



South Africa's District Health Information System: Case Study from Eastern Cape Province

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This case study describes efforts to support improvements to health services in South Africa's Eastern Cape province through the enhancement of the province's Health Information System. It describes the context of health systems reform in which these enhancements were made, key characteristics of the information system, the process undertaken by many players at different levels of the health systems, and identifies a variety of lessons learned that should prove useful for similar efforts in other countries.

One of the most interesting aspects of the work highlighted in this case study is the fact that the system was introduced into a rapidly changing health care system – and the system's implementation has helped both to monitor that change and to shape the change process. During discussions to gather information for this case study many examples of this inter-relationship were discovered. To cite just a few: district health workers have been using the system to help monitor priority health problem trends and the coverage of services such as EPI, TB and STD contact tracing in specific geographic areas. This has allowed allocation of increased resources to those facilities lagging behind. Analyses of certain indicators, such as workload, have assisted in the reallocation of staff and the determination of new locales for introduction of health services. Tracking selected supplies/drug stock-outs monthly has resulted in dramatic improvement in essential drug availability at clinics, with the average percentage out of stock dropping from 13.2% in 1998 to 8.0% in 2000. At the same time, the introduction of the system has led to the determination of new functions and staffing requirements to support data management at the district and regional levels.

For public health professionals and multi-disciplinary teams involved in developing health management information systems, the Eastern Cape experience is rich in lessons learned and innovation.

Background

HIS in South Africa since the Apartheid era:

South Africa (SA) has seen significant change in its health system since the end of apartheid. During the apartheid era, there were stark inequities in access to public health services. Health services were fragmented and there was a multi-tiered system for whites and three other 'racial' groups as well as a large private sector. The SA health sector was, and to some extent still is, very hospital- and curative-care oriented. Whereas this systematic discrimination based on skin colour has been abolished, there are still significant differences in public health services between historically advantaged and historically disadvantaged areas, both within and between provinces. Similar inequities in access to health services remain in the large and technically advanced private health sector, which continues to account for around 60% of overall health expenditure. The

private sector only caters for the 20% most affluent with medical insurance, a group still predominantly white.

Eastern Cape province was typical of this pattern, with much of the land being part of the Republic of South Africa, but with a large proportion of the population living in two homelands (Transkei and Ciskei). Without a uniform national health service, health information systems varied greatly depending upon the local initiative of the health authority providing the services. These systems generally focussed on hospital/practice management and to a lesser extent epidemiological surveillance.

“The economical and political focus on hospitals and hospital information systems, as opposed to primary health care, has made it difficult to (re)-direct funds and resources to district-based information system development. [It is estimated that], 90-95% of all development expenditure for new health care information systems today are spent on Hospital Information Systems (this excludes the cost of stationary, transport, and staff time used for existing data collection mechanisms).”⁵

There were limited guidelines as to what information should be collected and reported to the central level. Each province and homeland (14 such areas) and most vertical programs (including TB, EPI, STDs, FP, MCH, nutrition, chronic illness), had developed and deployed their own systems independently. Health workers at all levels were faced with multiple reporting formats in which massive amounts of data were recorded.

With the end of apartheid in 1994, this pattern began to change. The National Health Bill provided for the development of a district health system covering defined populations and responsible for all public health services in those areas. At the same time, the Ministry of Health became more conscious of the need to monitor health status and health service performance. This led to the publication of a document entitled “Year 2000 Health Indicators: Definitions and Data Sources”. This mandated the collection of a limited set of standardised data elements.

Definition of HIS:

A health information system⁶ is a set of tools and procedures that a health program uses to collect, process, transmit, and use data for monitoring, evaluation and control. The DHIS in South Africa is the acronym used to describe both the District Health Information System in the broad sense, and the District Health Information Software (used to manage the data collected by this system). It includes the procedures and formats used in all health facilities to collect and report the data, as well as the roles and authority enabling health workers to use their data to improve health service performance.

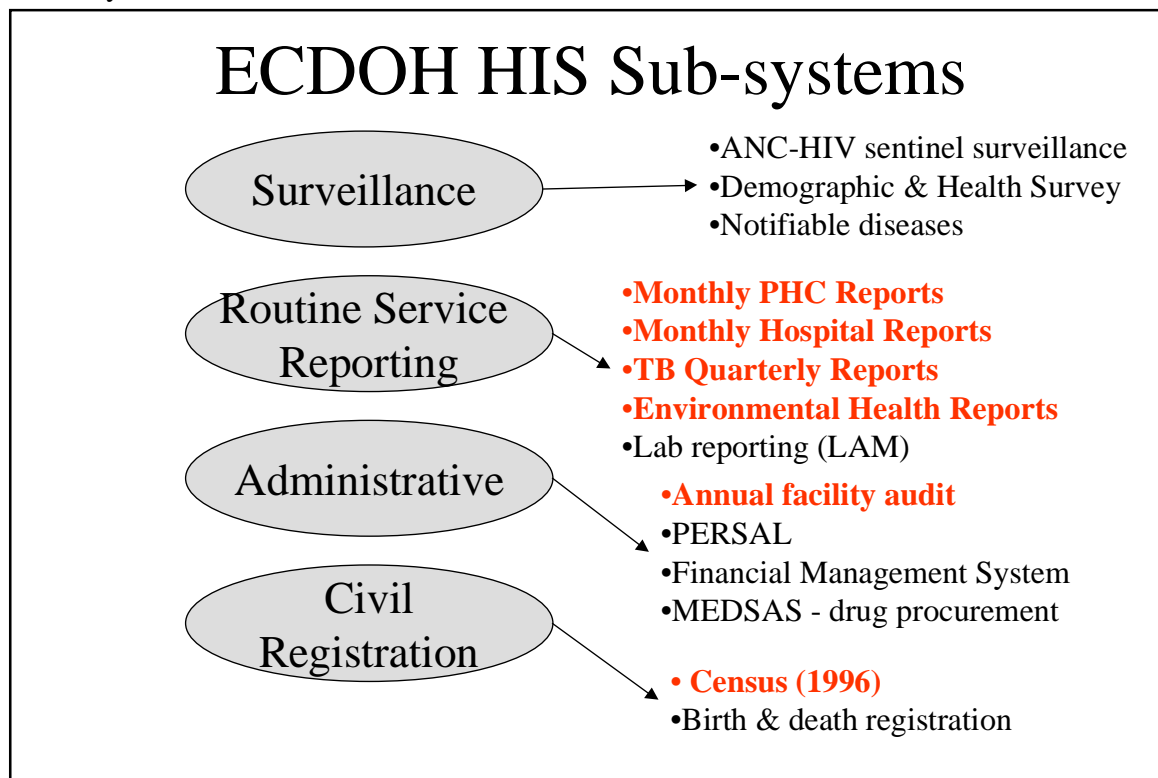
⁵ Developing District-based Health Care Information Systems: The South African Experience; Jørn Braa, University of Oslo (jbraa@ifi.uio.no); Calle Hedberg, University of the Western Cape & University of Cape Town (chedberg@mweb.co.za).

⁶ Note: this is also often referred to as a Health Management Information System (HMIS) when data is collected and used to improve health system management in addition to meeting conventional disease surveillance objectives.

Initiatives to enhance health information systems typically deal with several or all of the following data management steps:

1. Collection: This typically includes rationalising the amount and types of data that is collected, improving formats and procedures for data recording and reporting.
2. Processing: Among the improvements in this area are: computerisation of data capture, analysis, and feedback reporting.
3. Use: This step is often the most difficult to influence because it requires a change in attitudes as well as just the availability of new information and procedures. Efforts to introduce a 'data culture' (in which people base their decision-making on evidence rather than intuition or habit) typically focus on:
 - Establishing standard procedures for use of data and information at the level at which it is collected,
 - training staff in data analysis and interpretation, and
 - incorporating data/information use into routine activities such as supervision and planning.

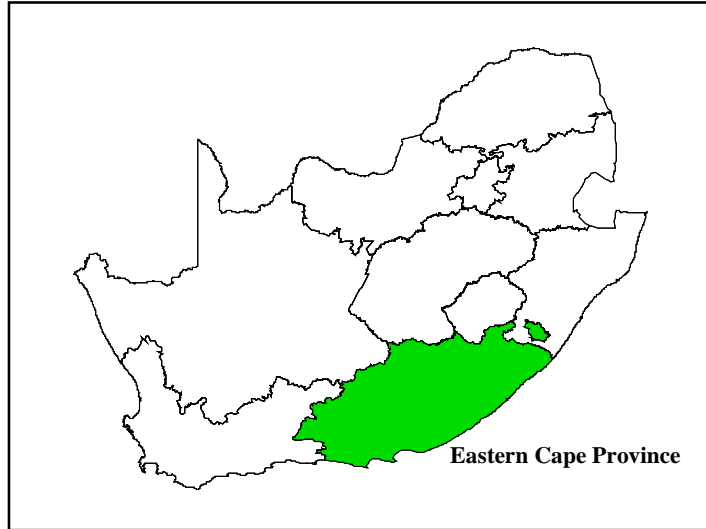
A health information system typically includes a variety of sub-systems. The illustration in figure 1, below, provides an overview of the various components of the Health Information System in Eastern Cape Province. The elements highlighted in bold are currently included in the DHIS.



HIS Evolution in Eastern Cape Province

Eastern Cape Province, one of South Africa's 9 provinces, has a population of around 7 million, currently organised administratively into 5 Health Regions and 21 Health Districts. The province has a network of 700 clinics, 130 mobile routes, and 64 district/community hospitals that also provide some primary health care services.

Since 1994, a number of initiatives were undertaken, mostly on a pilot basis in certain areas, such as the Drakensburg area, to improve primary health care related information systems. These efforts included several noteworthy innovations, including the introduction of standardised tick registers that simplified the recording and tallying of data on different types of patient visits. A major push to enhance the health information systems in Eastern Cape province began in 1997 with support from the USAID-funded EQUITY project. Initial steps during that year included detailed discussion with all programme managers to select a very small set of indicators that would be valid and sensitive to change in relation to key elements of each health service area. These indicators helped to define a minimum data set of 20 items (later increased to 25) with precise definitions to be captured at each of the more than 900 or so PHC facilities. Computers with 16MB of RAM were purchased in 1996/97 and installed in all 21 health district offices. A computer program was initially designed using Clipper (a DOS-based dBase compiler), to enable data capture of this data set, but this system lacked the flexibility desired for reporting and for enabling districts, and even individual health facilities, to capture additional data elements of their own choosing.



Initial PHC Minimum data set indicators:

- Workload (1)
- Tracer drug availability (1)
- Maternal Health/Family Planning (7)
- Child Health (3)
- STD (2)
- Mental Health/Chronic Care (3)
- Referrals (1)
- Information system (2)

Furthermore, as the provincial health team planned the system's roll out, it became clear that human resources available locally were not adequate to support both software development and to meet the training needs of staff throughout all 21 districts. . In October 1998, after 9 months of data collection and capture but negligible output and feedback from the existing system, the team sought support from the Health Information Systems Programme (HISP) team based in Western Cape. This team had already

developed a District Health Information Software (DHIS) application for use in Western Cape province (see box), and their ties to the University of Western Cape provided a convenient environment for organising many of the training activities required. The HISP team was also contracted to modify

Data Element Category	No.	Data Element	Min	Max	Today	Check	Comment
Administrative	2	PHC headcount 5 years and older	0	0	24		Note: Total PHC headcount
Administrative	3	DOTS visit - facility	0	43	3		
Administrative	4	Home clinical visit done (PHC)	0	20	13		
Maternity and neonatal care	5	First antenatal visit	0	20	5		
Maternity and neonatal care	7	Follow-up antenatal visit	2	20	5		
Reproductive Health	12	3rd pill cycle	0	180	23		
Reproductive Health	14	Reproductive infection	0	0	13		Note: 13/13/13
Reproductive Health	15	Depository/Plasma infection	0	0	14		Note: 14/14/14
Reproductive Health	17	Cervixes dedicated	0	1,000	0		
Child Health	19	Diarrhoea under 5 years - new	0	13	1		
Child Health	21	Child under 5 years weighed	12	477	20		
Immunisation	25	B2S at birth	0	20	18		
Immunisation	26	DTaP Hib 1st dose	0	4	1		
Immunisation	27	DTaP Hib 2nd dose	0	4	4		
Immunisation	28	DTaP Hib 3rd dose	0	3	2		
Immunisation	29	OPV 1st dose	0	4	1		
Immunisation	30	OPV 2nd dose	0	4	4		
Immunisation	31	OPV 3rd dose	0	3	2		
Immunisation	32	HepB 1st dose	0	4	1		
Immunisation	33	HepB 2nd dose	0	4	4		
Immunisation	34	HepB 3rd dose	0	3	2		

Figure 2 Sample data entry screen from DHIS Monthly Data

and further develop their software (developed in Microsoft Access), convert the existing data for use in the new software, install the system in all districts and train staff in its use.

During 1998 and 1999, the EQUITY project also worked on human resource issues at the district & regional level: helping to develop a new cadre of personnel called information officers and assisting with their recruitment and training.

In addition to providing on-going training and support to operational staff responsible for data capture and data management at the district level, the major focus in 1999 was on enhancing the computer system: adding new hardware in the districts, creating a more user friendly report generator, and developing a more systematic mechanism for feedback reporting. Members of the HISP team made repeated visits to each of the regions and most of the district offices to provide continuing training and to support efforts to enhance the use of data from the DHIS.

Efforts in the year 2000 focused on managers and improving their access to and use of information for decision-making. This proved to be a far larger job than expected because health workers were not used to having reliable and timely data, let alone using such information as the basis for resource allocation.

The evolution of the system has not always been without a hitch. There were at times heated debates with national and provincial health authorities concerning the development approach, the purpose of the system, and even the software development environment. Staff at the central level were had traditionally relied on their own rather simple EPI Info 6 (MS-DOS) applications, whereas the DHIS software had been developed using Microsoft Access and Excel pivot tables. There was a strong tendency to demand huge amounts of data, little of which was ever analysed or used, but which reflected the exhaustive statistics previously collected by vertical programs. EPI collected 44 data items monthly – DHIS proposed only 5 – they compromised 13 items enabling calculation of six useful immunisation indicators. By contrast, the World Health

Organisation's (WHO) requirements for TB data have been a major obstacle to smooth development of the TB module. The Eastern Cape Department of Health developed a 12 item data list for TB to replace the 130 items that "WHO required," but no one would accept it due to the WHO requirements. While much of this data may be useful for international comparisons, it clusters and confuses the important, WHO does not clearly distinguish between that data that is recorded for local use and that which it requires for its own needs.

Similarly, different provinces had different priorities for investing their information systems budgets – most preferring to focus on hospital information systems of far greater complexity and cost while others began by emphasising district level primary health care services. Ironically, , the Health Information Systems Programme was considering winding up its activities in late 1998 due to limited funding, when the Equity project stepped in to support the extension of the system to Eastern Cape province. The Western Cape province had adopted the software, but its entire health information system budget had been allocated to a large Hospital Information System for three academic hospitals – a system that is still non-functional and now on the verge of being abandoned.

In spite of these obstacles, others bought into the approach. The British NGO TransAID, working with health transport managers in 8 provinces, has developed software and made it available using the open source approach. That software is currently distributed together with the DHIS, and the HISP team are working to ensure full compatibility (e.g. by use of the same facility coding system). Other similar linkages have begun to take shape, including: (a) the National Health Laboratory Services is very positive towards interfacing their laboratory information system, DISLAB, (used in 8 of the 9 provinces) to the DHIS; (b) staff from the Cape Metropolitan Council developed a geographic information system (GIS) interface between the DHIS and the free desktop GIS viewer ArcExplorer, and (c) the HISP team has established contact with the EpiInfo 2000 development team at CDC/Atlanta to explore interfacing the DHIS with EpiInfo 2000.

The DHIS software was successfully piloted in Mozambique during 2000, and is currently being rolled out in that country. Other countries, including Mozambique Malawi, Nigeria, and India, are currently piloting and/or adapting the software for their own use

District Health Information Software:

The software, as implemented in the Eastern Cape Province, consists of the following modules (see the technical schematic diagram in Annex 1 for more details):

- Monthly Data – data entry for PHC monthly reports (with 25 required data items) and annual audit (far more detailed information on services provided, quality measures, infrastructure & staff) and production of standard reports
- TB – Quarterly TB data entry and standard reports
- Report Generator – This module uses temporary tables, referred to as a ‘data mart’, that take raw data entered into the other modules, calculates the indicators required and makes the results simpler to use for ad hoc reporting. This enables reports from any time period and any raw data or indicators to be tailored to the user requirements. Data can be selected for a cluster of facilities (used by the supervisor), for one district or several, by one program area, or across different programme areas for managers with a variety of interests. Figures can be averaged over periods, aggregated for a given time period and compared to a previous year. The data mart helps put together “exception reports” for any indicator. These reports list outliers – values above or below a given value that users can easily change according to their own assumptions. This is a very powerful tool for managers to see who is “out of line” - for example which facilities have immunisation coverage above or below a certain value, or whose workload is above or below local norms.

In addition, the system features links to other tools, including:

- a very user friendly set of Excel pivot tables that make it easy for users to cross tabulate, filter and graph data
- Maps displayed using ArcExplorer map display software.
- A web-browser based data dictionary that stores official names and precise definitions for all Data Elements included in national and provincial Minimum Data Sets. This Data Dictionary, as well as the Web Shell and other HTML/XML/Java tools under development, is running on the HISP Application Server (a local web-server).

During the course of its development a variety of interesting and unusual features have been added to the system - usually based on requests from users. For example, there are options to print out the monthly reporting forms and even the tick registers used to record the data manually in health centres. Similarly, tally sheets can be printed out with the size of cells automatically adjusted based upon data reported historically.

On the analysis side, the system has made innovative use of 1996 census data for calculating population denominators. This has included the development of an algorithm to impute catchment area populations based on the proportion of headcounts to the entire headcount per census district. This gives a reasonable estimate of the population actually served from which denominators can be calculated for coverage of services for any age group.

A key principle of the software development approach was that it should be ‘Open Source’ and gratis. This means that the software is distributed free of charge and that the source code (programming) and database structure are open to modification by anyone. While this does involve an element of risk – in that users could make modifications to the system that could have unanticipated consequences – this philosophy has also made it extremely easy to promote the use of the software. Not only do potential users incur no financial risk in trying out the software, but there is the potential for them to adapt it as they see fit and copy it onto as many computers as they wish. This had certainly not been the experience with most commercially marketed software that provincial health authorities have dealt with at the hospital level.

Current Status

Within Eastern Cape Province, the DHIS (including the software) has now been implemented in all 21 districts – a process that took about 36 months – although most districts were up and running with basic functionality (data capture, partial validation, and

transmittal upwards) within 3 to 4 months. The software is also installed in a number of individual health facilities and is used at the Department of Health office in the provincial capital Bisho (as well as by EQUITY project).

As the amount of data captured into the DHIS kept growing, it soon became clear that the 16 MB PCs in the district offices were inadequate. The EQUITY project financed the purchase of computer equipment for all district and regional offices, as well as some equipment for the Department of Health (approximately US\$ 140,000). Because of the demanding computer specifications required to run the DHIS (many due to MS-Excel pivot table memory requirements), each district received a “small business” PC (Pentium III 450, 128MB RAM), an A4 scanner and an A3 inkjet printer. The five regional offices and the provincial office received a “workstation” PC (512MB RAM) in order to handle much larger amounts of data. Two notebooks and two digital projectors were included for training purposes.

US government procurement regulations required that this equipment be purchased in the United States, with disastrous consequences. Firstly, whereas competitive bidding for this relatively standard equipment would have taken 2-4 weeks in South Africa, it took nearly 8 months from specification of the tender to its distribution to the recipients. Secondly, the people drawing up the tender specifications were told – rightly or wrongly – that the tender could not be limited to global suppliers that would be able to provide local support. The cheapest supplier that seemed to fulfil the specs would have to be chosen. Thirdly, various other factors resulted in several changes in the actual components used after the tender was awarded, with final PCs that proved highly prone to e.g. hard disk crashes.

Today, one year later, nearly all the 28 PCs have or are broken down. EQUITY project staff had to handle repairs and try to squeeze spares under warranty out of the US supplier, resulting in turn-around times of as long as 4-7 months. Some equipment, like a monitor defect on arrival, has never been repaired/replaced at all. Most districts have been forced to look for other PCs or parts to be able to cope.

Most districts are nevertheless using the system without major problems, and many understand and use the software more effectively than staff at the provincial level. Feedback reporting remains somewhat ad hoc and district information offices report that managers are not uniformly interested in requesting or using information from the system. More effort is obviously needed to create the information culture around the DHIS.

The HISP team continues to provide significant support, since local capacity for software development and design of specialised analytical reports is still not in place in at the provincial level. This support has focused on general computer troubleshooting and maintenance, configuration and use of the DHIS software, and use of data. In addition, the EQUITY project has provided support through the Department of Health for the training of district health supervisors in use of data for planning and service performance

monitoring and evaluation. Eight training courses that have been organised by HISP team members at the University of Western Cape include:

- Certificate in District Information
- Introductory, Intermediate and Advanced level DHIS
- Using GIS for Health Data analysis and display
- Use of information for management
- Using DHIS for management
- Using information for hospital management

While this case study has largely focussed on experience in the Eastern Cape Province it should be noted the DHIS has been introduced, at least on a pilot basis, in all the 9 Provinces of South Africa. Initially, interested information managers have attended courses at UWC lasting 1 to 2 weeks and offered once every 6 months. For those Provinces with a larger number of interested staff the UWC HISP team conducts tailored training on site including the installation of DHIS software on local computers and its initialisation for the chosen data set of the specific Province. Individual HISP facilitators have taken responsibility for 1 or 2 Provinces and return periodically to help troubleshoot problems and extend the training to new users. It has been difficult however, to rapidly introduce the system everywhere because of the large number of staff in need of training as well as requirements for computer hardware. In addition transfer of data electronically to the national capital in Pretoria has been irregular and especially from these Provinces only partial in its coverage. Hence the real power of DHIS to capture monthly primary health care activities throughout the country and make meaningful nationwide reports has yet to be realised. During 2000, Provincial and National authorities made the decision to extend DHIS to all health facilities in the country. This places heavy demands on the system especially the HISP trainers.

The HISP team is now fielding around 15 people to roll the system out and a MS Project workplan is being used to track responsibility of HISP, EQUITY and government staff. Nearly 100 people are involved in the roll-out that should be essentially complete by the end of 2001. A big challenge is to see how the system will continue to evolve and be maintained after EQUITY funding ends – but most of the actual roll-out is done by the provinces themselves without external funding which is reserved for consultant trainers and training courses.

During the visit to prepare this case study, plenty of anecdotal information was gathered about innovative uses of the system by health workers and managers alike. Some of the highlights are included in the box below. Such experiences need to be shared widely so that they become part of standard practice throughout South Africa.

Info to action: Innovative uses of DHIS data

Nurses Warden and Hendry are health workers from different health facilities in Southern Peninsula municipality, just outside of Cape Town. They have been given the difficult task of agreeing upon which of their two PHC centres should be closed – and how their patients and staff can be merged to provide services more efficiently – perhaps in a completely new location. In the past, Department of Health managers would have just made the decision at a high level and the health workers would have had to live with it. Now they are gathered around the computer at the municipal office, pouring over various types of data they have printed out from the DHIS. They are comparing staffing patterns with headcounts at each facility over time to determine workload and examining data on the catchment population for different services. This helps them see the case-mix of patients that each facility is seeing and helps them determine which facility is already seeing a larger part of the combined population. The sisters decide that this is still not enough information to make a recommendation. They live in a semi-urban area, and they believe there is considerable crossover of patients who live in one catchment area to the other – perhaps because they work in the other area. They have decided to request a large scale map of the two zones and conduct a brief survey of patients for a week or so to confirm their belief – plotting the residences of the patients with different colored dots on the map. This should help them decide on the best location for the combined facility.

Kevin is the district information officer for Aliwal North Health District, north of Queenstown. He has been trained to use the DHIS software to enter and analyze data coming from all the health facilities in his district. For the past several months he has printed out many pages of feedback reports covering all of the indicators in minimum data set and handed it out to each of the health programme managers and supervisors during district meetings. This has seemed like a waste of paper. There is too much paper to wade through, and the programme managers have many of other logistics and resource related issues that they feel are more important to discuss. This month he decided to use another approach, he works with the district health officer to identify one important theme, and produces a comprehensive analysis of recent DHIS data related to that theme alone. Instead of just handing out the print-outs, he prepares PowerPoint slides on the topic and works with the responsible programme officer to present the tables, graphs and key observations to the rest of the team. This takes a lot less time and results in much more animated discussion. Members of the team decide on a list of themes they would like the information officer to research for future meetings.

Virginia is the Community Health Coordinator for Southern Peninsula Municipal Office. She is faced with a major dilemma about how to allocate reduced funding for tuberculosis services among the 18 clinics in the municipality. In the past funds were allocated strictly on the basis of the number of cases treated (around 4000 Rand per patient per year). This approach is no longer possible, because there are more cases than there is money to go around. During a meeting of all TB programme nurses, the group decides to see if the data from the DHIS can help them. They ask Sylvia, the data entry clerk, to prepare a

graph of the TB cure rates from the each facility. To their surprise they discover that these rates differ sharply between facilities. Most are quite high – around 80 or 90% -- but there are 4 or 5 health centres with low cure rates. Because of the risk of developing more resistant strains of TB when the cure rate is low, everyone agrees that proportionally more funds should be directed to those facilities. Interestingly, data gathered the following year supports the effectiveness of their approach. Nearly all the facilities lagging behind have closed the gap and most of the other facilities have maintained their cure rates. How much of the change is due to more resources and how much due to the heightened concern of the nurses who saw for the first time that they were lagging behind, is a matter of speculation.

Ivan is the Director of PHC for the City of Cape Town. The availability of data from the DHIS has helped him to revolutionise the process of developing the provincial business plan for health services. The new planning process results in a work plan that includes quantified outcomes and outputs anticipated for each activity – in addition to the resources required. Not only do the DHIS tools empower staff – who must agree together with their managers on reasonable targets for key indicators, but mid-level managers get a clear message that they must use the DHIS data to monitor the performance of their health facilities on more than just financial terms. To add further incentive, a new post of clinic manager has been created at the facility level. This individual is paid extra for being accountable for performance. Not everything works as well as Ivan would like, though. There is still no easy way to link the performance data generated in the DHIS – which is built around health facilities - with cost centres used in the financial management system, since these cost centres sometimes cover many facilities (e.g. drug supplies to clinics) and sometimes only part of a facility (e.g. staff salary per ward in larger hospitals). Also, the city needs to establish a more effective procedure to ‘unpack’ the provincial business plan for each level of the health system. New challenges to use of data have also emerged with the transition of decision-making authority from health managers to municipal councils with limited health or medical training. The data and information will have to be presented in simpler ways that are understandable and convincing to this broader audience.

Lessons learned

Implementing a system of this size and scope provides a wonderful natural laboratory for testing different approaches and, hopefully, learning about what works and what doesn't. Below are some of the most significant lessons learned from the Eastern Cape experience.

- a) **District-level involvement in HIS development is not only possible, but it is critical for the success of information systems** aimed at enhancing health services at the district level. There are many examples of how input from district and health facility level staff led to new features and functionality in the system. The success of this participatory approach in Eastern Cape province is reflected by a genuine feeling of ownership expressed by many district health staff while this case study was being prepared.

- b) Whatever level is the primary focus of HIS enhancement activities even with a bottom-up development approach, **it is crucial to identify and involve all stakeholders or 'actors' in the process.** This includes individuals at all levels of the health system (potential users) as well as significant events and changes that are likely to influence the development of the system. It was important to focus on high level staff as well. Only when the information officers started making reports and putting them on managers' desks did anyone pay much attention to what the data were telling them.
- c) It is important to **'walk before you try to run with information systems.'** Considerable effort was focused on helping staff use paper and pencil to master analytical skills before the system was computerised. This required a minimum data set, that health workers could easily understand and analyse on the spot – without the need of a computer. Similarly, the use of hand-drawn, catchment area maps and graphs was strongly encouraged as a key step in getting people to understand the populations they serve and to trust the data they collect. Later the computer can help them do it faster and better.
- d) Several lessons were learned on the software development front:
 - i) **A system of this complexity requires good linkages between users and a professional software development team.** To this end, the prototyping approach has worked well in South Africa. It is also clear that the presence of extremely motivated and, in their own words “workaholic”, champions for the system within the department of health, the HISP team and the EQUITY project have played a crucial role in the rapid extension of the system. The excellent cellular telephone infrastructure in South Africa has also been an asset. Telephone support from HISP team members and Provincial DOH staff is available to users of the system almost any time of day.
 - ii) **Efficient communication between the partners is crucial.** The good fixed and cellular telephone infrastructure in South Africa has been an asset. Telephone support from HISP team members and Provincial DOH staff is available to users of the system almost any time of day. Bureaucratic rules and regulations and lack of infrastructure have actually been the major impediment to smooth communication – a manager in the provincial administration might wait months to get an email account or Internet connection, despite having a physical contact point one meter from his/her PC... The information officer in one Health District in the Western Cape was initially only permitted to receive emails and not to send, since it would save around USD 1 per month. Getting permission to also send took nearly six months and much paperwork.
 - iii) **Maximise data use by building links to off the shelf software** for analysis and reporting such as Excel pivot tables. This lets managers use the analysis tools they are most comfortable with and reduces the software development work that would otherwise be required to reproduce this functionality in their application.
 - iv) **Don't underestimate the potential appeal of a specialised software application.** Design database structures that can accommodate more records than you would have ever imagined. If database design is internally complex,

establish mechanisms to provide users with simpler views of the data for their own ad hoc analysis. Many users expressed frustration at not being able to understand the manner in which data were stored in the system.

- v) **Look to find a balance between precision and approximation.** This needs to take into account the expected quality of the data collected (including secondary data from census or other data sources, in addition to that controlled by the health sector itself) as well as the degree of precision required for decision-making. This was expressed several times using the adage: ‘It is better to be approximately correct than precisely wrong.’ In a similar vein, indicators that are too complicated to calculate are often also too difficult for mere mortals to interpret and use.
- vi) **Open source software that is distributed for free is easy to ‘sell’, but don’t underestimate the amount of training and technical support it requires.** The database structure and many of the algorithms used for calculating indicators and generating reports are quite complex – even though they are well documented and, in theory, user-modifiable. In fact, it has been much more effective for users to request most modifications from HISP team members, rather than trying to implement them alone. About 70% of overall HISP effort has been spent on training, support, and institutional development in general – only 10-15% on software development. In addition, open source software may be somewhat more expensive to support over the long term, since different versions may evolve making it much more complicated to introduce and test upgrades.
- e) The **implementation of new software can become a vehicle for change**, including: standardisation, integration, and more widespread dissemination of health data/information. This experience once again underlines the chicken/egg nature of technical innovation in a health system. Although this is somewhat the corollary of the ‘walk don’t run’ principle cited above, in this case it was also true that the process of computerisation served as a catalyst for change. By requiring managers to prioritise what information was really necessary and to question standard operating procedures for data collection and use.
- f) The **indicator-based approach** to determining information **needs is an effective way to reduce the number of data elements collected** and to ensure that data collected is relevant. A simplified indicator framework such as WHO’s health problem, service and critical resource indicator categories, would have been useful to ensure a more even distribution of indicator types and to clarify the linkages between them.
- g) **Improvements in data recording procedures deserve as much attention as reporting and data processing.** In the Eastern Cape, focus on this aspect came very late in the process. Problems of time spent recording data, poor data quality and limited use of the data at local level are likely to continue unless more emphasis is placed on this area.
- h) It has been very **hard to get people to make timely reports** – they prefer annual reporting – which some feel is HISTORY!! The system is most useful if it can provide fast and up to date indicators of what the problems are and where they are localised.

Future Directions

In spite of the great progress already made, there are a variety of areas where the DHIS can be further improved. Below are some of the key areas that are being worked on or explored at this time:

- a) **Using more sophisticated tools to manage the implementation process:** The DHIS is currently being rolled-out to the entire country, that means 9 provinces, some 180 health districts and 6000 health facilities in South Africa. The implementation team has recently developed a Microsoft Project work plan that is guiding the roll-out for this complex process, with a huge number of modifications to fit local needs. Remarkably it is all working and getting the standard numbers into Pretoria regularly now.
- b) **Focus more attention on data interpretation and use.** This has begun with the development of some standard curricula for data-for decision-making training of supervisors. In addition, certain Provincial and Municipal authorities are linking DHIS data to specific procedures such as work planning. District health workers are required to project how much change they expect in key indicators when they put together their work plans – and are then held accountable for the results.
- c) **Further develop the capacity of Provincial Department of Health and National health authorities to maintain the system,** including: receiving and aggregating data from all districts/provinces, providing systematic feedback, adapting the software as information needs change and providing timely support for end-user software trouble-shooting support.
- d) **Proceed with the development of a new version of the software.** Version 1.2 of the DHIS software is at a crossroads. Its current database structure, originally designed to provide maximum transparency for district users with limited knowledge of MS Access, is not efficient for the large data sets gradually emerging at provincial and national levels. The Eastern Cape data file, covering three years of PHC data, is for instance around 200 MB in size and with individual tables reaching towards a million records or more. Even if Access formally has a maximum size of 2 GB, the practical limit is probably around 20% of that. Network installations are also on the increase, but it is not advisable to run the DHIS on Access (a thick client) with more than around 10-15 concurrent users. Pivot tables, fully stored in memory when used, are also very RAM hungry with such large data sets.. The new features of the software may include:
 - The development of a ‘DHIS light’, client-server or web-browser based system, that will not have the same high computer resource requirements for end-users.
 - Replace the current DAO⁷ interface between the application modules and the data files with OLE DB and ADO⁸, thereby allowing users to store their DHIS

⁷ Data Access Objects – the “linked tables” in MS Access is using this technology, which is being phased out and replaced by OLE DB and ADO.

⁸ ActiveX Data Objects (ADO) enables you to write a client application to access and manipulate data in a data source through a provider like OLE DB. ADO's primary benefits are ease of use, high speed, low memory overhead, and a small disk footprint.

data on any SQL compliant Data Base Management System with an OLE DB driver (e.g. Oracle, DB2, SQL Server, Sybase, etc).

- Further improvements to the Report Generator and its temporary Data Mart tables, to make it easier for end users to understand the file structure and to use the data with other analysis tools and report writing tools (ArcExplorer, Crystal Reports, EpiInfo 2000, Excel, etc...).
- Bring the user interface more in line with common graphics interface or internet browser standards. This includes, revising the placement and use of menus and control buttons, changing the layout of data entry screens so that paper reporting formats can be organised in a more user-friendly manner.
- Introducing multi-language support, so that the system can be easily translated into different languages (Portuguese and French are likely requirements right now).
- Implement a common coding system for health facilities and geographic areas that will enable linking of many more of the computerised sub-systems – lab results, finance, personnel and drug management, for example.

Annex 1: DHIS Application Structure

