtained good results. In section 8.9.1., about the Ocean View clinic, we presented the best example we found on information usage from our fieldwork. Here, information was used in several different ways, and it was the staff and manager themselves that came up with areas of use for their information. LA clinics had a better record of information usage than PAWC

facilities, according to the visits we made in LA clinics, as well as statements from LA information officers.

Own initiative is of great value and Haga (2001) points out the importance of dedicated and enthusiastic personnel, and how central they are in driving the information process forward and inspiring local staff. We also saw the impact of such key persons, and we notice that we still find dedicated personnel in the same districts as Haga (2001) did, e.g. in South Peninsula. Even so, others should also be given the benefit of using information in planning and projects. And when initiative does not come from the grass root level, it must come from above. But it is important that information usage is not forced on the facilities – there should rather be a dialogue between the district information officer or district manager team and the facility management concerning what kinds of issues one could make decisions or changes based on information. People from higher levels should be tutors in the process, and give assistance in how to use and interpret data, but the actual decisions should come from the facilities themselves. District information officers and district managers will probably have a good picture of what kinds of decisions the facilities can profitably make.

In addition to guidance from higher levels, initiatives should be made so there can be vertical communication regarding information handling and use between the facilities. It might prove valuable and motivating for staff at the facilities to see how others use their information. One way to create such a communication channel is to encourage facilities to present their information use and results in meetings, for instance in the aforementioned regular feedback meetings.

Examples of areas where we got reports of successful information usage, are projects that were started in one facility due to increase in teenage pregnancies, and the discovery of too few cases of Voluntary HIV Counselling and Testing (VCT). The latter leading to more focus on informing the patients about this option, which again led to a higher frequency of VCTs. There were also examples of facilities using the data to substantiate an inquiry towards higher levels, asking for more staff within certain fields of profession. Also, one facility was putting together a report explaining why there was a need for a satellite dentist connected to the facility, basing their request on data from the facility.

As with so many other issues, this is also an issue where the access to resources is important. And again, this is a field where it would help with more information personnel at district level. Such personnel could help and guide personnel in the facilities on how to use information for decisions. But even if the situation could have been improved with more information personnel giving tailored and detailed assistance to each facility, much can be done with the human resources already available, mainly by encouraging the facilities and give some general, simple guidelines as to how information can be used.

But why should effort be put into encouraging facilities to use information when not even the district level has a strong reputation for using information for planning and decisions, according to the research project proposal (See Appendix G). We believe that if the facilities start to use information to a larger extent, they might get a stronger feeling of ownership towards the data collected and information derived from the data. When using information, they will also learn more about information handling and what different indicators mean. Both these elements are likely to lead to more accurate and correct data.

As mentioned in chapter 2.4.3, there is a risk that data becomes too aggregated when it reaches higher levels, and that local information is often lost when data is included in an average for a larger area [Opit, 1987]. This is another reason why decisions should be made close to the point of data collection. Facilities and districts have a better and more detailed picture of the situation around them than the higher levels, and because of this, they are better conditioned to make many kinds of decisions.

This also provides an opportunity for even closer cooperation between facility management and district management – if the actors make a point of sitting down together and discuss how they can use information on their respective levels. By doing so, the levels can gain more insight in each others' situation and work, and this might promote more use of information from both levels.

What we did find about the facility level was that there had been a lot of focus on the data quality and timeliness. This is of course very important, although something that we think becomes uninteresting if one is not supposed to use the data for anything oneself. We experienced that a lot of facility staff just collected data for "somebody else", and that it was not for them to use. This is reflected in the questionnaires about use of information in the audit, where many replied that 'yes' information is used. And when we asked how, they said 'at higher levels'.

A business plan for the Western Cape Province [Business Plan WCP, 2000] mentions that one of the future challenges is "*to ensure local use of information by managers for planning, monitoring and evaluation at district and sub-district level*".

Again, we ask; why should the facility level not be included in the use of information? This seems to be where our recommendations based on findings from the audit, differ the most from others.

A more recent survey [Health System Trust, 2003] agrees more with our views;

- Shift focus from training managers only - to training facility staff
- Involve facilities in plans – common objectives and targets
- Feedback to facilities essential: acknowledge and challenge
- Information to be used at facility level to improve quality and coverage of services (thus acting on own information)

The survey also captured views from the facility staff that were similar to what the information audit did;

- Collecting data for "*somebody up there*"
- "*We are only submitting data because we have to, we have no interest in it*."
- "*We can't make any decisions at our level … we are only acting on instructions from above*."
- "*… rendering services because it is policy and our job… , … it's National's responsibility to evaluate services*."

Hopefully, there is now a growing tendency to shift focus more onto training and information use at facility level. This view agrees with our recommendations, therefore the information audit seemed to capture these issues and concerns from facility staff well.

9.7.1 The HISP situation analysis on data analysis and usage

Data analysis

When it comes to the data analysis part of the audit, the DHIS is mentioned to be the major tool for data analysis. It can be used for generation of standardized reports etc. But because the current DHIS software does not contain any 1996 census population data, it was not possible to calculate any population-based indicators, neither at district nor facility level. A new version (1.3) of the DHIS software would contain this census information, and it would take some time for it to be installed, and before the facilities were able to receive printouts of facility-based indicators to assess the efficacy of their services.

Besides from mentioning that "o*ne facility has a hand drawn graph containing data pertaining to the number of births, deaths under 1 year, teenage pregnancies and TB cases*", there were no conclusions. This applied well with our findings, the number of graphs with analyzed data seen on clinic walls were close to zero.

The new version of the DHIS was available at the time of our visit, but we are not aware of if the facilities had been given printouts of the population data mentioned. The only feedback they received was raw data on the RMR data collected. This was seldom/not used at all for any analysis at facility level (see Chapter 8.4, Figure 37).

It seemed that the lack of information analysis was blamed totally on the lack of population data in the DHIS, but we wonder if this data would not be possible to find elsewhere. And that it would be possible to analyze a lot of health data without these numbers (workload, number of patients cured, measure of health tendencies etc).

Data use

The original situation analysis, done by HISP, gives no specific reasons why the routine monthly report data (RMR) was not used at facility level. For other data sets the reason given is "not responsible". This was also our general findings form the facility level. There seems therefore to still be a general issue that people feel no responsibility of using the collected data for anything - that it still is up to the higher levels to use it.

RDHS Project's health district report [RDHS Project, 2002] say the following about the quality and use of health information;

"*The quality and use of health information needs significant improvement. There are many gaps in the information presented in this situational analysis and some of the information is inconsistent. The collection and use of the health data need more attention. It was evident from some of the data provided that those collecting the data were not always able to provide the correct format of this data, for example, raw data would be provided where rates and coverage (in percentage) were required. This indicates that there is a need for health information training at regional and all other levels of management in the service. The data is probably not used in planning of health services. The HISP program should assist the district to be able to collect and use reliable data for health planning this should be offered on regional and on district and sub-district level. It is essential that the regional office, e.g. from*

Director level to program management level are familiar with the DHIS and how to develop manage health indicator data."

[RDHS Project, 2002, p.38]

9.8 Structure of the health information system

In Section 2.4.3, we quoted the South African Health Review from 1998 that stated that decentralisation is a long and slow process. Six years after, we see that this is still an issue, even though the situation *has* improved. Still, lack of training, staff shortage, motivation and awareness are obstacles in obtaining a decentralised health sector, according to our research. Since the investigations of Haga (2001) formal districts have been created in Cape Town. Among the benefits of such districts are that the hierarchal structure becomes more explicit and that the information flow is clearer. But in PAWC the lack of information personnel is one of the elements that retain the district based information system from functioning optimally.

"*The absence of a District based Information Management Structure, made it difficult to match the questionnaires with appropriate health persons in order to obtain a reasonably complete picture of the data available in the district.*"

[HISP situation analysis, 2002]

Information flow used to be more chaotic, with duplications and data being sent in different directions [Haga, 2001]. As mentioned, a few obstacles still remain, but in this area the situation has generally improved.

As regard to information handling, a very visible difference between PAWC and LA is that LA has Information Officers at district level. Each Information Officer is responsible for information handling in one or two districts. Our opinion, after having visited both PAWC and LA facilities, and talking to information staff at district and regional level in both branches, is that this is one of the main reasons that make the LA information system function a lot better than the PAWC information system. Our impression was that these district information officers see to that the facilities have everything they need in order for their information handling process to function as well a possible. They learn from each other, how to use data for decision making and so on. Facilities that have done well a month, e.g. that can show data that prove they have improved services, are rewarded with a diploma. Problem-facilities where the IO knows there is cheating with numbers to save time are not punished directly in front of the other facilities. One IO we spoke to said she used these facilities' data as bad examples on how somebody fills in numbers they think look ok, without mentioning the specific clinic names. They know the max/min limits of the range numbers should be within, and know what they can fill in, without being caught. The problem-clinic understands that the criticism is directed towards them, and then often improves by next meeting.

In PAWC there are only two employees with the function of District Information Officer, and they cover all of Cape Town.

As we have already mentioned, we strongly suggest more information personnel in PAWC, and we believe that a structure similar to the one LA has would be useful in PAWC as well. Making more use of Information Officers in PAWC may lead to more and better feedback to the facilities and others, and it can help staff in the facilities to use information to put focus on issues that need attention.

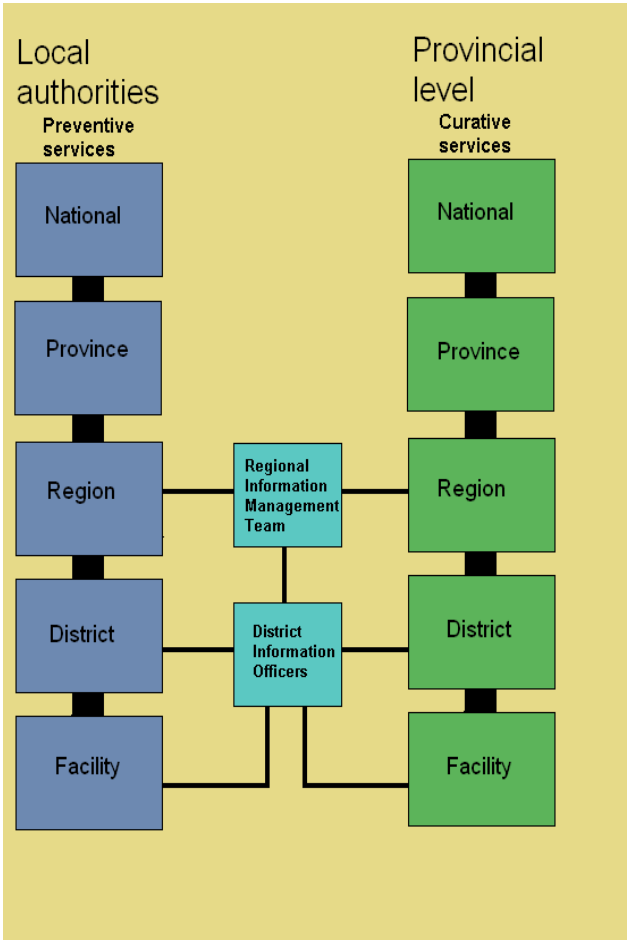


Figure 55. Information management of PAWC and LA could be joined in the future.

Seeing how well information management from LA and PAWC seem to be communicating today, we also take the opportunity to suggest a more fundamental change of structure, namely exploring whether it would be possible to combine the information management for the two branches. This would require District Information Officers in the same manner as in Local Authorities at the moment, and also a joint Information Management team at Regional level, i.e. for all of Cape Town. It is important to stress that it is still necessary to hire more information personnel if deploying such a structure. In fact, there might be a need for two Information Officers in every district – to be able to take care of both of the two health care services. In any case, the work load must not increase on the personnel that already exist.

The benefits of such a structure is that it will be much easier to get a holistic picture of what goes on in the city, and it is logical to gather all the expertise on the field of health information handling in one department. Information flow and feedback will probably also be easier to manage.

In addition, there are the prophecies that Local Authorities and Provincial level will be combined within a decade anyway. If information management begins to think aloud around uniting the information divisions of LA and PAWC already today, Cape Town will have a head start if the branches are combined altogether later. Or maybe Cape Town can even take action, and completely combine the curative and preventive branch now, even if this does not happen in the rest of the country simultaneously.

Facility staff's view and our own recommendation of hiring district information officers to improve the communication, feedback and support to facility level, has also been something the management it the health sector is striving for. We refer to the business plan for Cape Town Province [Business Plan WCP, 2000] again, which points out the need to set up district information centres, consisting initially of a computer and a trained district information officer, with the function of decentralise data validation and analysis to district level. However, we did not see any results of this proposal at the time of our stay in Cape Town.

9.8.1 The HISP situation analysis on optimal structure of the Health Information System in the District

Only two comments (in Afrikaans) to "What do you think should be the Optimal Structure of the Health Information System in the District?" were provided in the report. A general conclusion to the responses was that they leaned towards decentralization of the information structure.

9.9 Data collection, tools and software systems

Data collection and tools

Compared to the amount of data that was collected earlier and during apartheid, the amount of data elements that is collected today is much smaller. So why do health staff still complain about having so little time for the data collection process, when in fact this workload seems to have decreased?

Health personnel are faced with other challenges today than before. Some of the major ones are the change in diseases (HIV/AIDS epidemics), the increase in number of immigrants, and the shortage of staff. The fact that clinics see much more patients today than before, have not, led to an increase in number of available staff to treat these patients. Also, during apartheid, sufficient health services were not provided to the majority of the black and coloured population. By keeping these groups out, less pressure was put on the health system. Today, everybody has an equal right to primary health care, and therefore it is likely that there is still a huge gap between the recourses available and the resources needed to treat a much larger population than before.

"There are too many tally sheets, and this allows for inaccuracies. I think if the system is computerized, data will be more accurate."

– Facility manager

The tools used for collection of health data varied a bit from clinic to clinic. One LA facility manager said; "*There are too many tally sheets, and this allows for inaccuracies. I think if the system is computerized, data will be more accurate*". An A3 form (see Figure 43) that supposedly should be used for head counts was not used at many of the clinics we visited, staff felt it was too huge and unpractical, and instead used a very simple A4 form (see Figure 46). In some clinics, where staff had some computers skills, it happened that managers designed special forms for the different wards and treatment rooms.

A lot of facilities used an old version of the RMR form, as they had not received the new one or not gotten any training on it yet.

We observed that there were few standards or directions to define what data collection tools to use. We refer to what the facility manager said about there being too many sheets, and that this led to inaccuracies. We agree on this point, and believe that if the data collection process becomes more standardized and computerized it will also become more accurate – not having to go through so many steps before reported to higher levels. The data collection process starts when a nurse or doctor sees a patient and the process therefore relies on these people actually registering the treatments given. It would be beneficial that all treatment rooms/wards have computers with computerized systems that are interlinked on a network with the same patient database for the whole clinic. Data entered at the reception and in the treatment rooms should be updated instantly and be available for all health personnel who need it. The interface in the treatment rooms should provide quick and easy patient data capture for the nurse or doctor. Then, *based on these data*, reports should be generated by clerks or management without a lot of additional work needed. This way, nurses and doctors do their job with the data collection, the data collection process becomes more automatic, effective and hopefully accurate, and the analysis and use of the health information is left to for example the facility manager.

However, there may be a long way to go before this becomes reality, and in the meanwhile, facility staff should be able to use the forms they are most comfortable with as this would probably be most efficient and accurate due to the experience they have with it.

The year 2000 business plan for rolling out the District Information System in Cape Town Province [Business Plan WCP, 2000], states that the information system will be computerized at the lowest level possible, but that the system largely will be paper-based at facility level. There was to be no enforced standardization of tools for data collection, but a set of tools would be developed and could be used by those who wanted.

The lack of standardization of tools and the fact that no forced use of specific tools were to take place, applies well with our recommendations based on what we discovered with the information audit. We saw few formal/standard ways of collecting data within a facility. Staff used what they felt functioned best, and they had become experienced with a certain way of doing the collection. We also suggest that they should continue to do so, as changing tools would probably slow the data collection process down, and lead to more inaccurate data, at least for a while. What works, must be left as it is, to put as little extra work as possible on the facility staff.

9.9.1 The HISP situation analysis on data collection and tools

The HISP situation analysis states that the current data collection system within the district is entirely paper based. Within our research area, the data collection system still is entirely paper-based at the PAWC facilities.

The report states that all health facilities are currently (2002) using standardized collection tools that were provided by the provincial office. It says further; "s*ome staff members have designed their own data collection tools to suit their individual needs. In some instances, the data collection tools have been modified to meet the needs of the facility. These practices are often the consequence of the data collection tools not meeting the needs of the staff. Staff can be trained to provide customized data collection forms for community health centers, clinics and mobile units, which will not only assist with the data collection process, but also promote data accuracy"*.

What we saw was that staff used different version of data collection tools, and there seemed to be no standardization of it. The lack of computer/printers and training would make it difficult of staff to design their own tool.

9.9.2 Software systems

What computer systems will be used in the future health sector in Cape Town is very difficult to predict. A lot of unknown factors may influence these decisions; personal interests decides who will cooperate with whom about developing a system; old systems may be renewed or new ones developed; small individually developed systems may gain support from government, and become national standards for health and patient data collection, etc. It is very difficult to draw any firm conclusions about what will happen here.

When is comes to the different computer systems that are relevant for future use today, we refer to Chapter 6, where we have summarized some opinions on this issue among health managers at different levels within the health information system. Our own opinions are very much influenced by the opinions of those who want a system that is based on patient data, like the Patient Folder Application. Adding functionality to such a system for accuracy checks, report making, graphs, etc., would turn it into a very powerful multifunctional tool, which we imagine absolutely can have a vital future within the health sector. We think the DHIS, that is not patient based, soon will be out of date.

To support this view we refer to what the Cape Town City IT Directorate concluded in an evaluation of a TB module in DHIS compared to the locally developed tool; the Patent Folder Application.

The Cape Town City IT Directorate [MIS ICT Strategy, 2003] has assessed functionality, architecture, technology of the Patient Folder Application (here called Clinical Patient Record - CPR) and the TB module in the DHIS against user requirements.

The table below shows a comparison of the two systems.

Feature	**CPR**	**TB module in DHIS**
Data collection	Paper – PC capture	Paper – PC capture
Data storage	Facility level patient data (most)	Facility level patient data (TB only)
Transfer and aggregation	No	Yes
Data access	Does not meet requirement	Does not meet requirements
Integrated system	No	No
Database	Clarion	Access
Scalable	At facility level	No
Network capability	Possible	None
Support	Low	Nil
Current resource requirement	IT Directorate	IT Directorate
Risk	**CPR**	**TB module in DHIS**
Functionality	Low (major basic need fulfilled; pilot outcome good)	High (no basic needs completely fulfilled; pilot outcome uncertain)
Technology	Medium (unsupported database)	High (unsupported and inadequate database)
Current costs	No direct costs	No cost – but high indirect costs (time) due to no support

Future costs (as is)	Re-development and support	SLA with external organisation
Future costs (further development)	Expansion and support (medium risk)	Further development and support by external organisation (high risk)

Table 32. Comparison of two systems.

Cape Town City IT Directorate recommended to;

- Build on CPR application
- Migrate to supported database, meet IT standards for support of business specific application
- Roll out throughout District
- Progressive further development
    - Centralised database and real time access to information

This supports our view that the DHIS may be replaced by a patient-based system like the Patient Folder Application in the future. Cape Town City IT Directorate's main argument against the DHIS TB-module is the lack of local support for the system. With a system that is not locally build, one has to rely on support from outside, which sometimes can be problematic.

Evaluation of a health information system should be seen in comparison with a general health situation analysis for a district. This would resolve any unrealities of why certain data elements do not seem to make sense (very high/low numbers) for example. It would also help put focus to the most important problems, not only specific challenges on processes limited to the information handling in a district.

9.10 Perceptions and suggested improvements on the health information system – views from staff

Perceptions of the information system

60% of our respondents stated that they were positive towards the system. This view is the same as the one that was expressed in the HISP situation analysis; "*the participants are reasonably satisfied with what is being offered by the current information system, but perceive the acquisition of computers as a valuable asset to improving functionality. Computers are needed to assist with decentralization of information and consequently accessibility to information.*" One answer here was that the system was good, but that it would be more efficient if it was computerized.

The response rate was very low on the questions about "What do you think is the *greatest Achievement* of the current Health Information System?" and "What do you think is the *greatest Failure* of the current Health Information System?" only a few answers in Afrikaans were in the HISP situation analysis.

The response rate was much higher in our audit, as can be seen in Section 8.2.1 and 8.2.2. The greatest achievements mentioned were; better services to the patients/easier to evaluate the services, collection and accessibility to statistics, computerisation/software/tools for collecting statistics, better management of stock, to mention some.

Some of the major failures were; too little feedback, lack of equipment, not enough staff, increased workload on specific personnel, too little training, quality of data not satisfactory, lack of motivation among staff.

Suggested improvements to the information system

Answers in the HISP situation analysis to; "What information currently NOT being collected, do you think should be collected?" were either nothing or that the "the total amount of children on the malnourished register in their different target groups" should be collected in addition.

The answers to "What information currently being collected do you think is of NO VALUE (or very low value) and should not be collected?" were that no data was of no value.

The answers to "What additional Human and Other Resources (if any) do you think are required to optimize the Health Information System?" were computers, computer training and time.

In our version of the audit we got more details answers to these questions, which we summarize in the table below.

Information currently NOT being collected, that should be collected	**Information currently being collected that is of NO VALUE**	**Additional resources needed**
Patient/ staff ratio Maternity Obstetric reboarding Disability grant form Workload Communicable disease Deaths Death related to trauma Child abuse Patients on district service School health Health promotion officer Data from health educator Treatment Dressing More patient based information Cost of particular drugs Use of telephone Time spent talking to patients	Mental Health; "Stable chronic patients devolved to PHC" – closely related to "Visits Old Clients" (see RMR). "Other services" covers too broad (see RMR).	Training Computers Staff Feedback

Table 33. Summary of our findings on suggestion to improvements of the information system.

9.11 Concluding remarks to the HISP situation analysis

The HISP situation analysis (2002?) makes the concluding recommendation to the health information system situation within the Central Karoo District in Western Cape Province:

- Determine the financial implications of establishing an information structure
- Appointment of a District Information Officer (DIO) with a detailed job description

- Training data capturers to capture PHC and Hospital data
- Provision of Office space and computers for implementation of the program (DHIS)
- Installation of the software where appropriate (DHIS)
- Setting compulsory fields, minimum and maximum ranges and identifying common validation errors
- Establishing a Data Accuracy Monitoring Tool for the DC
- Formation of Locally relevant Information Team structures
- Theoretical and DHIS software training of all managers and program managers
- Facilities to produce and display catchment area maps with target population
- Key performance indicators per program to be identified and illustrated graphically at each facility
- Purchase of 3 more computers and relevant software for each of the Local Municipalities

We see that our investigations capture the same issues as the HISP analysis, and also that the situation is similar in the two cases. Like the HISP analysis, we conclude that there is a need for more personnel, training and equipment. The HISP analysis concentrates somewhat more on data elements and validating rules, whereas our investigation includes a more detailed overview over the status of the computers in the facilities.

When comparing the HISP analysis and our analysis, the same issues seem to prevail with regards to where there are room for improvements. The most important positive change seems to be better tools in validating and checking the accuracy of data. At facility level this improvement is often not taken advantage of, as PAWC facilities seldom use computers in their data handling.

It seems like the world has not changed so much as one could hope it would have. Earlier findings compared to ours show that a lot of the same challenges still remain in the health information system in South Africa. Issues like data accuracy and local use of information for decision making are still major concerns. However, there seems to have been a shift in the focus – from training of manager to training of facility staff/managers. Therefore it seems that one has realised that the facility level must be included more, and encouraged to use the data they collect for local use. We also hope, in addition to training, that facility staff will be given the recourses needed and that the right conditions will be put in place in order to nourish a vital information culture at facility level.

Another conclusion we draw from the conduction of the situation analysis in 2002 in South Africa is that evaluation of a health information system should be seen in comparison with a general health situation analysis for a district. This would resolve any unrealities of why certain data elements do not seem to make sense (very high/low numbers) for example. It would also help put focus to the most important problems, not only specific challenges on processes limited to the information handling in a district.

RDHS Project's health district report [RDHS Project, 2002] discovered that there is an "*indication that there are inequities in workload distribution in the district. The staff ratios reflect a highly inequitable staff workload distribution. Redistribution of staff to address the inequities should be done in conjunction with a general service improvement plan"*.

This report concludes further, that it is important for a management team to keep a list of all posts in the district and whether or not they are filled, and compiling such a list is an

important part of a situation analysis. We agree that the vacancies would be useful to asses, as well as the rate of turnover of staff, however, we were not able to compile such a list during our auditing process. We hope that such lists already exist at district/regional level, so that management know were more staff are urgently needed. If not, these lists should be a priority task to complete.

9.12 Discussion of the audits as a tool and alternative evaluation methods

9.12.1 Summary of our auditing process

Purpose with the audit

Our research aim with the information audit was to develop an effective tool for evaluating the health information system in the Cape Town area. We wanted the facility audit, which become our main focus, to be able to capture the views on the information system as seen from the grass rot level. The information collected with this tool should actively be used when it comes to planning, restructuring, mapping of where resources like training and computers are needed, discovering of weaknesses with the system etc.

The evaluation tool that was (re)developed covers areas like; training needs, data collection and accuracy, information handling and usage, data collection tools, feedback and general opinions about and suggestions to improvements in the health information system.

Design/pilot phase

Implications for IS design can be categorized into three main areas: the need for shared understanding; the need for participation by key people; and the need for agreement on joint action [Byrne, 2003]. This is true also for evaluation design.

Our work with adapting the audit to the context within the Cape Town can be characterised by action research, as described in section 5.1. We followed the principles of the Scandinavian approach were we viewed adaptation to the local context and the creation of local ownership through participative processes (see section 2.3.1; Scandinavian approach) to be valuable methods in our design/redesign project with the information audit. Participation with key personnel at facility, district and regional level became our most important source of acquiring the knowledge needed in order to make the right decisions.

In order to succeed with an evaluation process such as ours, where one must rely on that the responders of the questionnaires give an accurate picture of their situation, that they actually complete all questions in a satisfying manner etc, there is a need for shared understanding of purpose with the evaluation process puh . This purpose must be communicated clearly prior to an evaluation, so that joint action to reach the goal becomes possible.

Different prototypes (see prototyping in Section 2.3.1.) of the facility manager audit were presented and tested out after we had made changes to it. Our redevelopment of the information audit followed a spiral form (see spiral model in Section 2.3.2). Testing and piloting discovered problems with existing questionnaires in the original audits, and we discovered additional issues that were important to include in the evaluation of the system.

We refer to Section 7.5 and Figure 16 for the major changes that were made to the original audits. We can mention that data elements were made more relevant for the facility level in the Cape Town area, irrelevant training courses were left out, several questions and tables were reformulated/designed to improve understanding, and the computer specification part was expanded.

Lessons learned about the development process

In Section 7.9, we compared our own information audit process with Henczel's process. Henczel's audit model has proved useful in evaluation processes, which is something that has been expressed by other system evaluation projects (for instance by [Langley, Seabrooks & Ryder]).

We conclude that this model provided a good framework for an evaluation design and process. However, we used a spiral model and not a waterfall model because we found ourselves in a pilot project where testing and redevelopment were important. The last stages; stage 6 – implementing recommendations and 7 – the information audit as a continuum, in Henczel's model still remain to be put into practice by someone other than us (the management in the South African health system).

What we have learned from comparing Henczel's model to our process is that a spiral model and testing of prototypes in the design phase of an evaluation tool, is needed. A thorough ground work must be made in order for the tools to be useful and provide the right information later on. To accomplish this, a waterfall model may be difficult to follow in the design phase of the tool. We mention some aspects from Henczel's modell that we thing is particularly important; (1) understand of the organisation and develop of clear objectives, (2) determine the scope and resource allocation, and (3) enlist management support.

9.12.2 Is an information audit the right tool in this setting?

Information personnel, clinic staff, administration staff and personnel in HISP have all expressed that the questions asked in the audits are important to get the answers to, and report on to higher levels in the system. As mentioned earlier, much of the information, like the status of the computers, and what amount of training the clinic staff has received, is obvious to the staff in the clinics. On a daily basis, their work is influenced by how the computer performs, and the staff is very aware of the condition of the computers, but there are no formal organs in which to report this to higher levels. There are neither mechanisms at higher levels within the PAWC for collection this information and then use it for budgeting, etc.

In our study, we have developed and used an audit in order to get hold of the information that would be useful to have and keep track of for planning and decision making within the health management system in Cape Town.

But is this paper-based audit the right tool to use for evaluation and collection of such information, and does it produce the most relevant data with high enough quality?

We and the information workers in HISP are very aware of *what* we want answers to, but it has proved difficult to make this equally clear to those who are to complete our questions. This is something we experienced first hand, and something Gavin Reagon and Marius Gouws (School of Public Health and HISP) as well as Lorna Solomon from PAWC

experienced before us when they tried to use the information audit to collect the information they needed.

The reasons for not succeeding when trying to conduct an audit or another type of evaluation, can be many and vary according to the situation. In some cases, the way of formulating a question is not clear enough, and sometimes the personnel do not know the answer to a question. This results in that those filling out the questionnaire either just make a more or less educated guess, or they simply skip the question. Either way, this contributes to making the data in the audits less reliable, and of poorer quality, as one does not get a clear picture of why some questions are not answered. Limited time for answering the audit makes the personnel rush through it, and give a less elaborate response than we could have wished for. Lack of ownership of the information produced by the system, and the lack of interest in the audit itself (because they cannot see its benefits) also seem to be contributing to less complete and thorough answers.

We saw how the lack of ownership of health data and information was true at facility level, and that it might be connected to the fact that the information handling often is a task given to staff members on top of the work they already have, and on a day-to-day basis, many other tasks are regarded to be of greater importance, even though most facility workers see why it is important to have a well-functioning information system in the health sector. But as one clinic manager expressed; "*We have people literally bleeding to death at our doorstep. It is self evident that we have to see to these kinds of cases before we can sit down with the RMR – the problem is that the stream of sick people never ends!"*

"We have people literally bleeding to death at our doorstep. It is self evident that we have to see to these kinds of cases before we can sit down with the RMR – the problem is that the stream of sick people never ends!"

– Facility manager

The lack of time for facility staff tells us that the more understandable and quick our information audit is to fill out, the more value it has as an evaluation tool. The important thing is therefore to make sure that not too many compromises are made between getting all the wanted information, and keeping the audit short and quick. An important obstacle we found was the large numbers of tables in the earliest versions of the audit. This was one of the main reasons why the staff had audit fatigue when they had finished it, because even if the tables look neat and clean at first sight, they prove to take a lot more time to fill out than one should think. We tried to limit the number of tables to an absolute minimum, and rather ask textual, open ended questions where ever suitable.

Next, we present some other alternatives to conduct an evaluation of the health information system in Cape Town, and in the end of this section (9.8.) conclude if the information audit is the right tool or not at the present time.

9.12.3 Alternatives to the paper based information audit

Interviews and observations

In our study, interviews and observations are the methods we in fact used, even though the main focus was on having the facility staff completing the paper-based audit. There is no doubt that interviews and observations are very useful tools, and produce a lot of important information.

These methods have the advantage that the investigator can pick up the issues the staff is most concerned with, and get more elaborations on these fields. It is also easier to make sure that all questions are understood and answered. Also, if one cannot be certain that all possible aspects are covered through a questionnaire, it is necessary, in some cases, to be present at the facility to pick up on what is going on. One example of this is that we found out that one clinic wasted a lot of time in entering the same data in different systems, when there was really no need to do so. The clinic used a new version of the Patient Folder Application and entered data into it. Monthly, they automatically generated a report from this system, and printed it out. Then, they wrote all numbers by hand on a blank RMR sheet. This handwritten RMR sheet was then faxed through to district level. Then the district personnel sat and re-entered the figures into the DHIS. Talk about doing it the hard way! Instead of faxing in the RMR on paper, the staff should of course just forward the monthly report that was generated automatically by their system. There should have been mechanisms for picking these things up, and making the information handling work as efficient as possible. We do not think our information audit would be able to pick it up, because personnel are not aware that anything is wrong. In situations like these, personal visits to the clinics with observation and interviewing of staff would more likely discover such problems.

Interviews and observations are, however, expensive ways of obtaining the desired information, because it requires several people with a lot of time on their hands in order to get the interviews done. It also requires the staff and the investigator to make appointments, and it might be difficult to fit this into a tight schedule – and it gets even harder, the more people that needs to attend to the interview meeting, e.g. if a clerk has knowledge that makes her presence necessary. We experienced that staff had difficulties finding time to meet us, and we also saw that interviews like these takes time – we estimated approximately two hours for every interview, sometimes it took even longer. And it never took less than one hour.

So, purely using interviews and observations to obtain the information in the audit will be far too time-consuming and costly. Even so, if the audits are performed the way we suggest, that is, administrated by Information Officers or District Managers, there might be an element of interviewing included. This element will come into play if the audits are not filled out properly. In this case it will be the administrator's job to follow up the audit, clarify questions that seem to be unclear, and ask follow-up questions if the answers given are not complete enough. In any case, the importance of communication between the levels cannot be stressed enough. It should be redundant to say that there must be close contact between the District Information Officer/District Manager and the staff in all facilities in the district. In the Local Authorities we have seen examples of that the collaboration between facility and district functioning relatively well. Hopefully, the collaboration can be just as good in an auditing process, and even lead to closer co-operation and even greater understanding between the levels. However, as we have mentioned earlier, at the PAWC side there is a huge gap between facilities and the regional level – without any district support in place. The challenges may be greater here to succeeding with an information auditing process.

Reports from staff

Another alternative to the paper-based information audit is to make staff write freely about what their opinions on the information system are. This will give a good picture of what they are concerned with. But since no explicit questions are asked, there is a good change that one might not get the answers and information one requests.

It might also be problematic to summarise the reports from all relevant staff members in one district or region. It is also difficult to predict how much they will write, given such a task. It could be anything from a few lines to twenty pages. Given the work load earlier mentioned, it is more likely that they only will write a few lines. A few lines will with all probability not cover nearly everything we would like to know.

Additional modules in the DHIS

The DHIS software contains functions that make it possible to collect data for some of the audit questionnaires directly into the computer system. The DHIS is already used to collect data on different datasets, in particular the RMR. It would therefore be natural to derive information about what kind of datasets and variables are registered in different facilities, using the DHIS.

It could also be useful to use the DHIS to register some of the semi permanent data[15] in this system. One module that could be transferred from the paper based audit to the computer system is the computer specifications. This is data that is not changed very often, and it needs to be updated only when changes happens to the computers in the facility. These changes will typically occur when new computers arrive, and old ones are thrown out, or moved. A way to do this is having the DHIS communicate with the operating system on the computer and asking what type of machine it works on, hard drive size, etc, then storing this data into its own system for later use. This should be fairly unproblematic to implement (we will not go into more specific details around this in our thesis).

Another feature that could be implemented in the DHIS is an overview over what kind of training the different members of the staff have. This element might be a bit more of a puzzle than the computer specification module, as it most likely will require more frequent updates and a more complex structure, if all the employees are to have data on their training registered. If a module like this was to be implemented, it would not be very logical to only register the training of the staff. The natural thing to do would be to include other data elements, like the staff members' address, phone number, work schedule, and other attributes that would make the employee module useful for more than only keeping track of what training the person has. But again, this makes the module more complex, although not too difficult to implement. What might prove to be the main problem with this is that such a module requires a very high degree of maintenance – data needs to be changed whenever some of the attributes like address or work schedule changes, as well as when new employees are hired, or someone quits. This can also prove difficult because of the high staff turnover in some districts. The question is also; who should be responsible for the maintenance? On the other hand – such systems probably exist already; personnel systems for keeping track of staff data and salary payments, etc. We are not familiar with all the different types of system that are in use, but it might be a good idea having them talk to each other, making it possible to extract the updated information one needs.

Another problem is that the staff is not used to using the DHIS in this manner. In many facilities, especially in PAWC, the DHIS is not even operative, so an element like staff registration might not be worth the effort. Due to a heavy workload, it would be too much to demand from an information officer to add this element for all facilities in her district where the facilities does not have a functioning DHIS. Computer specifications, on the other hand,

[15] Data that seldom change; population in the district, number of beds and staff in a facility etc. Semi-permanent data does often not belong to any program.

are so limited, and change so seldom, that it is possible for an information officer her/himself to capture this data in his/her own DHIS if the facility does not have access to the software. Even so, with only two people functioning as information managers in PAWC, such a job will initially require considerable time and effort.

There is also a need for a quite substantial initial effort if something is to be changed or added to the DHIS. The modules must be developed and integrated in the system, and the data must be captured. But also, the changes must be rolled out in all the facilities. It is fairly easy to make changes and additions to the DHIS, but it must be done physically at every facility, as the system does not run online, so changes cannot be made centrally, and then be downloaded to all clients running the software. So, one option is that the changes are implemented in a new version of the program, and one can wait until all units have installed the upgraded version. This will probably take an extremely long time, as the staff is very reluctant to make changes to a computer system that is working, or maybe more importantly, that people are used to. One finds a lot of support for this reluctance among employees when changes to systems are introduced. Low computer literacy among most of the staff also makes the option of every facility installing the modules themselves out of the question. This might work some places, but overall, it is not possible to give the facility staff responsibility for this. The other option is that someone travels around to all the facilities and installs the new modules, which again requires a lot of resources and time.

In future auditing processes, it will most likely be very useful to make use of elements that are already included in the DHIS, as well as adding some new modules. But extra modules will lead to a lot of extra work, especially in the implementation phase, and with entering the initial data. Thorough consideration must therefore be given to what kind of audit information one wishes to use the DHIS to collect in addition to what it already does. Our suggestions are: (1) computer specifications and (2) staff training as the main modules. The DHIS already captures for instance the type of data sets that are collected.

If an audit module is successfully implemented into the DHIS, annual routines about reporting should not be too hard to get started. For example, e-mail from the higher levels that tells/reminds the staff of when to complete the information audit, and perhaps send it in with the same routines as for the RMR.

As we explained in Chapter 6, the DHIS will most likely soon be phased out in Cape Town. If so, the modules mentioned in this section could be added to the other software that is about to be implemented in the region.

Audit in electronic format

If one is to get some of the information in the audits from the DHIS or a corresponding software system, why not make all of it electronic? An online version could be made, and aired on the intranet. An electronic audit like this could make use of features like radio buttons, scroll menus, ratings and text fields for longer explanations. The results could be summarised and displayed at any level – facility, district, region, nationally, etc., and one could pick out special items of interest. A great advantage would be that personnel at all levels would instantly have access to the information, right after it had been submitted. Much of the administration around the auditing will be gone, like sending out the papers, reminding people to fill in the forms, and collecting them. Also the time-consuming work of having to enter all data into a computer system before analysing it is avoided. Much of the analysing can be done automatically, thus giving the leaders at different levels more time to concentrate

on how to use the results, and deciding what changes and improvements should be made to the information system instead of using valuable time on the analysis. For those who fill out the forms, electronic forms seem to be more engaging and fun than paper based forms. It gives the opportunity for some response from the computer while filling out the forms, and after one is done, it is possible to instantly get a short profile of the facility, and maybe also some comparison with other facilities that have already submitted their data.

Different types of computer-based evaluation forms get more and more common; everything from evaluations on university subjects and satisfaction with the insurance company to less serious things like quizzes and informal personal tests. The huge popularity of such a form of answering questions indicates that people think it is more fun and more game-like than filling out boring paper sheets.

In *reality*, however, an electronic audit for the health sector in South Africa is not advisable, at least not at this point in time. There are several reasons for this. One is that the infrastructure is far too underdeveloped for this to work. 50% of the facilities have no computers at all, and the ones that exist are so slow that it takes more time than answering manually. Many computers are not even connected to the network, which is not fully developed yet. In facilities with computers, there is often a high pressure on these, and they are needed for other and more immediate tasks than filling out questionnaires. There is also reason to believe that because of low computer literacy and not much experience with computers, the staff will not find it so much fun to fill out electronic forms as people with more computer experience do. All this makes the whole electronically-based evaluation rather wasted.

Electronic audits can be a good way to evaluate information systems, but in the health sector in South Africa, it is still far too early.

9.12.4 The right tool?

When developing an evaluation tool for the health sector within a developing country, the strategy should be to take advantages and use existing structures, working routines, installed and running systems (DHIS), etc. A term given to this development strategy is *cultivation* (see Section 2.3.1), which we think is the right strategy to follow when planning an evaluation process. By using what already exists and seeing advantages with the installed base (see Section 2.2.2. on information infrastructures), it should become easier to conduct and succeed with an evaluation process. When people can use, for example, familiar tools and reporting procedures to report on their working situation, we think they might behave more positively towards the amount of extra work an evaluation process brings with it, than if completely new and time-consuming procedures are introduced and forced through.

An initial evaluation design process would also benefit from focusing on participative development.

Cultivation was something we had in mind when going about the auditing development in Cape Town. However, it proved difficult to take advantage of the existing structures and systems, as a lot remains to be done to optimize the health information system. At the PAWC side where we operated the most, a lot of improvements must be made, and basing an evaluation process on structures that do not exist, would be rather difficult!

So instead we went along with what existed at the time being, and participation became an important and indispensable development method for the evaluation tool.

We write about the top down versus the bottom up approach in Section 2.4.3. In our work, we have a mix of these two approaches. We used a tool that was initially developed by top managers, but adapted the tool according to the response from the interviewees during the pilot.

In Section 2.3 we described how prototyping can be used as an element in systems development. Our piloting process is in many ways similar to the prototyping approach, with influences from all the kinds of prototypes, and in particular the experimental prototype.

We believe that the use of a paper based information audit is the most useful tool in this context. In addition, we have suggested some other supportive methods to do the evaluation, like extra modules in the DHIS, and also an element of informal interviewing by the district information officer or district manager.

9.13 Future use of the information audits

The pilot audit in the Cape Town Metro gave several important pointers to what the staff is concerned with, and for *future* audits, it might be an idea to use for example a grading system on items where our pilot revealed concerns from the staff, in order to determine how large a problem is, not just that it is a problem. It would for instance be interesting to see how satisfied facility staff is with the feedback they are provided with from higher levels. A grading system will be quicker to answer for the facility staff, and by presenting the same categories to all, one gets a better basis on which to make a comparison and summary of all the results for further presentation. In the pilot, however, we felt it was necessary to let the staff decide themselves what problems they were struggling with, and whatever they felt was important to highlight, without anyone putting words into their mouths or limiting their freedom to express their concerns. Participation on the design process is very important.

Here we summarize what the audits we work on consist of, and what role they may have in future evaluation of the health information system.

9.13.1 Motivation for using the audit

The intention with the audit is to keep a close track of how the information in facilities within the health sector is handled and used. The audit results can also be put together for larger areas like districts, regions and/or provinces. Some indicators in the audit are what kind of training the staff has received regarding computers and information handling, what the status of the computer equipment is, how the information flows, and what kind of information is collected, to mention some.

To know these things makes it easier to see what changes and improvements should be made to optimise the health information system, and to see what elements function well, and should be kept and built upon. Budgeting is also a reason why these things are useful to know. The audit gives a good overview over where computers are needed and which computers should be replaced.

Answers to some of the questions asked in the audit might seem very obvious to staff at facility level, and even at district level, like the quality of the computers or the software, and how much training staff has. This information, however, might not be equally obvious for people at higher levels, and there might not be any defined and appropriate forum to report failures with the information system, as well as having the opportunity to report on what works well, and should not be changed. The audit is a tool to document the information status in an accurately and complete way. The information can be looked at individually for each facility, or one can look at the district or larger areas as a whole.

9.13.2 The composition of the audit

The information audit should be conducted on a regularly basis, preferably once a year. A complete audit for a whole health district includes the completion of three parts; one part for the District Information Officer to fill out, and one for the facility manager together with the computer specification part:

- Computer specification with a short manual
- Audit for facility manager
- Audit for District Information Officer (DIO)

The audits can be conducted and reported on separately, if there is a special need for that. However, a lot of the information in the DIO audit should reflect on findings made from the facility in the district, and is therefore meant as a summary report from the whole district and all the facilities, for the higher levels to use in planning and budgeting.

Originally, the audits were made for different managers on district level; such as line manager, program managers and district information officers. For facility level there were audits for facility information officers and facility managers. The last two were tested out in the Western Cape health districts, but were abandoned, as it was difficult to make them work satisfyingly. The conclusion was that one cannot expect much from or put much extra work on the facilities.

We think, however, that it is important to include even the lowest levels in the audit process, and that it is possible. The people on facility level are an extremely important part of the information process, and it is important to get their views on the health information system, and listen to what problems they encounter as well as hear from them what works well. A District Information Officer can know a lot about what goes on in the facilities, how the work is done, and where bottlenecks in the information flow is, etc., but there will always be aspects that are not possible to pick up on if you do not ask the staff directly. Because of this, we used the framework from the original audits for the district information officer, facility manager and facility information officer, and developed a new audit for facility managers.

Evaluation tools like the information audits we have used will probably always need adjustments in time. Conducting the same audits year after year might not produce the most relevant information concerning the status of the health information handling. Besides being conducted annually, there should also be a process of revising it, to see if any questionnaires have become redundant during the last year, or if anything should be added due to changes in the system, etc. An evaluation tool must fit the *current* situation.

Next, we have made an outline of how we think the specific audits might be preformed in the future.

The facility manager audit

The intention with the facility manager audit is that the manager should be able to fill out the questionnaires within it on her own, maybe with some assistance and insights from one of the receptionists that are involved with information handling and collecting the RMR and other data sets.

We are also concerned that the audit should not be like an exam for the manager or receptionist on what the names of the different data sets are, but rather give a picture of how the information system is experienced. So, obviously, it is important to stress the point that questions must be answered truthfully – the aim is not to please the management at higher levels by saying that the system functions perfectly if it really does not.

The audit could be sent out once a year by post, or District Information Officers, District Managers, or another suitable person could bring it along on an ordinary visit to their clinics. It might be advisable that this person also picks up the completed questionnaires personally, so that any questions regarding it could be answered. This also ensures that the forms are actually submitted!

Technical specifications audit

Whereas the clinic manager should fill out the audit regarding information handling within the facility, there is also another audit part that regards the computers in the facilities, and their technical specifications, that a district manager/officer etc. should complete for every facility.

Finding the status of the computer is very easy, and also, this is very useful to know, in order for the information staff to have an overview over what conditions the computers are in, which ones need to be replaced, and how they perform according to the demands of different information system software.

Checking this is easy and quick, and gets even easier and quicker once it has been done a couple of times. This is why we think it is more effective to have the management at district level doing it in each clinic, instead of having different clinic managers or receptionists in every facility learning it. This will also reduce the workload put on facility staff. A district manager/officer will be able to complete the computer specification part in just a few minutes after some practice. We have made a short guide for finding the specifications, which the manager will be provided with. In many districts, the district manager/officer visits the facilities on a regular basis, and in these cases it is not necessary to set up an extra visit just in order to check the computers. Checking the computers is so quick; it can be done on one of the regular visits.

The technical specifications audit also has some questions about the performance of the computer, what it is used for and what the ideal number of computers is. For these questions, the district manager/officer needs to ask the staff how the computer is used within the facility and their opinions generally about the equipment situation.

District information officer audit

Lastly, there is also an audit for the district manager/officer to fill out. This is in many ways similar to the one of the clinic manager, but it is meant to summarize the findings from the

facilities, and there are some questions that are more elaborate and specific with regards to the information system.

In the end of this audit, there is also a guide, developed by Marius Gouws of the HISP team, that explains how all results can be summarized; it suggest what goals the district might want to strive for, and what actions should be taken if improvements need to be done in some area. This will provide a profile of the status of the health information system in the district.

It is, however, important to stress that the recommendations from the summary guide should be taken as general recommendations, and it should be left to individual judgment in each case whether the recommendations should be followed. Variations in needs, what works and what does not do occur. As mentioned earlier, we were not able to go much in depth of this audit, so we have not made any huge changes to the original audits developed for the district information officers. It might very well be that it needs major adjustments before being taken into use. Therefore, the managers at district level should come together and discuss what they think of it, if any changes need to be done, etc.

9.14 Applying Giddens' structuration theory to our evaluation process Interference between power, communication and norms ..

Many information systems researchers before us have used Giddens' structuration theory (Section 2.2.2) in their work. This theory also applies to our research, not least when we explore why information is used to such a limited degree. Communication, power and morality are among the important reasons why information use is limited in the facilities.

In this context, we regard training and feedback as forms of communication. In order to be able to use information to a larger extent, facility personnel need training on information handling, including how to use statistics, and training on computer, so they can use this important tool more efficiently. Offering certain types of training is a way the higher levels can communicate what responsibilities they want to delegate to the facility staff – this becomes a way of delegating power. Facility staff also need guidelines with regard to what kinds of decisions it is appropriate that they make. In communication we also include the feedback that facilities receive from higher levels. The facilities should receive more processed feedback than only raw data.

Power is another important issue. Several facility workers expressed that they did not feel that they had the authority to make decisions. Here, a change in power structures is needed, and again, it is crucial that the higher levels communicate that the facilities are not only allowed, but also encouraged to make their own decisions. They should delegate power more clearly. As Byrne (2003) states: "*Through the process of IS design and reflecting on the situation the excluded can be empowered, which redefines the power and resource structures*".

The facility managers we interviewed felt that they had little power and authority to make decisions. However, this perception does not change considerably as we move to higher levels in the hierarchy, according to the study of Mbananga and Sekokotla (2002). Their informants were managers at district and provincial level, and one of the responses they got regarding power was as follows: *"You know, higher authorities do not trust us as their managers, there is an X theory which is used here and it frustrates us, the X theory defines everybody as bad*

and we are treated with all the skepticisms." This statement represented an overall feeling among the interviewees, and was highlighted as one of the constraints to decision-making. A manager at provincial level explained that "*I cannot appoint a cleaner or secretary on my own, for example, I can only recommend and motivate with regard to [Human Resources] and it takes a long time."* [Mbananga and Sekokotla, 2002].

Even though improved, the data quality in facilities has been poor and the motivation for collecting data has been limited. Lack of training has been regarded as one major reason for this. One gets yet another perspective on the situation, however if one tries to understand *why* the health personnel act as they do. By using Giddens' structuration model, and analysing the norms and actions of the nurses, one may discover that they act this way because they see it as their main task to save lives. If a person is bleeding from a severe injury, a nurse does not waste any time filling in statistics, she tries to stop the bleeding. It is not that she lacks the skill or motivation, but her morality makes her focus on saving human lives rather than writing down and counting numbers.

It is important that an evaluation capture this understanding of the nurses' working conditions, and report on it. No matter how much money is spent on motivating and training in information handling and use of computers – the nurses will still see patient care as their primary moral responsibility, which will take up most of their time.

9.15 Conclusion

When planning improvements to an information system as the one this thesis has described, one must be careful not to individually recommend some types of needed recourses, as the resources often are strongly interlinked. If for example new computers are installed and one hopes that all problems with data collection and accuracy will be solved, one is likely to be very disappointed. First of all, one must also provide the help and support to get these computers up and running. Secondly, the right software must be installed so the computers can be used for relevant tasks. Thirdly, staff will need training, to be able to use these computers. It is of no use if some of the staff went on basic computers skill training in five years ago, or if the training is provided a year after the computer was installed, since the computer most likely has been collecting a lot of dust and started to become outdated (not fulfilling the demands of specific new applications that have recently been taken into use for example). Fourth, if the workload on facility staff is so large that they do not have time to enter all patient data into the computerized system, they will have no benefit from it as they will never be able to start using it, and the skills provided by the training would be forgotten over time. And even if all these things go right, there must still be a good backup system so that no information is lost – and one must remember that patients need treatment even if the computer system is down…

But providing computers, training, and the support needed so that a computerized patient- and data collection system runs satisfyingly does not ensure that the data collected and entered into the system is accurate. Furthermore there is no guarantee that the data is used for improving the services given and that people's health improves. What is then the point of having a well-functioning computer system?

We see clearly that the health personnel at the clinics we visited see it as their main task to cure and treat patients, and see to their well-being. This should also *remain* their priority. Instead more staff is needed; two different groups of staff – nurses and doctors to treat

patients, and clerks and other administrative personnel whose main task is *not* direct patient treatment. The latter group should rather work with health data and information.

Limiting the facility managers' current role of being both a nurse and a clerk/manager in the information handling area would enable her to focus on running the clinic in the best way, improving the health services given and make the right decisions by basing them on good data/information, etc. Having her be both a nurse and a manager, she would keep on focusing on curative health care on a day-to-day basis. And who in the facility would care about data accuracy or information use, if the manager does not?

Since the data collection process starts with a nurse or doctor registering the treatment they give, they should both have a good system for registering the data quickly and easy and there should be enough of them so that everybody has time to fulfil all their tasks in a satisfying manner. This may hopefully led to higher accuracy on the data being collected.

But, despite all problems and challenges, we have also seen examples of how facilities can be well run, that health information actually is being used to improve services, and that documentation with accurate data in fact can make it possible to receive some of the recourses needed to optimise the facilities functions. There is of course the fact that behind a 'success story' like the one we refer to (see Section 8.9.1.); there probably is an out of the ordinary dedicated, experienced and skilled person that one cannot expect to find everywhere. But the example still shows that it is possible to make a system 'work' by putting in some interest and effort.

We think that one of the ways forward for the health information system in Cape Town now, is to take advantage of and learn from those cases where things run a bit better than elsewhere. Relevant staff should learn from each other, they should get together and exchange experiences and opinions about the information system. Better cooperation and communication between the facilities is therefore important. Communication, feedback and support from higher levels is essential for making this happen; they must make it possible for clinic staff to be able to go to courses and meetings, and in this way provide the right conditions to develop an information culture within the lower levels of the information system. This includes first of all; providing enough staff, the right kind of staff, and the necessary training at the right time. Then, computers, software and other equipment should be provided to make the health workers' jobs easier.

We have used an information audit to help evaluate the current situation of the health information system in Cape Town today, and reveal the major concerns as seen from the grass root level. We have presented other systems evolution methods and some of the fundamental principles of different approaches and strategies for systems development that could be useful in an evaluation (design) process.

Whether we have succeeded in developing a useful tool for future evaluation of the health information system remains to be seen. At least we hope that people who are going to do similar evaluations in the future find our experience valuable in their own process. We also hope some of our findings from this tool might be useful for people within the health information system, and that they can take advantage of it in a way that can lead to improvements of the system.

We feel we have used an evaluation tool that was right for the setting we were in, and that we managed to make it a simple, specific, realistic and measurable tool to a fairly strong degree, if applying Henczel's approach to information audit design. We also hope our findings have been presented in the best, most understandable way, and that we managed to cover the most relevant and important topics that needed to be highlighted within the health information system in Cape Town, South Africa.

Data is not necessarily Information
Information is not necessarily Knowledge
Knowledge is not necessarily Wisdom
And none of the above is Action

– Unknown

10 LIST OF ACRONYMS

Here we provide a list over abbreviations the reader might come across in the thesis or in the appendixes.

ANC – African National Congress; The leading political party in South Africa after the fall of apartheid.

ANC – Antenatal Care

ANT – Actor-Network Theory (chapter 2.2.2)

AR – Action Research

CHC – Community Health Centre

CPU – Central Processing Unit

DHIS – District Health Information System; Software used in the health sector in South Africa and other countries for collecting and handling data, mainly routine data.

DHS – District Health System

DIO – District Information Officer

DMT – District Management Team

ESD – Essential Data Set

FIO – Facility Information Officer

FM – Facility Manager

HIS – Health Information System

HISP – Health Information System Program; The project building a platform for the work on data and information in South Africa and other developing countries.

HMIS – Health Management Information System

ICT – Information Communication Technology

IS – Information System

ISD – Information Systems Design

ISR – Information System Research

IT – Information Technology

LA – Local Authorities; The branch of the health sector concerned with preventive health care.

MDHS – Metro District Health Service

MS – Microsoft

MOU – Maternity Unit

NGO – Non-Governmental Organisation

NORAD – The Norwegian Agency for Development Co-operation

OT – Occupational Therapy

PAWC – Provincial Administration of Western Cape; The curative branch of the health sector in the South African province Western Cape.

PD – Participatory Design (chapter 2.3.1)

PHC – Primary Health Care, and can also mean Primary Health Centre

PMTCT – Prevention of Mother to Child Transmission (with regards to HIV/AIDS)

RAM – Random Access Memory

RHINO - Routine Health Information Network

RMR – Routine Monthly Report

SA – South Africa

STD/I – Sexually Transmitted Diseases/Infections

TB - Tuberculosis

UCT – University of Cape Town

UWC – University of Western Cape

VCT – Voluntary Counselling and Testing; Testing for HIV/AIDS

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