USABILITY OF A COMPUTERISED PATIENT RECORD SYSTEM IN A BUSY TOWNSHIP PRIMARY HEALTH CARE CLINIC: A FEASIBILITY STUDY

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A COMPARISON OF DIFFERENT APPROACHES TOWARDS A COMPUTERISED INFORMATION SYSTEM FOR PRIMARY HEALTH CARE IN THE FREE STATE

Dissertation submitted by

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INFORMATICS IN PRIMARY HEALTH CARE : A BACKGROUND

1. PRIMARY HEALTH CARE - A DEFINITION

In the health policy document of the African National Congress (ANC) [2], the reigning political party in South Africa, Primary Health Care (PHC) is defined as "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." It is the first level of contact of individuals with the national health system, bringing health care as close as possible to where the people live and work.

According to the above mentioned document PHC will form an integral part of the country's National Health System. The PHC approach, as it is called, will guide the overall social and economic development of the community.

Chapman et.al. [6] further highlights the following aspects of primary health care:

- Education concerning prevailing health problems and preventative and controlling methods
- Provision of food and proper nutrition
- Adequate supply of safe water and basic sanitation
- Provision of maternal and child health services, including family planning
- Immunisation against the major infectious diseases
- Prevention and control of local endemic diseases
- Treatment of common diseases and injuries
- Provision of essential medicine

Mc Donald and Chapman [24] adds the following:

- Psychiatric, geriatric and rehabilitation services
- Occupational health and environmental control
- Dental care

2. INFORMATICS IN PRIMARY HEALTH CARE

2.1 Health Informatics : A definition

According to Power [29] the World Health Organisation defines *Health Informatics* as "an umbrella term used to mean and to encompass the rapidly evolving discipline of computing and communications, methodology and technology to support health and health related fields such as medicine, pharmacy, dentistry and nursing."

Power [29] says that the concept extends over three dimensions which define who it serves, what services it provides and what technologies it employs. It serves policy makers, managers at all levels, health care providers, health care educators and their students, patients and the public. The services my be categorised as data processing, communication, cognitive and library services. The technologies are not restricted to computers and electronic networks - paper-based information systems have an importance that is often underestimated.

2.2 A National Health Information System for South Africa (NHIS/SA)

One of the key issues mentioned in the health policy document of the ANC [2], is to establish a comprehensive health information system that is relevant to local, provincial and national levels. The system would be part of the management subsystem of the National Health System envisaged for South Africa by the ANC. The system will consist of "the collection, organisation, reporting, storage and use of data for planning and management purposes".

According to the health policy document, the time-frame for the NHIS/SA is as follows:

- Definition of essential information required at each level by the end of 1994
- Training of personnel at all levels and facilities by the end of 1995.
- Commencement of collection of information at all levels by the end of 1995.

As work is still done by the NHIS/SA Committee and the various provinces on the first aspect mentioned above, it is clear that the time frame has been somewhat unpractical.

The information gathered by the NHIS/SA will fall into four broad categories:

- Health status information including births and deaths, morbidity and mortality profiles, injuries and disabilities, violence, etc.
- Health related information including access to clean water, sanitation, unemployment, school attendance, etc.
- Health services information including facilities, finances, personnel, support services, etc.
- Management information including health workers in training, staff requirements, cost-effectiveness of services, etc.

The health policy document of the ANC states further that "Specific indicators will be included to monitor the apartheid-generated disparities in health status and access to health care and in order to do this data will be disaggregated by gender and in the short term by 'race' as previously defined by the apartheid state" [2].

The above mentioned document also states that "Information collected by the system will be used for strategic planning, for policy formulation, for monitoring health care delivery, for evaluating specific health care programmes and for assessing and reviewing progress on district, provincial and national plans" [2].

A document compiled by the National Health Information System Committee [28] presents health goals, objectives, strategies and indicators based on the above principles.

2.3 A patient-record based system

The NHIS/SA focuses on global details on the macro level. It is therefore interested in the number of cases, not in the details of each individual patient. To render primary health care effectively however, it is important that service providers have access to demographic and clinical details of each patient as well as interventions on previous visits. Therefore the information system must provide for information on both the macro and micro levels.

Currently two manual systems are in place to provide for the two aspects of health informatics mentioned, namely a tally system [33] on which the service provider makes ticks for every case seen and a set of patient cards. When computerising the information system, the world wide trend is to combine these aspects into a single health information system. The system would keep permanent record of individual patients and simultaneously increment the number of cases without the service provider even being aware of it. At regular intervals the statistical data will be summarised and presented in a format that will be useful to both the service providers and nursing management at regional, provincial and national level.

According to a paper by Wallace [43] a patient record currently consists of paper-based patient records, film-based x-rays and scans from diagnostic procedures, strip charts and other output from laboratory equipment as well as voice recordings of clinicians' notes. According to him the computerised patient record (CPR) must include all these aspects and furthermore adhere to the following requirements:

- It should support patient care and improve quality of care.
- It should enhance the productivity of health care professionals.
- It should reduce administrative costs of health-care delivery.
- It should support clinical and health services research.
- It should accommodate future developments in health care technology, policy, management and finance.
- It should allow its users to design and utilise their own special needs and to organise and display data in various ways.
- It should ensure patient confidentiality at all times.

Wallace states, however, that neither paper-based records nor contemporary computer-based records can effectively support all of these objectives today.

According to a paper by Neame [26] the benefits of an electronic medical record are the following:

- Availability from every computer that is on-line, that is connected to the database where the records are kept.
- Records made by multiple providers in different locations can be linked to create a single record for an individual.
- Storage space is cheap and compact.
- Different views of the same data are possible.
- Processing of statistical reports is easy and can be done automatically.
- Data can be checked as they are entered to ensure adequacy and accuracy.
- Links to knowledge based tools are possible.

3. THE PHC/INFO PROJECT

Health authorities rendering primary health care services in the Orange Free State, as the province was known then, initiated a research project in 1989 to overcome the deficiency in statistics that are routinely collected by the service rendering components. The study concentrated on the disadvantaged communities and from the results it was evident that this type of information was needed on a more regular basis and on a magisterial level in order for local health services to manage their services more effectively.

The PHC/INFO Project originated in June 1993 when a proposal for funding was jointly submitted by the *Provincial Administration of the Orange Free State* (PAO) and *the Centre for Health Systems Research* (CHSCR) at the University of the Orange Free State to the *Health Systems Trust* [6]. According to this proposal the main objective of the research project was to develop and institute an information system which will ensure that primary health care resources in the Free State are optimally put to socially accountable use. This aim would have been pursued by the improvement of routine health statistics and by the refinement of community-based studies in order to provide the main stakeholders in primary health care in the province with appropriate and scientifically sound information on the real needs, the deficiencies and desirable strategies regarding primary health care.

3.1 The problem

According to a recent study by Mc Donald, et.al.[25], PHC nursing staff is experiencing an excessive administration burden. A large amount of time is devoted to the processing of above mentioned statistical reports. It may even happen that a whole work day is devoted to this aspect on a regular basis. According to him 35% of a PHC nurse's workload can be computerised.

The proposal of Chapman et.al. [6] mentioned the following aspects being problem areas that needed attention:

- Health management and staff don't know the exact primary health care requirements and health status of the population at specific magisterial and community levels.
- Health personnel are burdened with the collection of routine statistics without proper feed-back of results from management. Because they don't see the purpose of the collected information, they are not motivated to capture the statistics accurately. Furthermore, there is no fixed way of collecting data, confusing the service providers to a large extent.
- Management and primary health care personnel are not properly trained in the collection, interpretation and utilisation of information.
- Information is collected by a number of health authorities but the results are not always sent to a central point for processing. This leads to inaccurate conclusions.

3.2 Aims of the PHC/INFO Project

Generally spoken the project wants to equip health management with proper skills in the application of health information in planning and decision making and to improve and optimise primary health care services in the Free State, thereby promoting the health status of populations, particularly in disadvantaged communities. These services must simultaneously be rendered in an efficient, acceptable, accessible, appropriate, affordable and equitable manner.

According to Chapman, et.al. [6] the development of an appropriate research instrument which can be implemented in both urban and rural areas as well as the training of health workers to accurately and effectively collect and evaluate routine statistics would facilitate these objectives.

3.3 Organisational structure

The following diagram (fig. 1) is taken from the second progress report [39] by the project leader and depicts the structure of the PHC/INFO Project and the various fields of research.

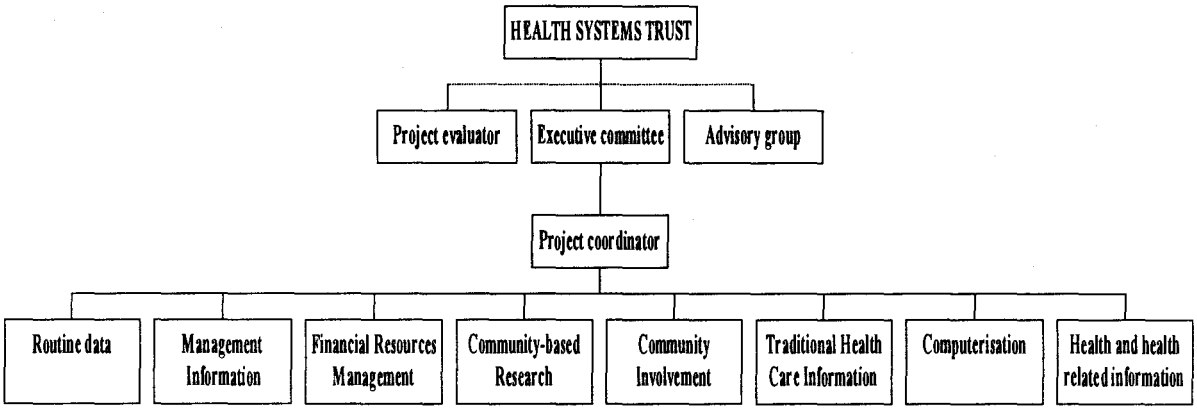


Fig. 1

According to Van Rensburg [38] and Van Rensburg [39] the work is done in eight task groups with the following assignments:

- **Routine data** : The revision and upgrading of the current routine statistics procedures and system.
- **Health and Health related information**: The compilation of a comprehensive health and health-related profile of the Free State.
- **Financial Resources Management** : Development of a strategy for the appropriate management of financial resources for PHC.
- **Management information** : Decision on the nature of appropriate management information for PHC.
- **Community-based research** : The establishment of an appropriate community-based methodology for the collection of health care information and the training of health care workers in the application of this methodology in their daily work.

- **Community involvement** : The development of strategies for effective community involvement and participation in all aspects and phases of the development and sustainment of a community-based health information system in the FS.
- **Traditional Health Care Information** : The establishment of an information system relating to traditional healing in the FS.
- **Computerisation** : Development of strategies according to which the entire PHC Information System in the FS could gradually be computerised.

3.4 Work of the task groups

Of the above mentioned task groups, the **missions and goals** of the task groups Routine Statistics and Computerisation are applicable for this study.

3.4.1 Routine Statistics

- **Mission** : Optimising PHC by means of a user and collector-friendly routine statistics system which reflects and can be used to monitor the actual PHC status of the community [18].
- **Goals** :
  - To determine which routine data-elements to collect.
  - To establish collector-friendly collection procedures for storing, processing and reporting routine statistics.
  - To determine how routine statistics can best be used.
  - To train PHC managers to make optimal use of Routine Statistics during the planning of services.

The Routine Data Task Group of the PHC/Info Project has consequently developed a set of health indicators [19 & 41] to provide for the necessary statistics and implemented it in the form of a tally sheet [33]. This set of indicators is based on the guidelines from the National Health Information System for South Africa (NHIS/SA) [28] as interpreted by Mackenzie [20].

3.4.2 Computerisation

- **Mission** : To provide health administrators with the necessary information so that they can optimise PHC services and resources through an appropriate, cost-effective computer system that collects, processes, retrieves, displays and communicates accurate and timely information to managers at all levels of the information hierarchy [40].
- **Goals**
  - To develop a plan how to computerise PHC services.
  - To do the necessary research to prove or disprove that computerisation would improve the functionality of PHC personnel.
  - To obtain funding to develop a computerised information system for PHC.

The above-mentioned mission were broken down into the following **requirements** that any future computerised system should meet [7]:

- The system should enhance quality of care.
- The system should be affordable to the province.
- The system should have the approval of the community.
- All the components of PHC should be integrated into one computerised system.
- The system should require a minimum of interaction from the user and should save a maximum amount of time.
- The system should be friendly and easy to use.
- The system should be flexible to cater for different communities with different needs.
- The system should protect the rights of individuals when keeping sensitive information.

This study has been done as part of the PHC/INFO Project with the primary purpose of fulfilling in the first two goals mentioned above. During the development of systems as part of this study the above mentioned requirements have been taken into consideration.

CHAPTER 2

THE CURRENT SITUATION

INTRODUCTION

Currently the administrative burden of service providers under jurisdiction of the Free State Province constitutes of six separate manual systems:

- A set of cards, constituting the **patient record**, is kept for each patient. Some are held by the nurse in a filing cabinet and others are held by the patient himself.
- A register for TB patients.
- A bulky tally sheet exists on which ticks are made next to an appropriate entry by the nurse for every patient seen. These ticks are added regularly and summarised on statistical reports. This system constitutes the **statistical process**.
- A **stock control system**.
- **Logistical system** regarding the vehicle.
- The **district management system**

In this study, only the first three systems are investigated.

It is clear that duplication exists regarding the first two of the above mentioned systems. For each patient seen, his personal record must be updated as well as an indication on the tally sheet of the kind of visit and intervention done.

1. A MANUAL PATIENT RECORD SYSTEM

Currently the patient record system constitutes of the following hand-held cards.

1.1 Held by the nurse

- Community profile for farm population (11 fields per farm)
- Family history card (44 fields/family + 19 fields/child + 2 fields/TB contact)
- Patient health record (91 fields at first visit + 7 fields at all subsequent visits)
- Family planning: Female client card (100 fields at first visit + 8 fields at all subsequent visits)
- Ante-natal record (91 fields at first visit + 12 fields at first visit for each previous pregnancy + 14 fields at all subsequent visits)
- Child health record (72 fields at first visit + 4 fields per immunisation + 52 fields at each subsequent visit)
- TB register (22 fields at first visit + 3 fields at each subsequent visit)

1.2 Held by the patient

- Tuberculosis patient treatment card (27 fields + 7 fields at each subsequent visit)
- Family planning appointment/referral card (12 fields at first visit + 6 fields at each subsequent visit)
- Ante-natal examination card (18 fields at first visit + 15 fields at each subsequent visit)
- Road to Health Chart: Child chart, including the growth chart (44 fields at first visit + 3 fields per immunisation + 3 fields at each subsequent visit)

In the case of a first visit of an ante-natal patient, three cards have to be opened and 200 fields have to be completed! The result in practice is thus that only the most essential data fields are completed and even then the data can be very inaccurate. The question thus arises: What is most important - a complete but inaccurate data set or a limited but accurate data set? Furthermore, if a patient's address changes, all three cards have to be updated, most probably resulting in a loss of data integrity . If the patient have lost the patient-carried

record, this card and if he visits another clinic the two nurse-held cards have to be completed all over again. It is thus evident that this situation of heaps of patient records with a huge number of unnecessary data fields can no longer be tolerated.

2. THE CURRENT STATISTICAL PROCESS

In the past two years extensive research was done to revise the tally sheet and a new tally has just been implemented in the Free State. Although every effort has been made to minimise the number of data elements to be captured and to design the tally as concise as possible, it still comprises an overwhelming 18 pages. Figure 1 is an example of the ante-natal part on the tally.

	BLACK	COLOURED	ASIAN	WHITE
First visits before 20 weeks	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
First visits after 20 weeks	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Follow-up visits	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Referrals	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Women with HB < 20	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000

Fig. 1

Periodically the nurse herself must add the ticks on the tallies and the totals must be carried over to another sheet. These forms with the totals must then be collected from all nurses and somebody must consolidate them all and process the reports required by nursing management.

2.1 Statistical reports

As indicated above, the statistical system incorporates also a set of manual reports that must be generated regularly from the tally sheet:

Weekly statistical reports

- Report of all notifiable medical conditions (10 fields/patient)
- Report on deaths from notifiable diseases (8 fields/death)

Because the number of occurrences may differ from week to week, the number of fields that should be completed on the reports is not a constant.

Monthly statistical reports

- Psychiatry statistics (105 fields)
- Immunisation statistics (77 fields)
- Nutrition surveillance report (94 fields)
- Tuberculosis statistics (40 fields)
- Report on school health services (254 fields)

A total of 570 data fields have to be completed at the end of each month!

Quarterly statistical reports

- Family planning statistics (178 fields)
- Monitoring the impact of free services to pregnant woman and children under six (19 fields)
- Sexually transmitted disease surveillance (45 fields)
- Report on Tuberculosis case finding (69 fields)
- Summary report on Tuberculosis case finding (69 fields)
- Report on Tuberculosis treatment outcome (65 fields)
- Summary report on Tuberculosis treatment outcome (65 fields)
- Primary health care services (815 fields)

A total of 1325 fields need to be completed on the quarterly statistics. If the monthly statistics of every third month is added, a total of 1895 data fields need to be completed at the end of each quarter!

Ad hoc reports

- Anonymous AIDS report (53 fields per patient when occurring)
- Birth register (29 fields at each occurrence)

A large amount of time is thus devoted to the processing of above mentioned statistical reports. According to Mc Donald, et. al [25], it may even happen that a whole work day is devoted to this aspect weekly. According to this study 73% of the nursing staff makes the

assertion that PHC is neglected because of a preoccupation with data collection. Mc Donald [25] further showed that PHC nurses spend only 24% of their time on direct patient care. The administrative activity that consists mainly of completing forms and preparing reports accounts for 23% of their time. According to him 35% of a PHC nurse's time lends it to computerisation.

2.2 Disadvantages of the tally system

The current manual tally system has the following additional disadvantages:

- **Lack of accuracy**

It happens in practice that a nurse fails to record every patient on the tally. If she is aware of it, she can either enter a good guess at the end of the day or just omit it. But mostly it happens that she simply forgets to record a patient. Errors with the manual processing of the tallies are also most probable.

- **Inflexibility of tally**

It is difficult to implement small changes to the tally when necessary. For example, at this stage provision has been made to count incidences of 50 diseases. It might happen that the National Health Department wants all incidences of another disease to be counted as from a certain date. It would be difficult, if not impossible, to adapt the tally sheet accordingly, distribute it throughout the province and notify all nurses in time.

Furthermore, if a change causes some data for instance on page 3 to be carried over to page 4, all subsequent pages must be modified as well.

- **Training**

The correct use of such a bulky tally is not always easy and obvious. An extensive training process must be conducted by nursing management prior to implementing a new tally sheet.

Notifying everybody concerned of changes on the tally after implementing it, is a comprehensive task as well.

- **Piles of paper work**

The basis of patient management is currently done by means of a set of patient records on hand-held cards kept by either the patient himself or the clinic. While a nurse is busy with a patient, it is sometimes necessary that several cards must be updated. Adding the tally to that might give the patient the idea that the paper work is more important than his well-being. Furthermore, it often happens that the same data must be entered on one or more patient records and on the tally sheet.

- **The tally sheet is still incomplete**

The very nature of the tally sheet has forced the designers thereof to stick to the bare minimum data elements to be captured. Some most important, but not compulsory, data elements have been omitted. This include data concerning sexually transmitted diseases (STD's) amongst others.

- **No clinical record**

A tally sheet only provides a way of counting incidences. It does not provide for clinical information of a patient. Therefore the patient carried records and patient files at the clinic must still be in place. It happens quite often that a patient loses his patient carried record or moves to another place in which case the clinical history held by the clinic is not available and a brand new file must be opened at the new clinic.

- **More than one tally**

Capturing complete data on incidences of Tuberculosis (TB) is compulsory and is currently done on a separate tally sheet which is just as bulky as the one for general use. This means that the nurse must tick the TB entry on the general tally sheet and she has to reach out for a different tally sheet if a TB patient sits in front of her. Furthermore, the TB tally must be used to update the TB register periodically.

- **Statistical reports not designed for local use and decision making**

A statement by the NHIS/SA-committee says: "If a data-element cannot be used at local level, it should not be captured" [28]. This is a truly ambitious statement and currently definitely not the case. Very little, if any, of the statistical reports are used to support decision making at a local level. Furthermore, the largest bulk of all statistical reports are filed somewhere at provincial level and not utilised at all. Devoting so much time to the aspects of capturing data-indicators and processing statistics are thus not justifiable.

3. CURRENT INFRASTRUCTURE

Currently the Provincial Administration of the Free State is in the process of providing computers to clinics under its jurisdiction for the main purpose of connecting them with the Healthlink network - a network used for file distribution and e-mail. At this stage more or less 50% of all fixed and mobile clinics have been equipped.

Apart from the software giving access to Healthlink, each computer is delivered with Windows 3.11 and the standard version of MS Office that comes with MS Word 6.0 for Windows and Excel 5.0 for Windows. At certain pilot sites one or more patient record information systems has been installed as well. However, because of a total lack of computer-literacy very little of the service providers are able to use the computers to their full extent.

No clinics are provided with more than one computer and therefore no local area networks exist. This results in the unbearable situation that a service provider must share the use of one computer that is situated in a separate room with several others.

CHAPTER 3

THE ALTERNATIVE: COMPUTERISATION

INTRODUCTION

Many of the disadvantages of the manual systems mentioned in the previous chapter can be dealt with if the processes of data capturing and processing are computerised. The following advantages are in addition to those mentioned in chapter 1, paragraph 2.2:

- Changes to the data set can be made easily and effectively.
- Built-in help functions can replace the need for follow-up training sessions.
- The tally system to count incidences will be abandoned either partially or completely.
- All data capturing will be centralised, i.e. the need for several cards, files and tallies will not exist any more.
- The piles of paper work will be taken away from the nurse.
- The regular and ad hoc reports can be processed easily and accurately by a single person.
- Increased accuracy of the data captured and reports produced will be ensured.

Mc Donald [24] mentions some advantages as well:

- The service provider would have more time to attend to patients' needs.
- Defaulters would be identified and attended quicker.

Unfortunately a computerised system has disadvantages as well:

- The infrastructure, i.e. computers, peripherals, network links, etc., is quite expensive.
- The software itself may be expensive
- The fact that the service providers are mostly computer-illiterate may cause delays.
- Because of their computer-illiteracy the service providers might feel threatened by the computer, thus revealing a resistance against the use thereof.
- Authorising changes is difficult to implement.
- If the system used is too comprehensive, the delays become too long.

- From a patient's viewpoint, it is better to wait for the nurse to finish writing on a hand-held card than to be ignored for some time while the nurse is updating the computer record. The patient can feel neglected.

It is clear from the above that the general perception that a computerised patient record system will be the ultimate solution, is not necessarily true. In the following chapters several approaches towards implementation of a data set will be investigated to determine whether it is feasible to computerise the primary health care environment at all.

1. SCENARIOS WITH REGARD TO THE AVAILIBILITY OF COMPUTERS

A program of issuing clinics in the Free State with computers is currently in progress. Because of the lack of funds, however, it is not expected that every nurse will have access to a computer on her desk within the next five years. A computerised PHC system must thus make provision for a situation in which a computer is readily available at every consultation and for a situation in which a computer is shared by several nurses.

Several strategies for handling patient records in a fully computerised and partially computerised clinic are possible. The following strategies are from least desirable to most desirable.

1.1 One computer per region - Manual patient records submitted regularly

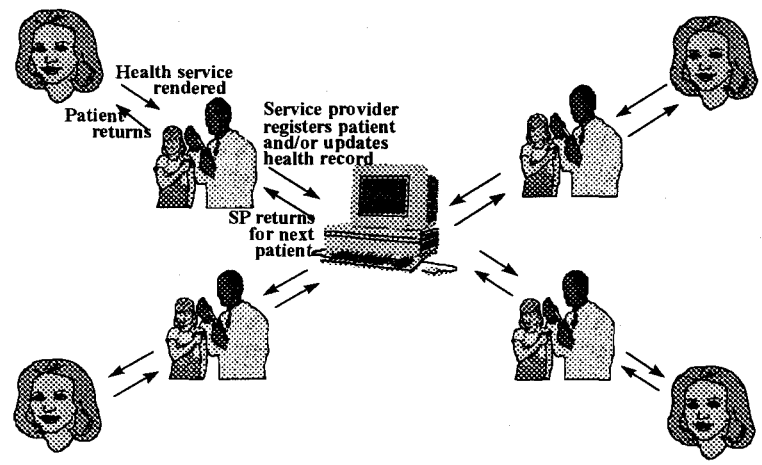
This scenario provides for a set of forms that has to be completed at every consultation. These forms are then sent regularly, e.g. weekly, to a central point where somebody is appointed to enter all the details on computer. Such a set of forms has been designed as part of this study and is included as appendix B.

It was soon evident that this approach is not feasible at all. Because the patient's record must be available at the clinic at all times, the manual records must still be in place, resulting in duplication of entries. The only advantage is that the service provider does not have to capture and process statistics. The extra time involved in the completion of the forms does not justify this advantage. Furthermore, the approach of scanner cards for capture of

statistical indicators as discussed in chapter 7, is much more feasible and it also takes the burden of statistical processing away from the service provider.

1.2 One computer per clinic - Computer records are updated between services

As illustrated in fig. 1, the patient is serviced and the service provider updates the patient record on computer immediately if the computer is available. If the computer is used by a colleague, the service provider updates the patient record as soon as she gets a chance on the computer.



(SP: Service provider)

Fig. 1

This scenario is only feasible if the number of patients visiting the clinic is low. In a busy clinic the competition for hardware amongst service providers will most probably result in long waiting times

1.3 One computer per clinic : Computer records are updated at the end of the day

When the patient arrives, the service provider registers the patient if it is a first visit or else requests a printout of the patient's demographic details and clinical history. The service is then given away from the computer and the printout is updated during the service. At the end of the day all the patient records are updated from the printed records. The scenario is illustrated in fig. 2.

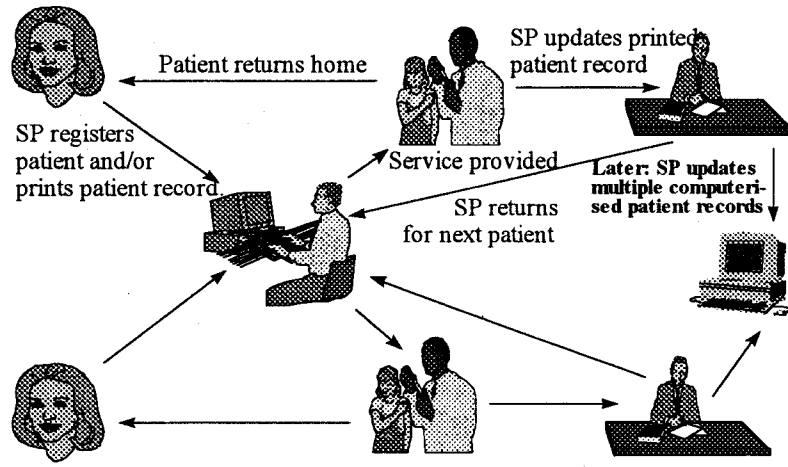


Fig. 2

This scenario is also only feasible in a low-volume clinic because, although less than in the previous case, there will still be competition for computer hardware. Furthermore, extra paper work is involved and the service providers might have to work after hours to update the computer records.

1.4 One computer per clinic with a computer operator appointed

This scenario is illustrated in fig. 3. When the patient arrives at the clinic the computer operator registers the patient if he is not yet registered. A printed patient profile similar to the one in the previous scenario is requested. The patient then returns to the waiting room until a service provider is ready to see him. The service is then rendered and the service provider updates the patient's record on the printout. This printout is then given back to the computer operator who updates the electronic record. Because of the relative simplicity of the tasks involved, the general assistants currently employed at clinics could be trained to fulfil this duty.

With this scenario the service provider has more time for direct patient care. The administrative burden is taken away from her almost completely and there is no competition for computer hardware. The printed profiles, however, still results in some paper work and the computer operator has insight into confidential patient data . Currently the assistant does the filing and she has in any case access to private patient data.

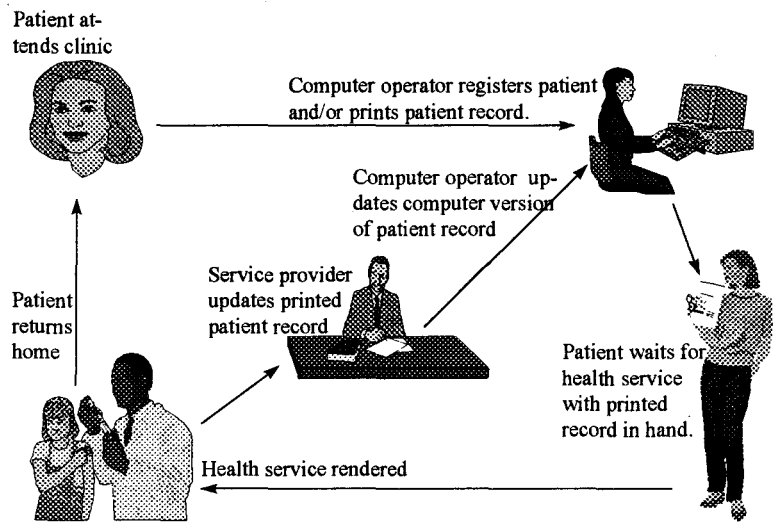


Fig. 3

1.5 One computer per service provider

The ideal situation is illustrated in fig. 4. When the patient attends the clinic, the service provider immediately registers the patient if he was not yet registered, does the service and updates the electronic record directly on the computer in the presence of the patient.

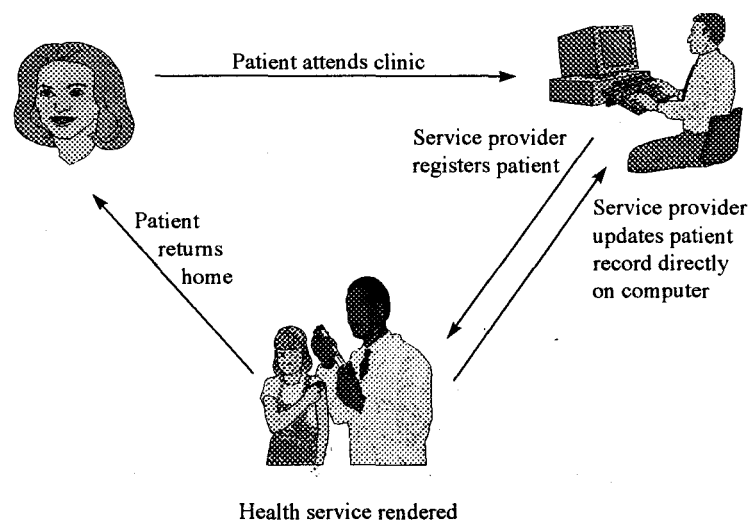


Fig. 4

This scenario is an expensive alternative because a computer must be available for every service provider. However, the advantages are numerous. No paper work is involved and the service provider has more time for direct patient care because of the direct availability of

the computer and the fact that no statistics have to be kept or processed. This scenario is further discussed in chapter 5, paragraph 2.1 ("An on-site evaluation").

1.6 Summary

It is clear that the first three scenarios are totally unwanted in that the nurse will eventually have less time for patient care and not more. The average waiting time of a patient from the moment he has arrived at the clinic up to the moment he is serviced will also increase. In these circumstances the current manual system of patient records will be better than a computerised system. The statistical processing can, however, be computerised and this alone will lighten the burden of the service provider considerably.

2. SCENARIOS WITH REGARD TO THE AVAILIBILITY OF NETWORK CONNECTIONS

2.1 Not connected

If a clinic is equipped with only one computer that is not connected to a regional or provincial server, the database must be sent regularly to a central point where it should be merged with those from all other clinics. All statistical processing should be done at this central point, taking the burden of weekly, monthly and quarterly statistical reports off the shoulders of the service providers.

The merged database should be redistributed back to the clinics. In this way migration of patients would not result in a duplication of data or time taken to register them. Furthermore, the complete clinical history of the patient would still be available and the service provider can see what have been done on a previous visit even to another clinic.

If a clinic is equipped with more than one computer that is not connected, the service providers should be taught how to merge the database files and reload their computers with the updated version on a daily basis. It is important because it is unlikely that the same patient will be attended to by the same nurse at every visit. The merged database from all the

computers at the clinic must regularly be submitted to a central point where all database files from other clinics will be merged with it and statistical reports processed as explained above.

The process of merging and redistribution of database files at a central point will unfortunately result in outdated records. The more frequent this process can be executed, the less serious the problem would be. However, the submitting and redistributing of database files would take considerable administrative organisation and doing it often might prove to be unpractical.

2.2 Local area network (LAN)

If a clinic is equipped with more than one computer it is preferred that they are connected to each other in a local area network. The service providers would not need to merge and reload the database files as was necessary in paragraph 2.1 above.

The database on the file server at the clinic must still be submitted to a central point to merge it with other databases in the province and process the statistical reports. The merged database should still be redistributed to the clinics thereafter as well.

2.3 On-line (WAN)

This is the ideal situation. The file server is situated at a central point and every computer at every clinic has direct access to it. This way the data is always up to date, complete and readily available to all service providers and management. The administrative burden of submitting and redistributing the database files does not exist anymore. Processing of statistical reports is done by a single person directly from the file server.

2.4 Summary

The dream of connecting all computers at primary health care level in the province or even in the country is still a long way from realisation. In the meantime, however, it is important that service providers should be trained in computer-literacy and get used to use the computer in

their everyday tasks. As such it is more important to put a computer on every service provider's desk and train them than to spend millions in connecting all facilities.

The alternative of connecting all computers in a clinic in a local area network seems the most feasible. Submitting the database files to a central point for merging and statistical processing can be done quarterly. In this way not too many patients would have to be re-registered because of migrating.

3. REQUIREMENTS OF A COMPUTERISED SYSTEM

A computerised system for primary health care management should enable PHC nursing staff to devote more time to health care and less time to the capturing and processing of statistical data. A successful system must therefore comply with the following requirements:

Some **physical restrictions** must be kept in mind. It is improbable that all PHC nurses will have access to an own personal computer in the very near future. Furthermore, personnel is not always available to type in data from tally sheets or data capture forms. It is also unreasonable to expect from a PHC nurse to capture all data during the day and then type in the data herself by the end of it.

A nursing management system should be **modular and flexible** in that it should be possible to implement only relevant modules at a specific venue (Mandil [21]).

According to Schach [34] **utility** is the extent to which a user's needs are met when a correct product is used under conditions permitted by its specifications. It must perform useful functions and execute them correctly and cost-effective. In this case the system must carry the relevant clinical data for each patient and provide for the statistical reports that nursing management wants. If the specifications were correct and the system conforms with them, the utility is usually of a high standard. It is thus important that the specifications are correct, unambiguous and complete.

One of the most important features of a PHC system is that it should be **user-friendly**. Because of the lack of computer exposure, a large number of nurses in the Free State are

relatively computer illiterate. For them, navigating through an extensive menu system will be frustrating and time consuming. It will also lead to misuse of the system and inaccurate data. Mandil [21] states that the system "should have automated and flexible data entry interfaces, a facility for ad hoc queries and easy to use pre-set reports." He also says that the system should "be menu-driven with a flexible and easy to use menu/icon generator."

A **contextual on-line help facility** should be available to guide inexperienced users through the system (Mandil [21]).

A **training package** which exactly mimics the operational system should be available. Such a package should include a training database which can be used for training users without any effect on the operational database. (Mandil [21])

Performance is equally important. According to Schach [34] it is essential to know the extent to which the product meets its constraints with regard to response time or space requirements. For example, the system must make provision for an effective search procedure. Eventually the centralised database will carry tens (if not hundreds) of thousands of records and finding and processing the record of a specific patient at any workstation throughout the province must be quick if not immediate. Nurses do not have the time to wait even 30 seconds before they can continue with a transaction.

According to Bell et.al. [3] **portability** is the feature of software to run on any kind of computer. In this case it is especially important that the application programs can run on existing computers which might be older. Supplying every clinic throughout the province with the latest technology may prove to be too costly to implement. Furthermore, it might be possible that some remote clinics may not be connected to the central database. In this case the database should be structured in such a way that a relevant subset of data can be imported or exported electronically to and from the hard disk of the microcomputer with ease.

Maintenance on application programmes as well as the database should be easy and inexpensive. One of the primary means to achieve this, is to ensure that a proper design methodology had been followed. A normalised database which is properly documented by

means of an entity relationship diagram is much easier to maintain than a haphazard set of tables. The database as well as the application programs must make provision for dynamic changes, i.e. they must be **flexible**. The data set may change over time, the implementation environment may change, the target population may grow, nursing management may need a different statistical indicator or report, etc.

Production cost must be kept as low as possible. Basing the system on a minimum data set will help in this regard. However, it is important not to down scale on crucial aspects such as security features.

According to Schach [34] **reliability** is a measure of the frequency and criticality of product failure. In this case the database and application programmes keeps track of people's health - the most precious possession of man. Allowing for duplicate records of the same patient or, even worse, mixing the details of patients, may prove to be disastrous.

The **robustness** of a product is an indication of its behaviour in case of invalid input or the possibility of invalid output with correct input (Schach [34]). In an environment where the users will have a low level of computer literacy, it is important to ensure that the product will be able to detect and ignore invalid keystrokes or values.

The package should include adequate **security measures**. "The existence and contents of a person's medical file cannot be communicated to people or organisations outside the fields of medical care, public health or medical research without his or her explicit and conscious consent, unless such communication is allowed by the rules relating to medical confidentiality" (Thiry [35]). According to Rittman [32] security issues in developing a nursing information system include control over the users of the systems as well as the information that is available. Mandil [21] states that the system must be totally secure and allows different authorisation levels for access and use. If the system is to be implemented on a public network, the means to optionally encrypt data for transmission should exist.

Mandil [21] also states the importance of **user definable codes**. The user should be able to define the size and structure of these codes and to specify whether the entry of these codes is mandatory or not.

The design has to be **implementation independent**, i.e. it should not be biased by any programming tool or environment.

4. AN OVERVIEW OF THE SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)

The life cycle of the total information system describes all the phases in the development and use of the system. It consists of the requirements definition and specification phases as well as planning, design, implementation and integration. Testing, according to Schach [34] is an integral part of the SDLC. It should be done after every phase and is therefore not a separate phase.

The relative cost with regard to time and financial outlay of each of the various developing phases are outlined in fig. 5.

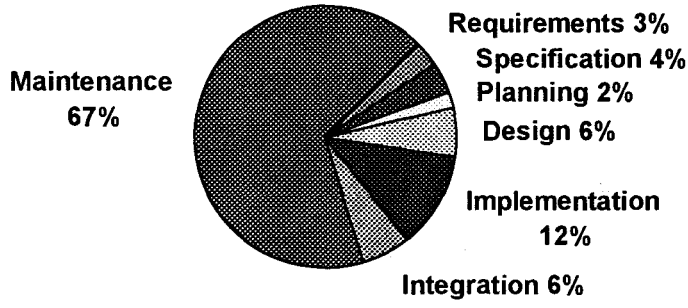


Fig. 5

During the **requirements phase** the client's requirements are ascertained and analysed by various methods, e.g. interviews, questionnaires, study of existing documentation, observation of employees at the workplace, etc. During this phase the current system, which might be a manual system, is studied as well. The principle of prototyping is widely used to determine the exact user requirements. With this approach a working model of the new system is developed, the user tests it with real data, gives feedback to the designers who modifies the prototype until the client is happy. Thereafter the rest of the development process is carried out and the new system is developed.

During the **specification phase** the results of the previous phase is documented and presented to the client. The client must then confirm that the systems analyst understands correctly what is expected from the new system. Apart from this confirmation it must also be ensured that the specification document is unambiguous and complete.

During the **planning phase** the budget, personnel involved, deadlines, hardware and software requirements, etc. are documented in a management plan. It also includes a description of the specific methodology that will be followed.

During the **design phase** a complete logical and physical design have to be done. The logical design is mostly a graphical representation of the system and should be done in such a way that it can serve as a basis for communication with the client and end-users as well as the programmers. During the physical design algorithms have to be selected, data structures chosen and internal data flows determined. The decomposition of the whole system into modules as well as a description of the functionality and interface of each module must also be specified in detail.

The **implementation phase** entails the coding of the different modules according to the design. During the **integration phase** the different modules are integrated to form the system. This phase ends when the client agrees that the system conforms to the specification document and goes into operation.

Maintenance includes all changes to the product after it has become operational. It includes corrective maintenance and enhancement. During this phase the system can also be modified in response to changes in the environment or needs.

5. THE NECESSITY FOR A COMPLETE SYSTEMS ANALYSIS AND DESIGN APPROACH

"If you fail to plan, you plan to fail."

Studies by Schach [34] and others have shown that the relative cost of fixing a software fault is an exponential function of the stage in which the fault is detected, i.e. the earlier the fault is

detected, the easier and cheaper it can be corrected. The following graphic representation taken from Schach [34] (fig. 6) serves to highlight this fact:

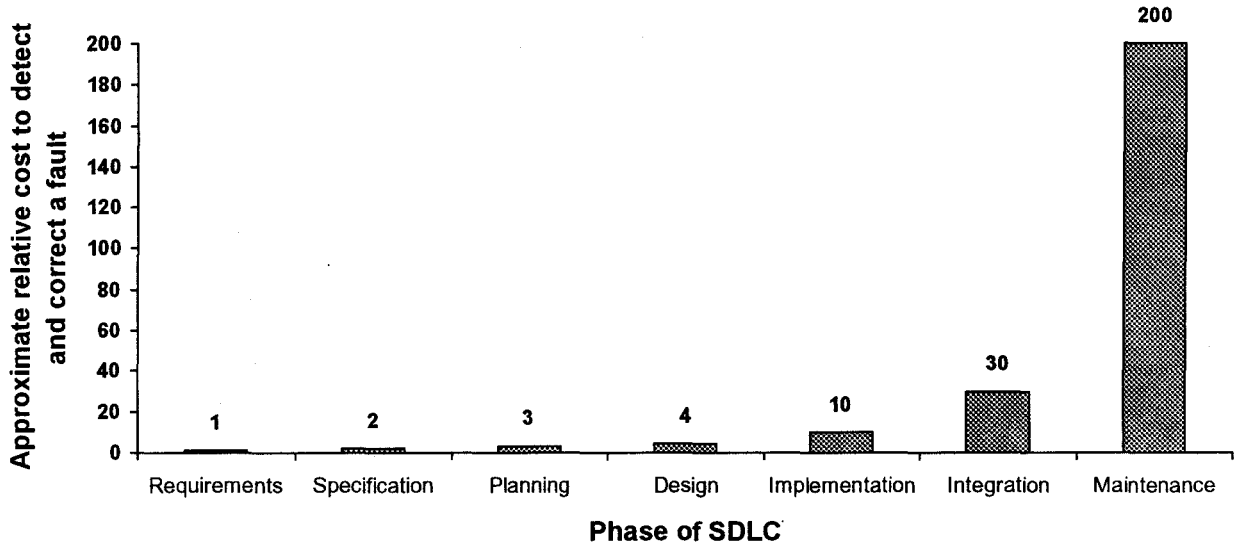


Fig. 6

Other studies (Boehm [4]) have shown that between 60% and 70% of all faults detected in large scale projects are specification or design faults. Omitting these phases from the developing process can thus be disastrous because of the relative cost to detect and fix faults in the implementation and integration phases.

It can thus be stated that a phased approach to software development is absolutely essential.

6. THE ARCHITECTURE OF A DATABASE SYSTEM

A database is a set of stored data. In a relational database the data is organised into two dimensional tables with a set of pointers that relate data-elements to related data in other tables. A database management system (DBMS) is a collection of programs that enables users to create and maintain a database (Elmasri et. al. [12]). A three-level schema that has been proposed and used by database specialists such as Date [9] and Elmasri et.al. [12] to represent the architecture of a database is illustrated in fig. 7.

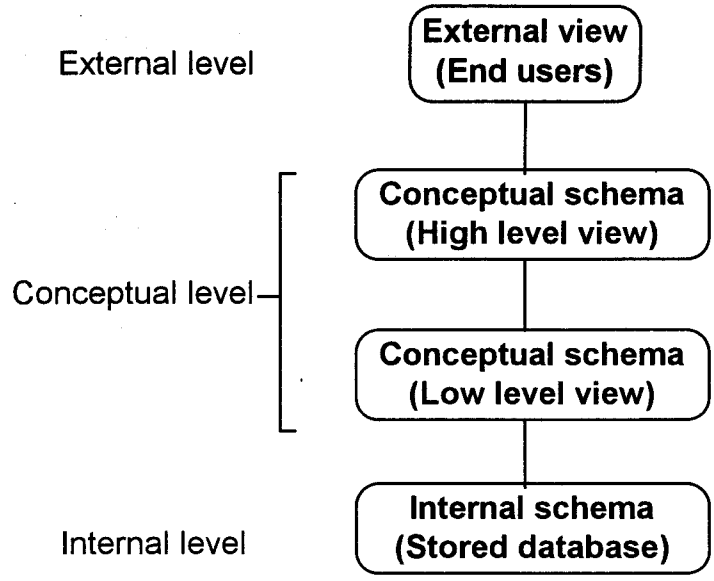


Fig. 7

"The external view is the content of the database as seen by some particular user" (Date [9]). Every day users, in this case the nurses, should be able to use a database without getting entangled with the complexities thereof. Therefore **a set of user-friendly application programs** may be developed to interface with the database. Also, different users, such as nurses and nursing management, may use different subsets of data and perform different functions on the same database. Therefore separate programs may be developed so that users may have different views of the same database. It should e.g. be possible for nursing management to change the disease codes in the database while the ordinary service providers should only be allowed to utilise the disease codes, not change it.

The **conceptual level** describes the global structure of the database without giving details about the physical implementation like data types and access paths. The high level conceptual model is usually in the form of an entity relationship model which depicts the relationship between different data-items (entities). Mostly the diagram also show the properties (attributes) of the entities. This high level model is used to confirm user's needs and serves as a basis for further discussion.

If both the system developers and the users are happy that the conceptual model describes reality accurately, it is then mapped into a **low level model** (a relational model) which relates to the specific implementation environment in which the database will be implemented. The

conceptual design should therefore be complete enough so that systems development can be based on it but also simple enough so that it can be used as basis for discussion with the users. It should be possible to modify the conceptual design if new information is available and it should also lead to a system that is easy to use and fulfil in the users' requirements.

The internal level is "a low level representation of the entire database" (Date [9]) and is described by the **internal schema** which defines the physical storage structure of the database. A person conversant with the data-definition language (DDL) of the database used is able to execute ad hoc queries on the database with SQL without the need for a front-end or user-interface.

7. THE METHODOLOGY FOLLOWED IN THE DEVELOPMENT OF THE PROTOTYPES USED IN THIS STUDY

Three prototype systems were developed as part of this study. The first one was intended to lead to a **comprehensive system** and included patient demographical data, nursing management facilities as well as a somewhat comprehensive clinical patient record. The prototype was finished, but before it could be tested in practice, nursing management in the Free State started to pilot two similar packages from vendors in South Africa. It was then decided to rather evaluate these (proven?) packages.

It was soon evident that these packages were too comprehensive to be feasible in practice and it was then decided to try an alternative approach, namely a **limited system**. This second system did not include nursing management facilities and was based on a much smaller clinical data set. The patient demographical data was limited to the patient's ID, name and address.

The third prototype was not based on a patient record but only counted the number of incidences. As such it is actually a **computerised tally sheet**. The nurse uses a mouse to make ticks in appropriate checkboxes and the system adds the ticks from service to service. Eventually a report that summarises the number of incidences could be requested.

The methodology outlined here applied to each one of the three prototypes, although only the second one was piloted.

Requirements analysis

- Several interviews with nursing management and service providers were held. Management were represented by a task group of the PHC Info Project in the Free State. This task group did extensive research in the past two years to establish a minimum set of indicators that must be recorded at primary health care institutions (clinics, hospitals, GP consulting rooms, etc.) in order to deliver the annual statistical reports required by nursing management and the national ministry of health. Their work culminated in a revised tally sheet that has just been implemented. This set of indicators together with the latest input from national level, the NHIS/SA project, served as a starting point for the design.

- The service providers were observed while at work and they explained the day to day administrative work and provided examples of the current manual records.

- The current manual system of patient-held and nurse-held patient records were studied.

- A literature study on data sets in similar systems elsewhere in the world was done.

- Eventually, the new tally sheet, the current manual system as well as data sets elsewhere in the world were taken into account when a decision was made as to what data-elements will be included in the prototype systems.

Conceptual database design

An entity relationship model of the proposed prototype was designed. This design was confirmed with nursing management.

Logical design

The entity relationship model was mapped into a relational model as the system was to be developed as a relational database. The relational model was normalised and the database tables were created in the DBMS used, Access 2.0 from Microsoft.

Implementation

The input screens, transactions and report screens for the first (comprehensive system) and third (tally system) prototypes were developed in Visual Basic 3.0 and the second prototype (limited patient record system) was implemented in Visual Basic 4.0.

Piloting

The second prototype system was implemented at several clinics throughout the Free State. The pilot sites were visited several times to train the users and obtain feed-back from them. The prototype was evaluated together with other systems by means of an evaluation instrument developed by Mc Donald [23].

CHAPTER 4

REQUIREMENTS ANALYSIS

1. THE POINT OF DEPARTURE

The following inputs were used to decide on a data set for the prototypes.

1.1 Task group Routine Data

The routine data task group of the PHC Info Project in the Free State has done extensive research in the past two years to set up a minimum set of health indicators that will facilitate the generation of statistical reports wanted by nursing management in the Free State.

- In October 1994 they have released a document "Proposed information to use for the management of primary health care" [19].
- In October 1995 they have released a tally sheet to capture these data elements on ground level [33]. This tally sheet have been implemented in a pilot study, revised and will now be implemented as the data-capturing standard from March 1996.

1.2 Current patient based cards, forms and reports

- The family history card, patient treatment card (GW20/10), patient health record cards (H206 & H206a), female client card (GW10/9), birth and immunisation register, child health record (H205), growth charts (GW8/123) and others were used to determine the format and contents of data previously captured.
- The forms for family planning statistics, monthly psychiatry statistics, immunisation statistics, monthly nutrition surveillance return form, the surveillance form for sexually transmitted diseases, the monthly report form for tuberculosis statistics, the quarterly form for national and population development and others were used to determine the format in which summarised data from the tallies were presented in the past.

1.3 NHIS/SA

In June 1995, the Department of Health released a draft document of health goals, objectives, strategies and indicators for South Africa. The intention of this document has been to serve as a basis for discussion and further development and to give guidelines to provinces to develop their own set of health indicators. This document has been updated in March 1996 [28].

1.4 Previous studies

Literature on previous studies on computerised patient records have been studied:

- Abdoo [1] reported on the feasibility of bar code technology for data entry in a, what she calls, a "patient care medication administration system".
- Gillies [14] is concerned with the computerisation of primary health care in the United Kingdom. Although this care is given by general practitioners (GP's) whereas in South Africa it is given at clinics staffed with nursing personnel, some valuable lessons could be learnt in this regard.
- Hettinger, et.al. [16] discussed the database design for a management system for primary health care. He focused on the following base set of data :
  - Nursing care elements, i.e. diagnosis, intervention, outcome and intensity, etc.
  - Client demographics, i.e. Identification, date of birth, sex, race and ethnicity, residence, etc.
  - Service elements, i.e. agency number, client's health record number, number of service provider, episode start date, termination date, disposition of client, expected payer, etc.
- Leske [17] also refers to the above three elements of a nursing minimum data set and discusses the background that lead to it and the purpose thereof.

The following studies are all concerned with privacy and security of personal patient data in a computerised system:

- Callens [5] investigates the status of health privacy in the light of legislative measures in Belgium.

- Dierks [11] argues that medical data cannot be used outside the sector for which they were compiled because that would interfere with the individual's right to informational self-determination. Therefore most data compiled in the course of therapy may not be utilised for research purposes.
- Neethling [27] discusses the issue of privacy of personal data from a judicial perspective. Threats to personal privacy and ways to protect it when using electronic records, are discussed.
- Rittman [32] refers to the three basic components of the Nursing Minimum Data Set (NMDS) (see also Hettinger [16] and Leske [17]) and discusses ways in which privacy of these components can be ensured when implemented in a database.
- Van der Poel et.al. [37] gives some general principles regarding medical ethics and current statutory instruments. He discusses medical secrecy in everyday medical practice with specific reference to computer technology and its application in medicine.
- Van Roooyen [42] discusses the issue of people that come into contact with private medical data by nature of their everyday task. This includes the administrative personnel of a medical practitioner, administrative personnel at medical aid funds, etc. He argues that the patient has given his silent consent for this.

1.5 Other systems

Similar systems have been developed elsewhere in the world and it was worthwhile reading the literature on these systems in order to learn from them and not making the same mistakes. Some of these systems are aimed at the clinical level, some at the physician level and some were an effort to integrate all services.

- Churgin [8] reports on the EpicCare system which was piloted in Chandler, Arizona. The system operates in a client-server environment and completely replaces the paper chart in all phases of medical care. Reportedly, the service providers appreciate the ability to view complex medical information within seconds of requesting it. Several functionalities, benefits, aspects on user response as well as obstacles are discussed.

- Forster et.al. [13] evaluated a system for field data collection during health surveys. This system focuses on routine data collection by means of interviews using a hand-held-computer.
- Grant et.al. [15] discusses the implementation of a province-wide computing network in Quebec. The idea was to connect all medical facilities in order to share information between different categories of service providers.
- Pulliam [30] reported on the NELA system developed for the College of Nursing, University of Delaware.
- Reitmaier, et.al. [31] reported on a system that was developed to record anthropometric nutritional data from children under 7 years.
- Warshawsky et.al. [44] evaluated the CLINIC system, developed at Ben-Gurion University and found that using a computer during patient encounters lead to definite changes. The conversational atmosphere between service provider and patient was sacrificed.

1.6 Other factors

- The availability of data

  It has no sense to make provision for data that is impossible to capture during nurse-patient interaction, e.g. the number of health facilities with mapped catchment populations.
- Practicality

  Because of the physical restrictions it is not always possible to determine some of the data-elements. In South Africa it is e.g. sometimes difficult to determine the exact age of a pregnant women because her date of birth is not known.
- Security

  Although easy to provide for, it is not always legal to capture and permanently keep record of the HIV-status of a patient.
- Representation

  To determine e.g. the percentage of the population that has a habit of smoking, it would not suffice to only take into account the people that visit the clinic.

2. STATISTICAL INDICATORS

Based on all of the above inputs, but mostly that of the Routine Data task group of the PHC Info Project in the Free State the following emerged as a minimum set of statistical indicators:

General : Total number of visits per type of illness and age group (<6, 6+)

Women's health : Number of smears taken and number of abnormal smears

Births : Number of live births and still births
Number of babies with mass <1.5 kg, 1.5-2.5 kg and >2.5 kg.
Average age of mothers
Number of deliveries in hospital, clinic at home or elsewhere

Post-natal visits : Number of first visits before 7 days, 7-28 days, after 28 days.
Number of follow-up visits and number of home visits

Ante-natal visits : Total number of visits and number of first visits before twenty weeks of pregnancy.
Number of referrals
Number of cases with anaemia during pregnancy
Number of pregnant women treated for sexually transmitted diseases

Child-health : Total number of visits (children < 5 years and 5 years separately)
Number of first visits (children < 5 years and 5 years separately)
Number of cases with retarded development with indication of number referred.
Number of cases with mass/age < 3rd% and height/age < 3rd%.
Number of referrals for visual, aural or other problems (separately).

Family planning : Number of visits (men and women separately) and number of sterilisations

Tuberculosis : Number of patients treated, newly diagnosed patients, patients who discontinued treatment before completion and persons who relapsed.

Immunisation : Number of children <1 and 1-4 who have completed immunisation.
Number of women who have completed immunisation for tetanus.

Dental visits : Number of patients referred for dental care.

Health education : Subject of presentation and number of people attending presentation.

Psychiatry : Number of patients on active treatment
Number of first visits and total number of visits.
Number of defaulters (persons who themselves discontinued treatment before completion of treatment)

School health : Number of schools visited, pupils seen, referred and treated.

Geriatric health : Total number of visits, number of first visits and number of home visits.

Deaths : Number of deaths per race, sex, age and cause

Population : Number of people per race, sex and age.

All statistics must be presented per race and magisterial district within a certain time period.

Looking at the above set of indicators, it could be argued that a set of tally sheets in conjunction with a spreadsheet system would equally well do the job. According to Van Biljon [36], however, a computerised information system should be an integrated system in that "*all* routine statistics and data should be generated and supplied by the system itself." If a complete patient record based system and not merely a system of head counts could be implemented, all the manual patient records which is currently in place could be abandoned. In such a system the statistical tallying would be done automatically in the background whenever a nurse registers a particular intervention for a specific patient.

In the development of the patient-record based prototype systems as part of this study, this remark was taken very serious and provision was made for background tallying, i.e. as soon as a patient is seen, the applicable incidence counter(s) was incremented.

3. DATA ELEMENTS TO BE REGISTERED

From the inputs mentioned in paragraph 1 above, the following data set could be deduced.

3.1 Data elements that should be entered by nursing management

3.1.1 Supervisor data

The following data should be entered by provincial nursing management for every supervisor in the province:

- ID
- Surname and initials
- Date of birth
- Address
- Telephone at home
- District in which she lives
- Category
- Number personnel reports up to date / late / not up to standard
- Number of reports on grievances up to date / late / not up to standard
- Number of reports regarding disciplinary action up to date / late / not up to standard
- Number of nominations for merit awards and rank promotions

3.1.2 District data

The following data-elements should be entered by a district supervisor for every district in the province:

- District name which is unique for every district
- Geographical size
- Approximate population size
- - Population density can be inferred from the last two entries.

- Approximate number of households
- Number of farms
- The existence of a PHC programme for the district
- The number of approved PHC posts per category
- An indication of whether the water in the district is contaminated or not.

3.1.3 Contact data

Every supervisor must enter details regarding **contacts** with her direct subordinates:

- Date
- Number of subordinates seen simultaneously OR
- The ID's of the subordinates seen.

3.1.4 Nurse data

The following data should be entered by a district supervisor for every nurse in the district:

- ID
- Surname and initials
- Date of birth
- Address
- Telephone at home
- District in which she lives
- Category
- Qualifications
- Experience in years
- An indication of whether the nurse has completed a basic training course.
- An indication of whether the nurse has attended some in-service training courses.
- An indication of whether the nurse has attended any seminars.
- An indication of whether the nurse is busy with or has finished further study.
- An indication of whether the nurse has access to a vehicle.

- An indication of the condition of the vehicle.
- The name of her direct supervisor.
- The name of the district(s) in which she works.
- The name of the PHC team of which she is part.

3.1.5 Farm data

The following data should be entered by a clinic-manager for every farm in the clinic's catchment area.

- Farm number
- Farm name
- District under which it resorts

3.1.6 School data

The following data elements should be entered by a clinic-manager for every school in the clinic's catchment area.

- the name of the school,
- the name of the district under which it resorts,
- as well as indications regarding the water supply, refuse removal, sanitation and accommodation

3.2 Data elements that should be entered by service providers

If a computer is not readily available during the interaction with the patient, the nurse can request a printed patient profile and updates this during the consultation. The nurse self or somebody else can then update the electronic record at a later stage from the printed profiles. See also chapter 2, paragraph 1 in this regard.

3.2.1 Patient data

For every patient seen for the first time, his personal details must be completed:

- ID
- Surname and initials
- Sex
- Race
- Date of birth (or an approximation)
- ID of head of household
- Relationship to head of household
- Job
- Any other information that could be applicable, e.g. allergies, physical disabilities, social status, income, etc.
- An indication of whether the patient is HIV positive or not or whether he/she has not been tested yet.
- Record must be kept of the immunisation status of the patient with regard to Measles, Polio, Tetanus, Pertussis, Tuberculosis, Hepatitis, Cholera, Typhoid and the date of immunisation of each.

If the patient is the head of a **household**, the following details must also be captured:

- ID
- Surname and initials
- Date of birth (or an approximation)
- Address
- Telephone (if any)
- Magisterial district
- An indication of whether the water supply, sanitation, refuse removal and housing is adequate.

3.2.2 Programme data

A nurse can address a group of people with an educational talk or specific programme such as nutrition, health education or family planning. People reached with these programmes are not registered as patients and therefore global counts must be done.

- For an activity regarding **family planning** the number of first visits, the number of women reached and the number of sterilisations done must be registered.
- For a talk on **health education**, the subject, place and number of attendants must be registered.
- For an activity that is part of the **nutritional programme**, the number of supplementary feedings for children, adults, pregnant women, women during puerparium and TB sufferers must be registered separately. The number of children treated for worms must also be registered.

3.2.3 Visit data

For every farm or school visited, the following data elements must be recorded:

- Date of the visit
- Distance travelled
- Time travelled
- Time spent at the farm or school

3.2.4 Service data

Every interaction of a nurse with an individual patient is regarded as a **service**. For every service the following data should be registered:

- Date in
- Date out
- Facility number (number of clinic or hospital),

- Weight of the patient on the date of service (optional),
- Diagnosis which can be one of
  - Routine visit
  - Pregnancy
  - Immunisable diseases
    - Measles, polio, tetanus, pertussis, hepatitis, cholera, typhoid
  - Tuberculosis, Gastro-enteritis, Schistosomiases, Haemorrhage fever
  - Hypertension, Maternal mortality, Undernutrition, Clinical depression
  - Neonatal tetanus, Diabetes, Carcinoma of the cervix
  - Sexually transmitted diseases, incl. AIDS
  - Alcohol (or other substance) abuse
    - Abuse of females or children
    - Anything else which must be specified
- Intervention, which may include smears taken
- Details regarding any referral
- The kind of service which may include
  - Geriatric, Post-natal, Ante-natal, Sterilisation
  - Immunisation, Death, Birth, AIDS-test

  In the case of an **immunisation**, the immunisation record of the patient must be updated.
- Time spent
- ID of the expected payer
- An indication of whether enough medical supplies is available for the service.
- An indication of whether the accommodation for the service was adequate enough.

3.2.5 Birth data

For every birth in the catchment area the following data must be registered as well:

- The child's ID (if available)
- The ID of the mother as well as the ID of the delivery supervisor;

- Date of birth
- Place of birth
- An indication of whether the mother was hospitalised or not.
- Type of birth e.g. Live, stillbirth, normal, Caesarean,
- Mass of baby

3.2.6 Death data

If a person in the catchment area dies, the following detail must be recorded:

- Date of death
- Cause of death

3.2.7 Special cases

If **Tuberculosis** was diagnosed, the following data must be registered as well:

- If hospitalised : Date in and Date out
- The date of relapse if applicable
- An indication of whether the patient was discharged from hospital before 120 doses of treatment have been given.
- An indication of whether treatment was discontinued before 120 doses of treatment have been given.

If **acute infectious Gastro-enteritis** was diagnosed, the following data must be registered as well:

- An indication of whether the child minder was informed properly.
- The date on which the patient died if applicable.

If **Schistosomiases** was diagnosed, the following data must be registered as well:

- An indication of whether the patient was treated prophylactically.

4. REPORTS WANTED

According to Mackenzie[18] and NHIS/SA [28] the following should be the main objectives of the system:

- Monitor the rendering of a Primary Health Care service
- Monitor the health status of the community
- Monitor the outcome of Primary Health Care programs
- Monitor the objectives of the PHC service in a particular district, area or region
- Monitor the response to training programs and other interventions

Mackenzie [19] makes the following proposals amongst others regarding reports that should be delivered by the system

- Personnel per category per population per rural/urban district
- Coverage of the district as a percentage of farms/areas which receive/have access to services at intervals at a daily/weekly/monthly/6 weekly/12 weekly basis.
- Summary of the data of the supervisors as recorded.
- Summary of the data of the nurses as recorded.
- Percentage of services able to provide the essential medical supplies.
- Percentage of available days lost due to lack of transport.
- Percentage of services where accommodation is adequate.
- Incidence per population group per district of each of the conditions as recorded.
- Acute gastro-enteritis: Percentage of children over 6 where the childminder was given preventative information and the ability to provide oral rehydration treatment (ort).
- Schistosomiases: Percentage of children under 6 treated prophylactically per district per year as well as percentage of school children treated prophylactically per district per year.
- Incidence of pollutants/contaminants per district.
- Percentage of access per household to safe water, adequate refuse removal, adequate sanitation and adequate housing.

According to the 1994 annual report of Primary Health Care Services in the Free State the following reports are required from the system:

- Rural population by age and by sex
- Nursing personnel by post level
- Facilities available
- Ante- and post-natal visits by mother's age and birth rate
- Mortality rate by age
- Main causes of death
- Number of services given for
    - Child health
    - Nutritional programme
    - Gastro-enteritis
    - Sexually transmitted disease
    - Family planning
    - Laboratory examinations for Tuberculosis
    - Psychiatry visits
    - Minor illnesses and injuries
- Number of health education sessions
- Number of schools visited
- Number of pupils seen and referred by age
- Number of people suffering from malnutrition by age
- Number of TB cases notified, treated, discharged, relapsed and defaulted

5. DATA SETS

The above mentioned data elements from the different viewpoints were incorporated in the data sets used in the prototypes. In the following chapters, these data sets are discussed as part of the discussions on the entity relationship model and the relational model.

CHAPTER 5

COMPUTERISATION BASED ON PATIENT RECORDS (A COMPREHENSIVE SYSTEM)

INTRODUCTION

A prototype primary health care management system was developed that included patient demographical data, nursing management facilities as well as a comprehensive clinical patient record. The system was designed according to the principles outlined in chapter 2 and based on the requirements of service providers and management in the Free State. The prototype was finished, but before it could be piloted, nursing management in the Free State embarked on a search for a suitable package that is already available.

Several vendors were asked to demonstrate their packages for managing primary health care at clinic level. After aspects such as cost, training, after-training support, flexibility and applicability to the specific needs of the Free State have been compared, two vendors were approached to install their packages at pilot sites throughout the Free State. Several nurses at various clinics as well as representatives from nursing management had the opportunity to take part in the pilot studies.

The finished prototype then served as a neutral reference for evaluating the commercial packages. In the following paragraphs the prototype that was developed as part of this study is discussed and thereafter the two commercially available packages are evaluated.

1. A PROTOTYPE SIMULATING A COMPREHENSIVE PHC MANAGEMENT SYSTEM

1.1 The design

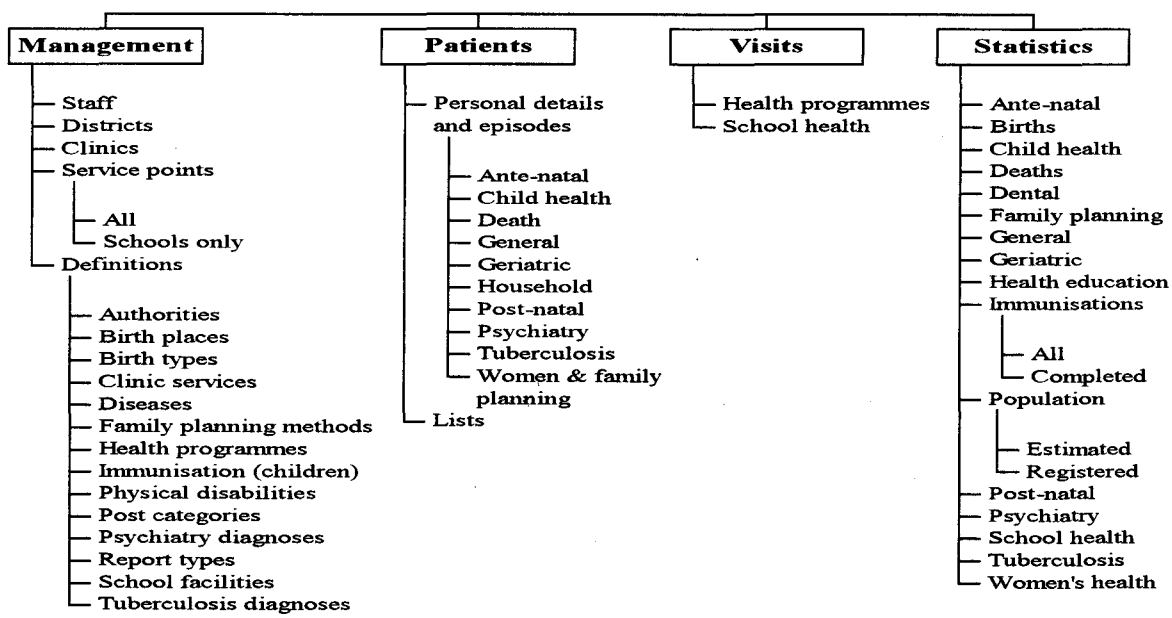
The prototype has been designed with the requirements mentioned in chapter 3, paragraph 3 in mind. The following two aspects were, however, attended to specifically:

- The system must fulfil in the needs of management with regard to the minimum indicators and statistical reports that must be provided for.
- The system must be easy to use for PHC nurses who are likely to be computer illiterate.

A high level conceptual model has been designed and is presented in the form of an entity-relationship diagram in Appendix A. The ER-diagram has then been mapped to a logical model, the 3NF relational model which is also presented in Appendix A.

1.2 The user interface

The prototype has been designed around the following menu structure:



Although this prototype does not include a context-sensitive help facility it is regarded as an essential feature.

The diagram (fig. 1) shows the opening screen with the management menu-item pulled down:

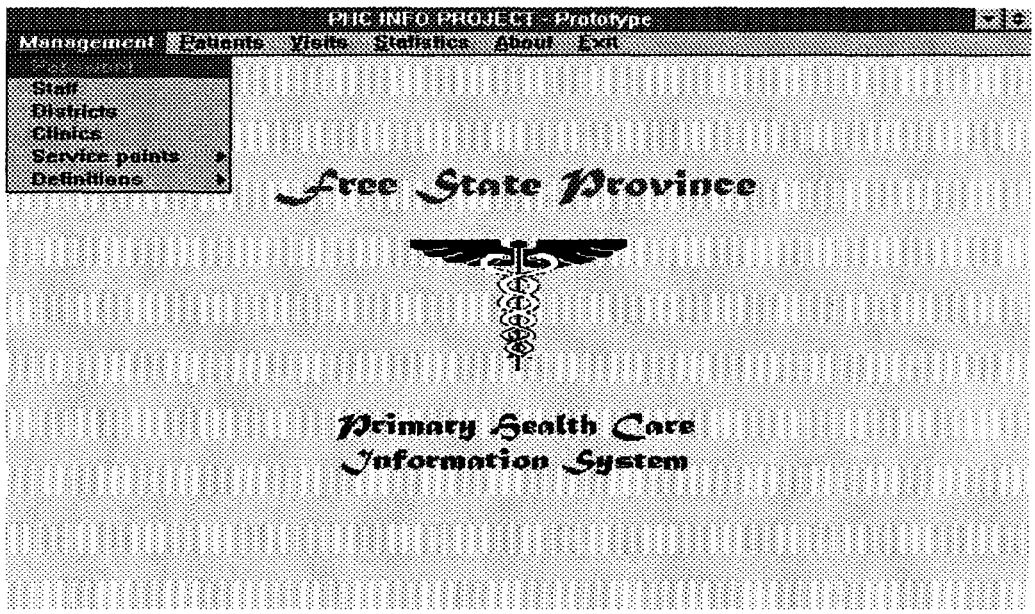


Fig. 1

1.2.1 Management

This menu-item with all its sub-menus are available for nursing management only. Personal staff-details (fig. 2) such as qualifications, post category and reports as well as demographic details of districts, clinics and service points are registered here.

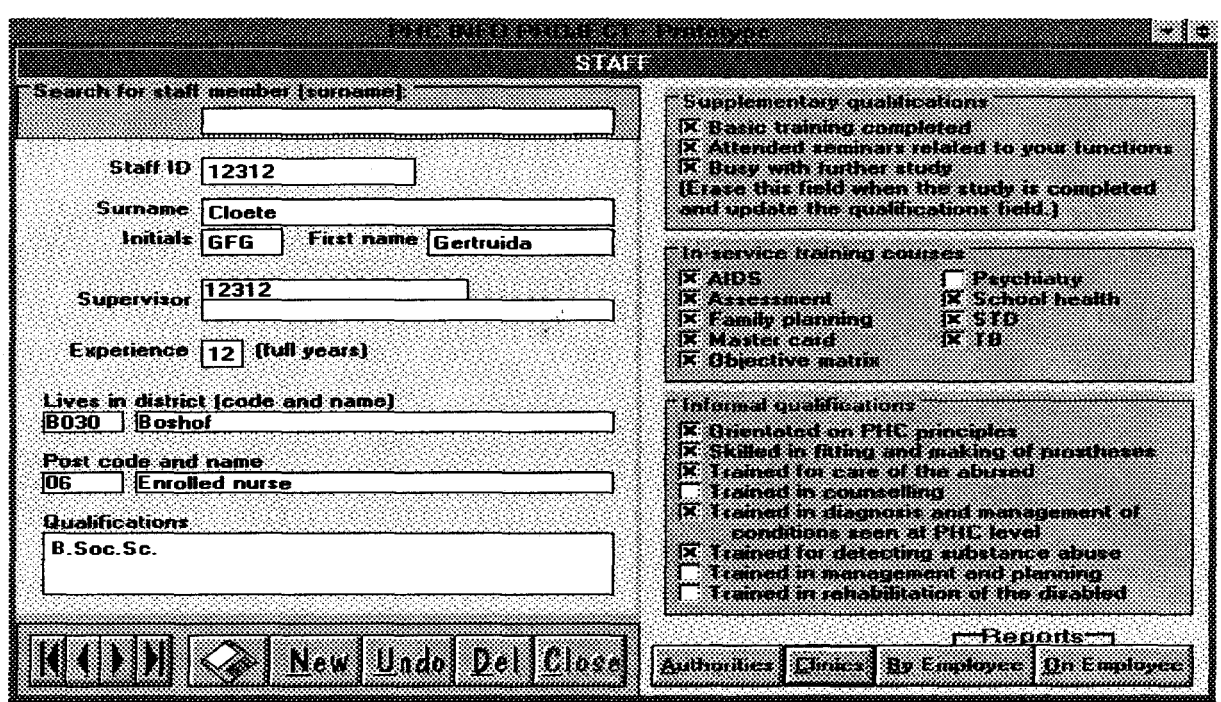


Fig. 2

In order to make provision for dynamic changes in the kind of data that must be captured, it is possible for management to make changes to basic definitions (see fig. 3). For example, management could themselves decide which disease code legend to use, say for instance ICD10 and then register it here. If on the other hand the name of a post in the hierarchy changes, it can be changed here as well. These facilities would not have been possible without a normalised database design.

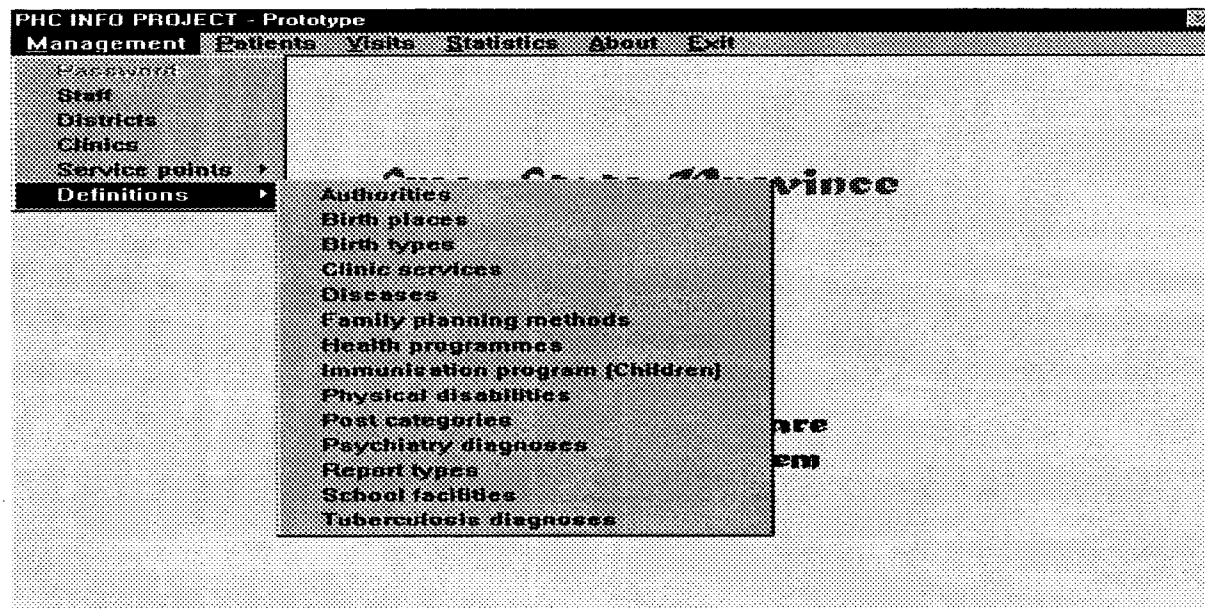


Fig. 3

1.2.2 Patients

Clinical details regarding patients in one of the listed categories are registered here. Fig. 4 is a screen-print of the screen for a patient record with a record of a family planning consultation on top.

Note the following:

- The basic patient details remain visible while the consultation details are completed.
- None of the basic definitions must be typed by the nurse. In this case the race, relationship to household, district, service point and family planning method will be entered by means of a mouse click on the appropriate item in a pop-up list.
- A patient can be found by any combination of letters in his surname. Therefore it is not necessary that the patient must remember his ID-number.

- For every patient that appears on the screen, a history list is available that indicates the date and category along with other details of all previous visits.
- For every consultation that appears on the screen, a dynamic history list with clinical details is available.
- A text block is available on every consultation record where clinical information that is not required for statistical purposes, may be entered.

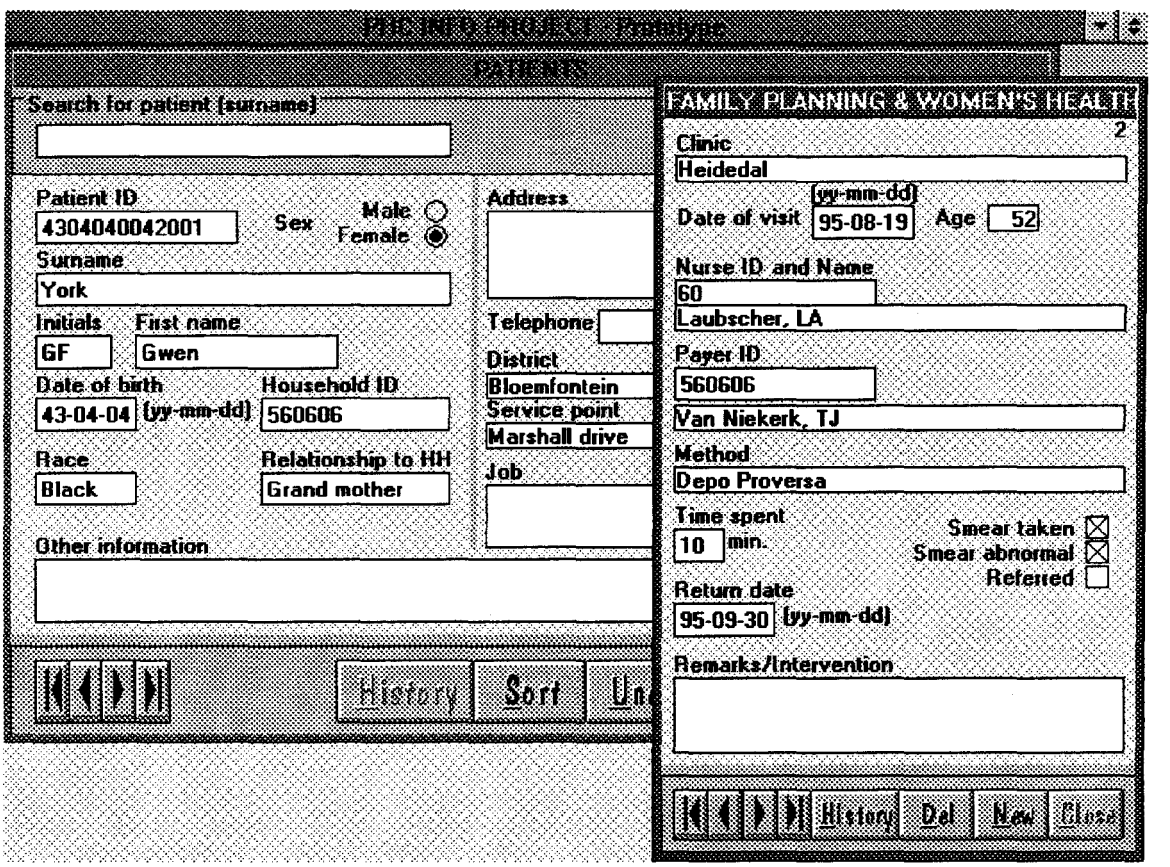


Fig. 4

The aspect of dynamic lists are explained with the following two screen-prints. Fig. 5 is a patient list and fig. 6 a consultation history list. In both cases the fields that must be included, must be checked beforehand and filter conditions regarding clinic, service point, race and date can also be defined. With a mouse click on 'Printer' the list will be printed just as it appears on the screen at that stage.

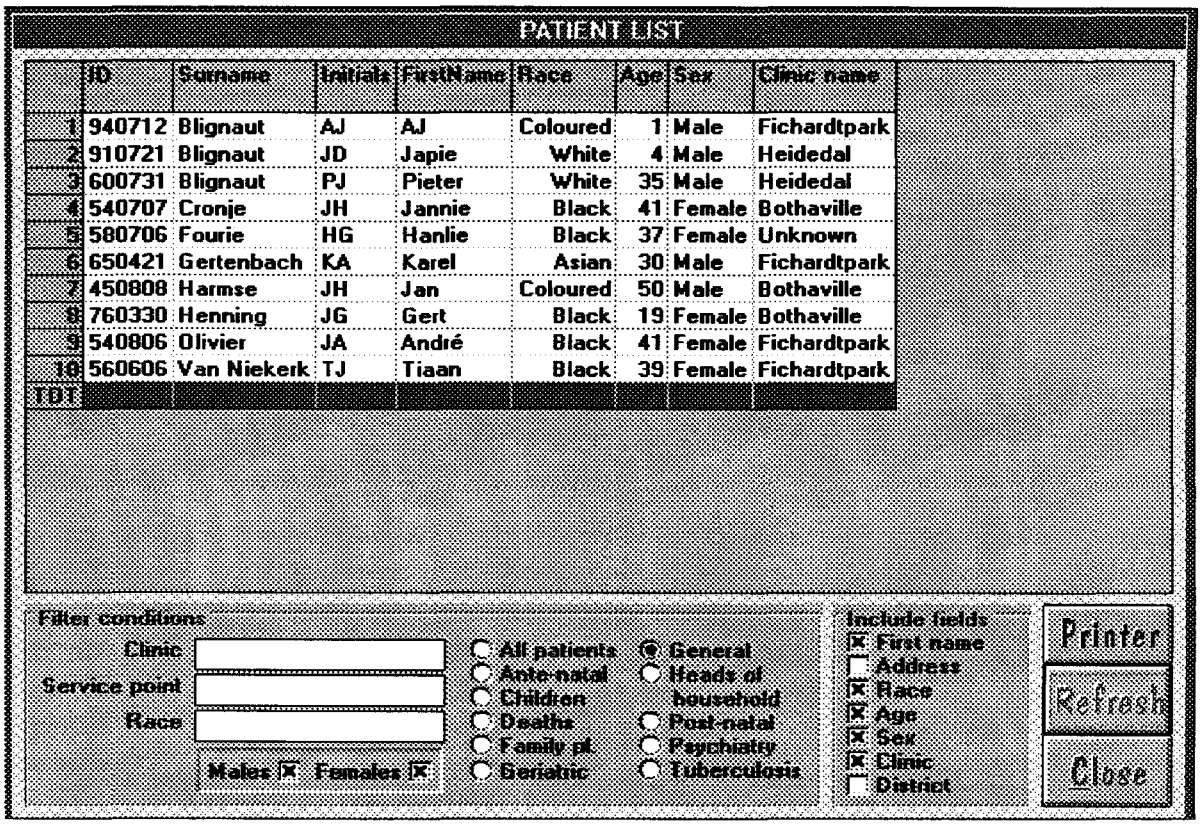

PATIENT LIST
ID Surname Initials FirstName Race Age Sex Clinic name
1 940712 Blignaut AJ AJ Coloured 1 Male Fichardtpark
2 910721 Blignaut JD Japie White 4 Male Heidedal
3 600731 Blignaut PJ Pieter White 35 Male Heidedal
4 540707 Cronje JH Jannie Black 41 Female Bothaville
5 580706 Fourie HG Hanlie Black 37 Female Unknown
6 650421 Gertenbach KA Karel Asian 30 Male Fichardtpark
7 450808 Harmse JH Jan Coloured 50 Male Bothaville
8 760330 Henning JG Gert Black 19 Female Bothaville
9 540806 Olivier JA André Black 41 Female Fichardtpark
10 560606 Van Niekerk TJ Tiaan Black 39 Female Fichardtpark
TOT
Filter conditions
Clinic
Service point
Race
Males Females
All patients
Ante-natal
Children
Deaths
Family pl.
Geriatric
General
Heads of household
Post-natal
Psychiatry
Tuberculosis
Include fields
First name
Address
Race
Age
Sex
Clinic
District
Printer
Refresh
Close

Fig. 5

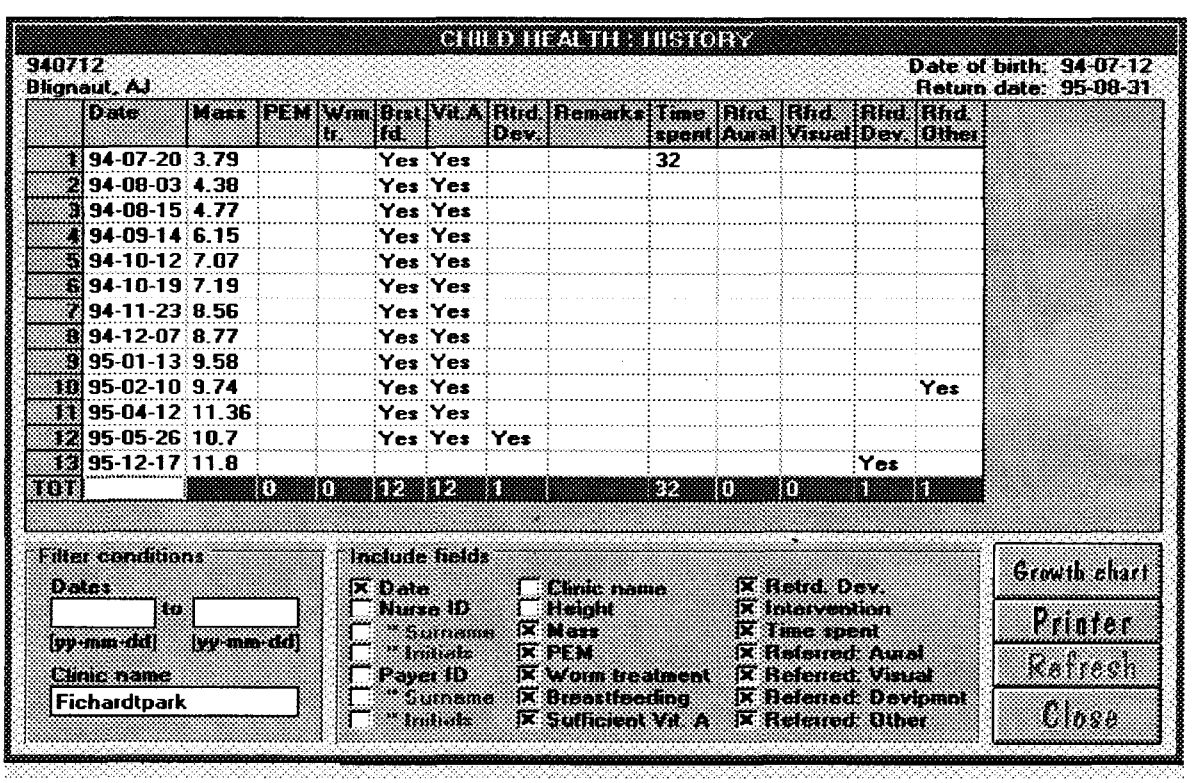

CHILD HEALTH : HISTORY
940712
Blignaut, AJ
Date of birth: 94-07-12
Return date: 95-08-31
Date Mass PEM Wrm tr. Brst fd. Vit.A Rfrd. Dev. Remarks Time spent Rfrd. Aural Rfrd. Visual Rfrd. Dev. Rfrd. Other
1 94-07-20 3.79 Yes Yes 32
2 94-08-03 4.38 Yes Yes
3 94-08-15 4.77 Yes Yes
4 94-09-14 6.15 Yes Yes
5 94-10-12 7.07 Yes Yes
6 94-10-19 7.19 Yes Yes
7 94-11-23 8.56 Yes Yes
8 94-12-07 8.77 Yes Yes
9 95-01-13 9.58 Yes Yes
10 95-02-10 9.74 Yes Yes Yes
11 95-04-12 11.36 Yes Yes
12 95-05-26 10.7 Yes Yes Yes
13 95-12-17 11.8 Yes
TOT 0 0 12 12 1 32 0 0 1 1
Filter conditions
Dates
to
[yy-mm-dd] [yy-mm-dd]
Clinic name
Fichardtpark
Include fields
Date
Nurse ID
" Surname
" Initials
Payer ID
" Surname
" Initials
Clinic name
Height
Mass
PEM
Worm treatment
Breastfeeding
Sufficient Vit. A
Retrd. Dev.
Intervention
Time spent
Referred: Aural
Referred: Visual
Referred: Devlpmnt
Referred: Other
Growth chart
Printer
Refresh
Close

Fig. 6

The following screen print (fig. 7) shows one of the available graph functions. The -60%, -3%, 50% and 97% mass/age graphs are the smooth curves and are in different colours on the screen. The other graph is that of the specific patient.

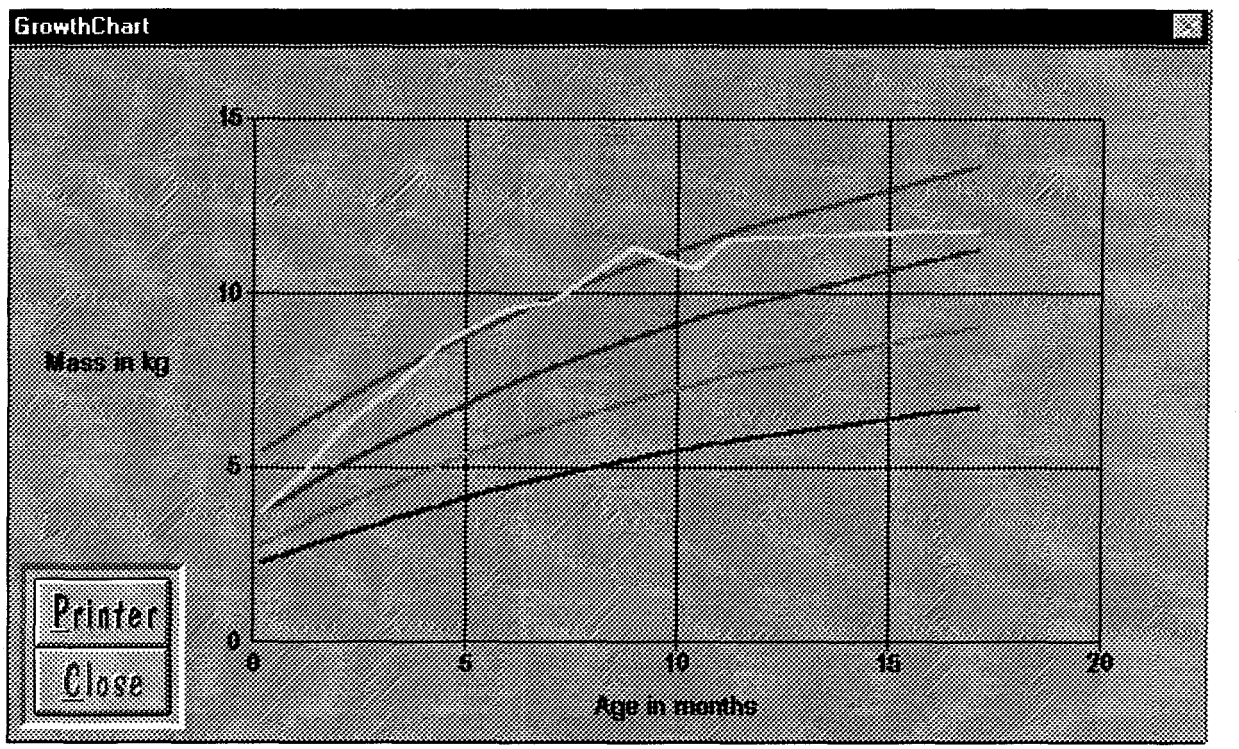


Fig. 7

1.2.3 Visits

Unlike the other screens which are all patient record based, entries here refer to a visit to a specific venue (school, farm, community hall, etc.). The two screen prints (fig. 8 and fig. 9) will explain it all:

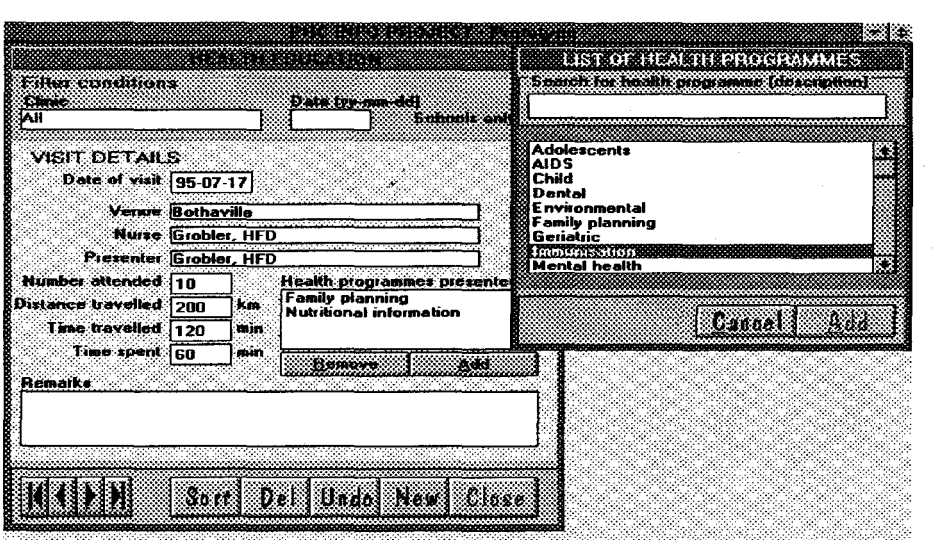


Fig. 8

- Note the pop-up list from which an item can be selected to add to the box of health programmes presented.

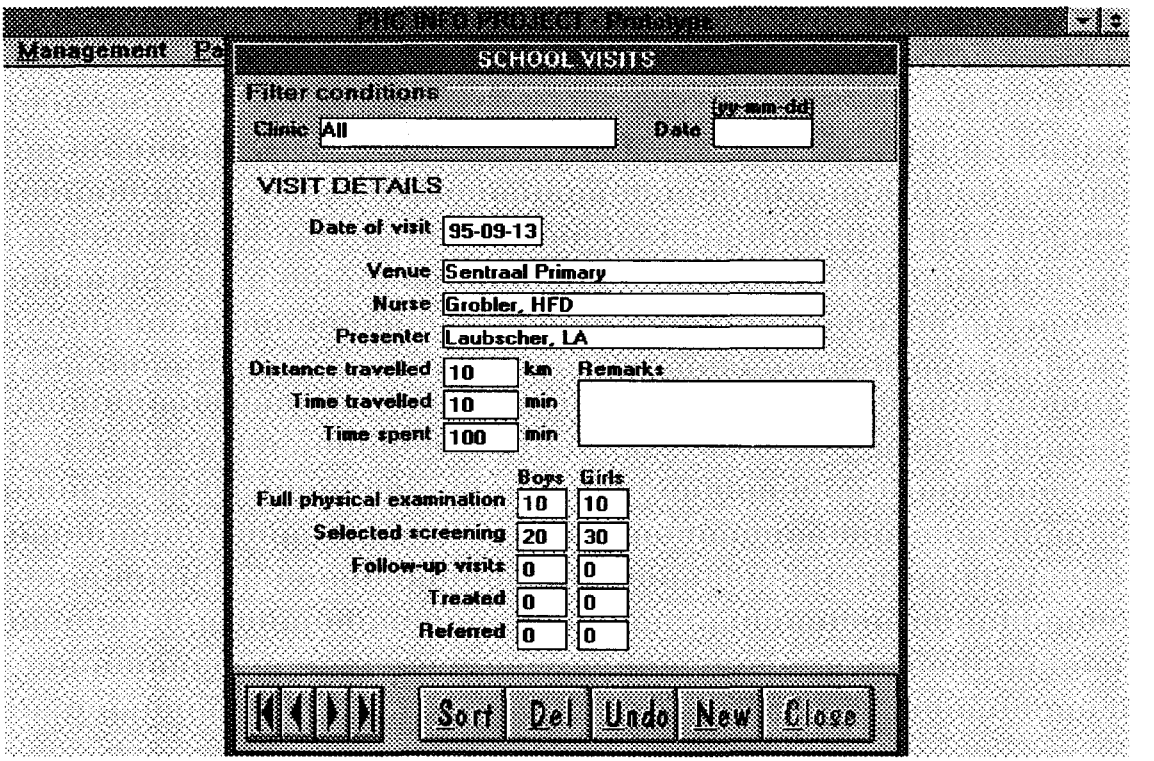


Fig. 9

1.2.4 Statistics

The statistical reports generated by the prototype only include the set of indicators of the Routine Data task group. Because no specific guidance regarding the layout and content of management or demographic reports was given, it is not included yet. It would, however, be easy to include such reports because the data-items have been captured already.

The next screen print (fig. 10) again serves to indicate the dynamic nature of the lists. The fields that must be included in the report, must be checked beforehand and a set of filter conditions is possible. With a mouse click on "Printer" the list will be printed exactly as it appears on the screen at that stage.

The same results could have been obtained from the manual tally system, but with a computerised system the counting of incidences takes place in the background, without any deliberate action from the service provider.

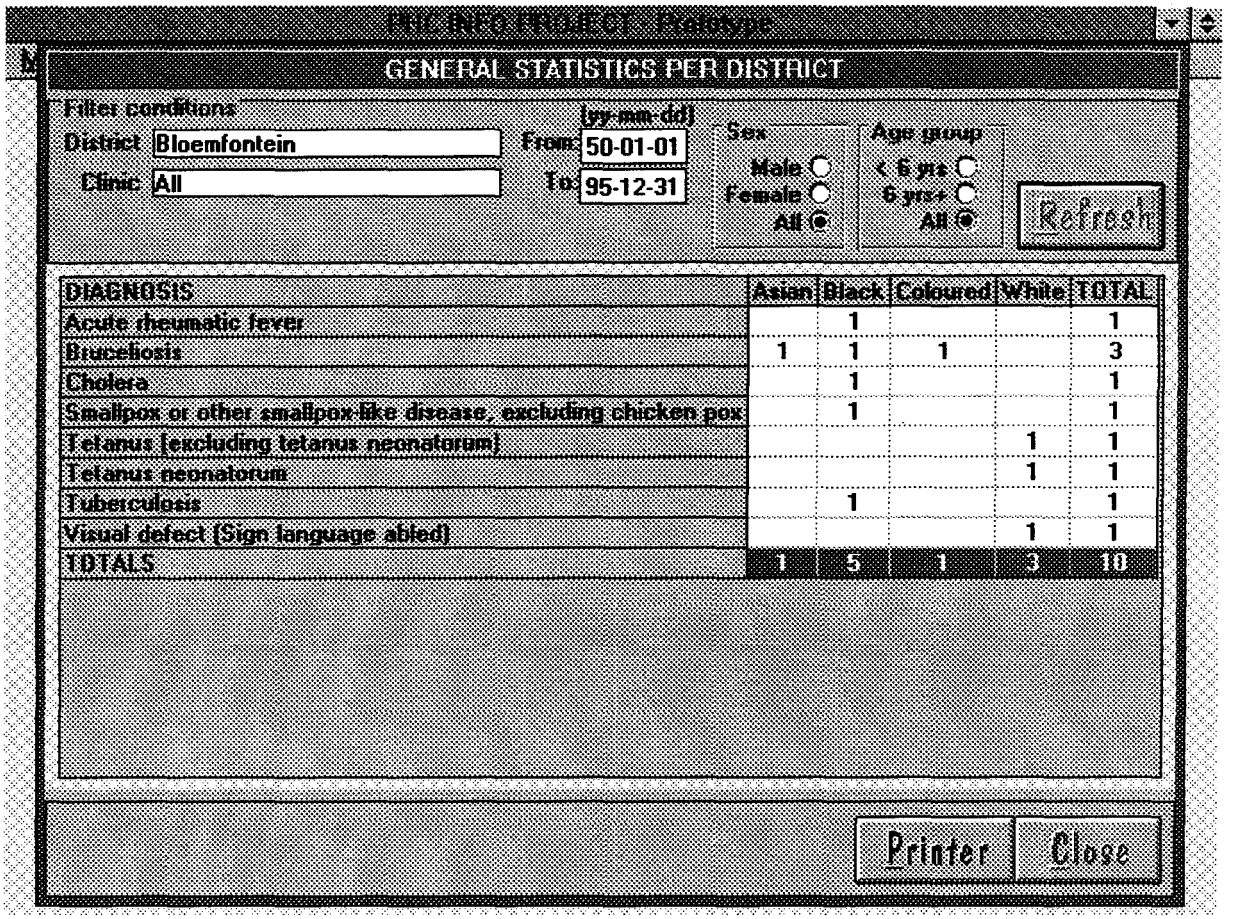


Fig. 10

1.3 Data capture forms

A set of forms has been designed in conjunction with the above-mentioned prototype. The idea was that these forms could be used in a clinic where a computer is not available immediately. An entry must be made for every patient seen and the set of forms must be submitted to a central point regularly. A data-typist could be appointed to enter these data into the computer. These forms are attached as Appendix B.

Because the prototype is based on a patient-record-approach, the forms had to conform with this approach in order to keep the computer system up to date. Because the service provider needs immediate access to up-to-date patient records, the current manual records would have to remain intact, resulting in an increase of paper work during consultations.

Although the work load of the service provider with regard to statistical processing would be taken away from her, this increase in paper work does not justify the approach. Other ways of getting around the problem of limited hardware facilities had to be investigated.

2. EVALUATION OF PRE-WRITTEN PACKAGES

The two pre-written packages piloted in the Free State were evaluated with the prototype system described above as neutral reference. No discrimination is made between the two packages. Unless otherwise indicated, only aspects common to them are mentioned here.

2.1 AN ON-SITE EVALUATION

A study was done at the municipal clinic in Welkom that has been using a pre-written package for the past 6 years. Although a specific package has been evaluated, the comments below are of a general nature that applies to the approach of an extensive package rather than to the specific package.

No manual cards are kept at the clinic. Each one of the eight consultation rooms in the clinic is equipped with a computer that is connected to a central database through a local area network. A patient record is opened on first visit for all permanent residents in the catchment area. On all follow-up visits the patient records are updated. The details of visitors from outside the catchment area are not registered. The system provides for a screen where the specific intervention of visitors can be recorded for statistical purposes. In busy times the interventions for visitors and adults with minor ailments are not recorded on the computer and the necessary statistics are kept on a separate piece of paper.

The service providers do not keep any statistical records. The system does the tallying in the background and senior personnel prepare the monthly and quarterly statistical reports. Because these reports are not in the format wanted by nursing management, some manual processing is necessary. At the end of each month the statistical reports must be processed form both the computer print-outs and the loose pieces of paper.

The patient-carried records are still in place. These records, e.g. the child-health chart, are for the sake of the patient and to facilitate services at other clinics when the patient migrates or travels. This means some duplication as some data has to be entered on the patient-carried record as well as on the computer.

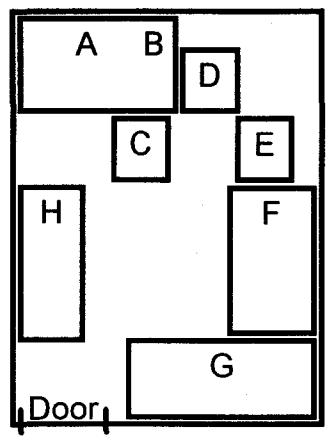
The program runs in a DOS-environment. This limits the number of pick lists available and a lot of typing has to be done by the service provider. If the service provider has little experience, this is very time consuming. It also influences the accuracy of the statistics because of the different spelling possibilities of a particular intervention.

According to inexperienced users and management a one day training session on the computer program is adequate for a new user - even those with no prior computer experience. From the observation done it seemed that the inexperienced user loses more time in looking for keys on the keyboard than suffering with the program.

The study has shown that it takes an inexperienced user about 20-30 minutes to register a new patient. An experienced user registers a new patient in 10 minutes. An existing patient record is updated in about 1 minute by an experienced user whereas it takes an inexperienced user 3 minutes. It was, however, evident, that although the system offers a large variety of data-fields that can be completed, only a limited subset was used regularly.

During the time that the computer record is updated, the patients are waiting. The experienced users manage, however, to maintain contact with their patient because they are able to talk to the patient and ask questions while they are working on the computer. In the case of an inexperienced user, however, patients have to sit waiting for up to 20 minutes without being attended to.

A typical lay-out of the consultation room is indicated in fig. 11. Note the position of the patient's chair. The nurse can switch eye contact with very little effort from the computer back to the patient.



A. Desk
B. Computer
C. Nurse's chair
D. Patient's chair
E. Extra chair
F. Instruments table
G. Examination table
H. Cupboard for medicine

Fig. 11

Currently the service-providers are obliged to keep the TB register and therefore opted not to register the TB patients on the computer also. Updating the milestone development details during child health consultations are not done, the excuse being that it takes too much time.

The patients that were questioned were not feeling uncomfortable with the set-up at all. They trust that the service provider knows what she is doing and believe that the computer speeds up the process, even in the case of an inexperienced user registering a new patient. The service providers all agreed that the computer speeds up the process and makes their task easier. They are specifically thankful for the fact that they don't have to file documents and sit with masses of records.

2.2 ADVANTAGES OF THE PRE-WRITTEN PRODUCTS

- Extensive clinical and demographic record of each patient is kept.
- Sophisticated security measures (only in one of the two systems tested) are part of the packages.
- Extensive search facilities are available.
- Definitions are accessible through the user-interface and are not hard-coded.
- Context-sensitive and on-line help is available.
- The user-manual (available for one of the packages only) is good.

- An integrated on-line tutorial is available.
- Training is done by the system-developers themselves.
- Good after-training-support was given by one of the vendors.

2.3 DISADVANTAGES OF THE PRE-WRITTEN PRODUCTS

- Not all PHC services are provided for.
- Statistical reports are either absent or very limited. The format and contents of these reports are also not according to the needs of health management in the Free State.
- Ad hoc-reports or queries are difficult if not impossible because access to the database other than through the fixed front-end is impossible.
- Although the vendors claim that it is not the case, it seems that maintenance and future expansion might take some time.
- These packages are quite expensive.
- After-training-support is limited.
- Information provided is in a format that is seldomly useful at local level.
- The systems are too comprehensive to be implemented completely at once.
- The systems proved to be time consuming in practice, mainly because of
  - the difficulty of use (Nurses took a long time to become conversant with the systems.)
  - navigating through several menu-levels
  - the number of data-fields to be entered
  - the unfamiliar format and layout of data-fields on the screen
  - the fact that the data on one patient is distributed on several screens
  - limited use of pick lists (A large amount of typing has still to be done.)
  - the slow response times (The more comprehensive the database the longer it takes to access a patient's record.)

CHAPTER 6

COMPUTERISATION BASED ON PATIENT RECORDS (A LIMITED SYSTEM)

INTRODUCTION

It was soon evident that the comprehensive packages were too comprehensive to be feasible in practice and it was then decided to try an alternative approach, namely a **limited system**. This system did not include nursing management facilities and was based on a much smaller clinical data set. The patient demographical data was limited to the patient's ID, name and address.

1. THE PROTOTYPE BASED ON A LIMITED DATA SET

1.1 The design

A high level conceptual model has been designed and is presented in the form of an entity-relationship diagram in Appendix C. The ER-diagram has then been mapped to a logical model, the 3NF relational model which is also presented in Appendix C.

1.2 The user-interface

The prototype has been designed around the following menu-structure:

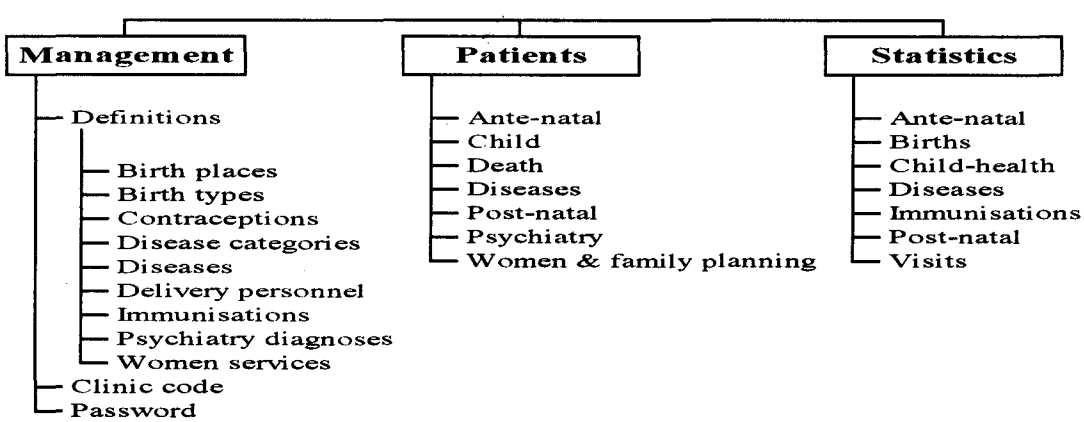


Fig. 1 shows the opening screen with the management menu-item pulled down:

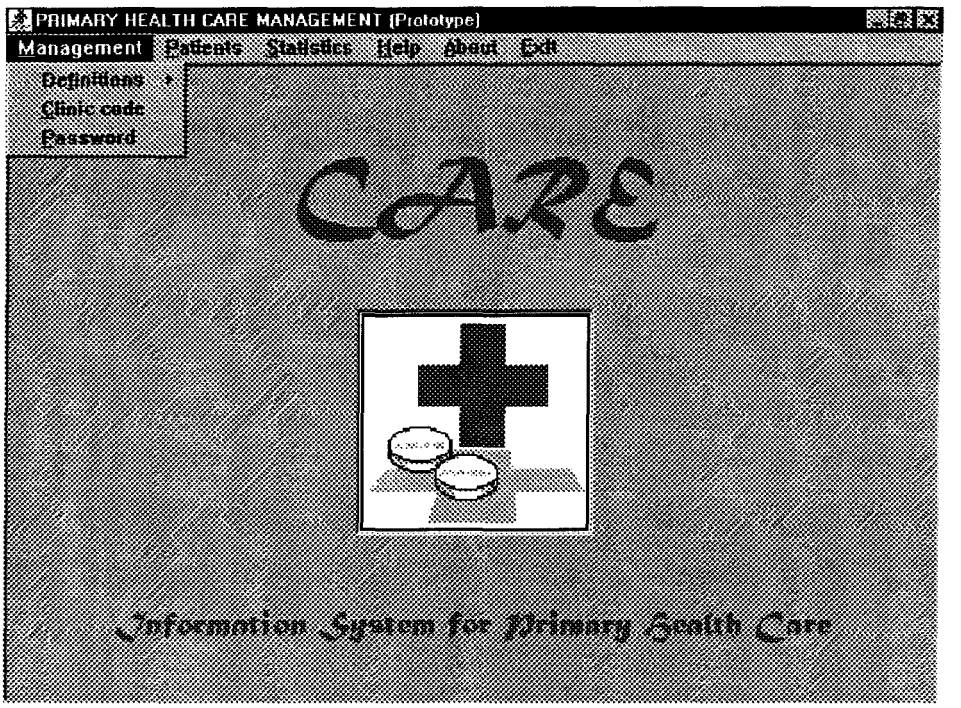


Fig. 1

1.2.1 Management

The definitions tables as indicated in appendix C can be accessed and dynamic changes to the contents of pick lists in the other screens can be made here. Following is the DISEASES screen as an example (fig. 2):

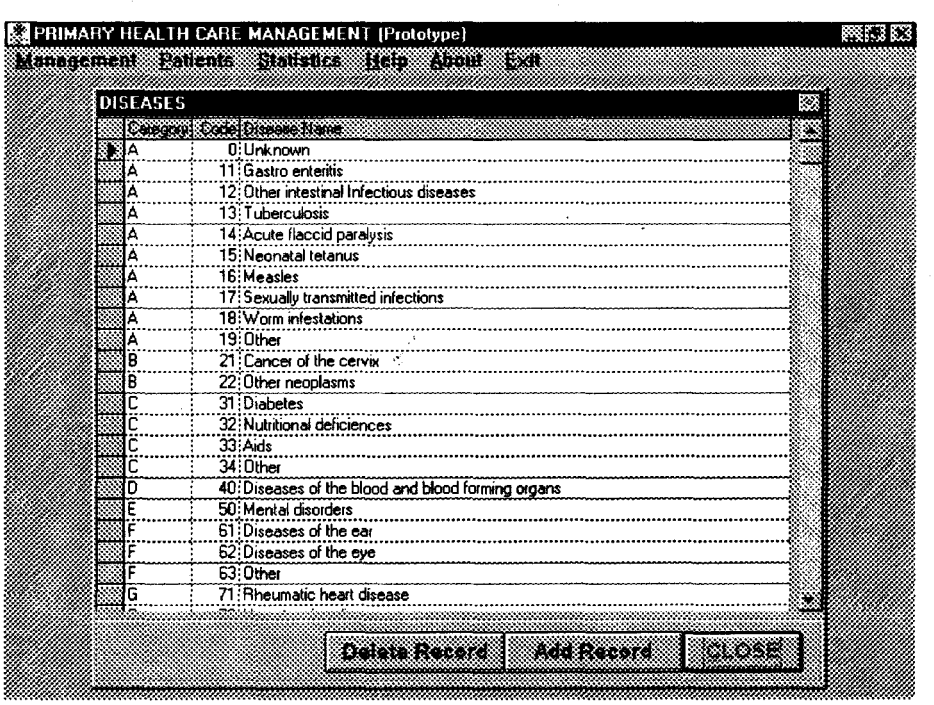


Fig. 2

1.2.2 Patients

Clinical details regarding patients in one of the listed categories are registered here. The following screen-print (fig. 3) depicts the screen for demographic patient details. Note the search list on the left hand side that enables quick access to a specific patient. Note also the memo field in which any other applicable information can be entered.

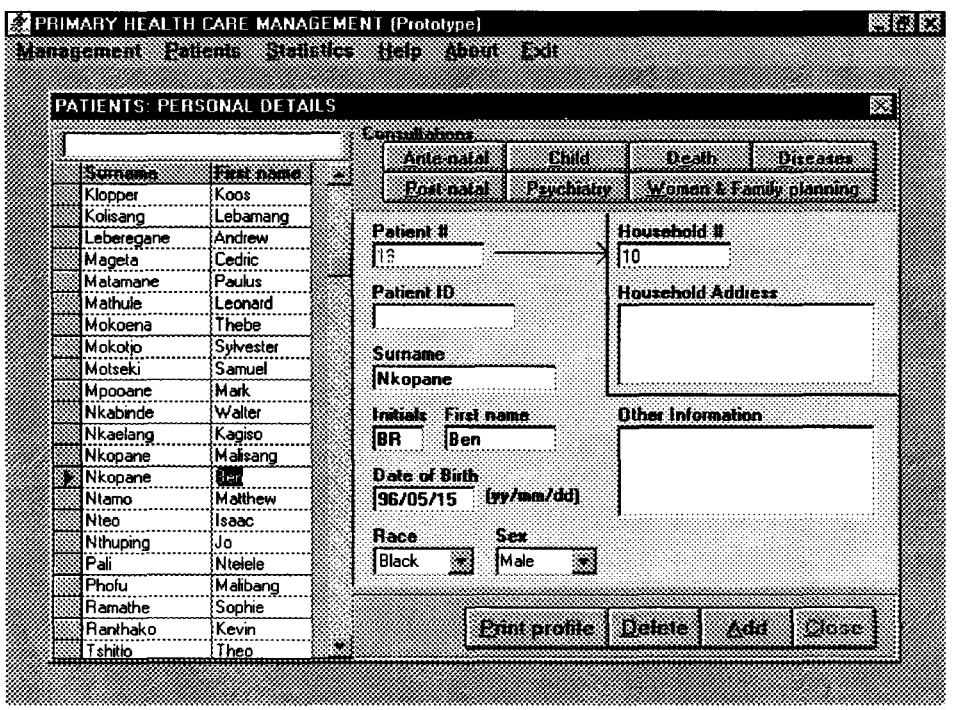


Fig. 3

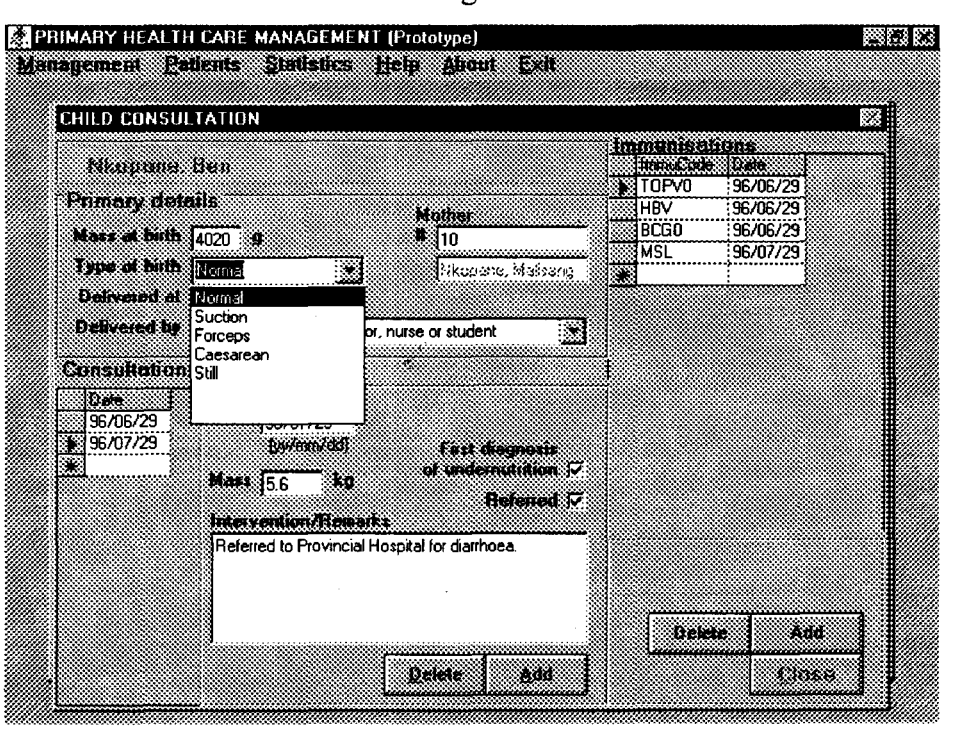


Fig. 4

Fig. 4 shows what the screen would look like if the "Child" button on the screen shown in fig. 3 would have been clicked. Note that this screen is divided into three parts. The contents of the CHILD PATIENT, CHILD CONSULTATION and IMMUNISATION tables (refer to appendix C) are accessed on a single screen. Note also the pick lists that limit the amount of typing that has to be done by a nurse. The contents of these pick lists can be changed as indicated in paragraph 1.2.1 above.

1.2.3 Statistics

The statistical reports generated by the prototype only include the set of indicators of the Routine Data task group. The date limits must be entered and then a click on the "Refresh" would produce the necessary report. Although not included in the prototype, a "Printer" button could be added easily. In fig. 5 a screen-print of ante-natal statisticts is shown.

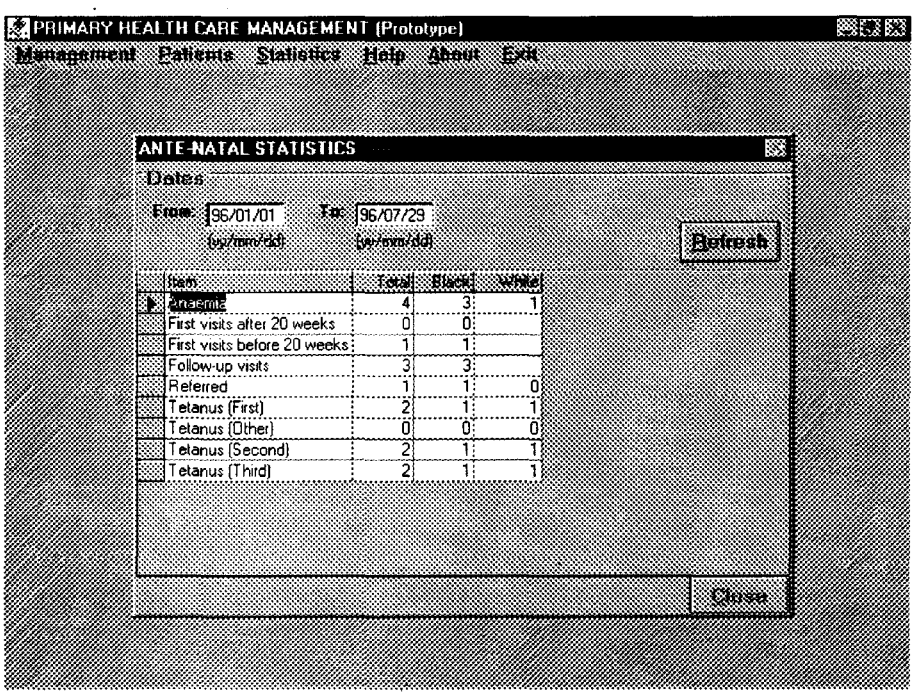


Fig. 5

1.2.4 Help

Context-sensitive on-line help is available. Pressing F1 while on any screen, a help-window on that screen will appear. Following is the help screen on the patients window (fig. 6):

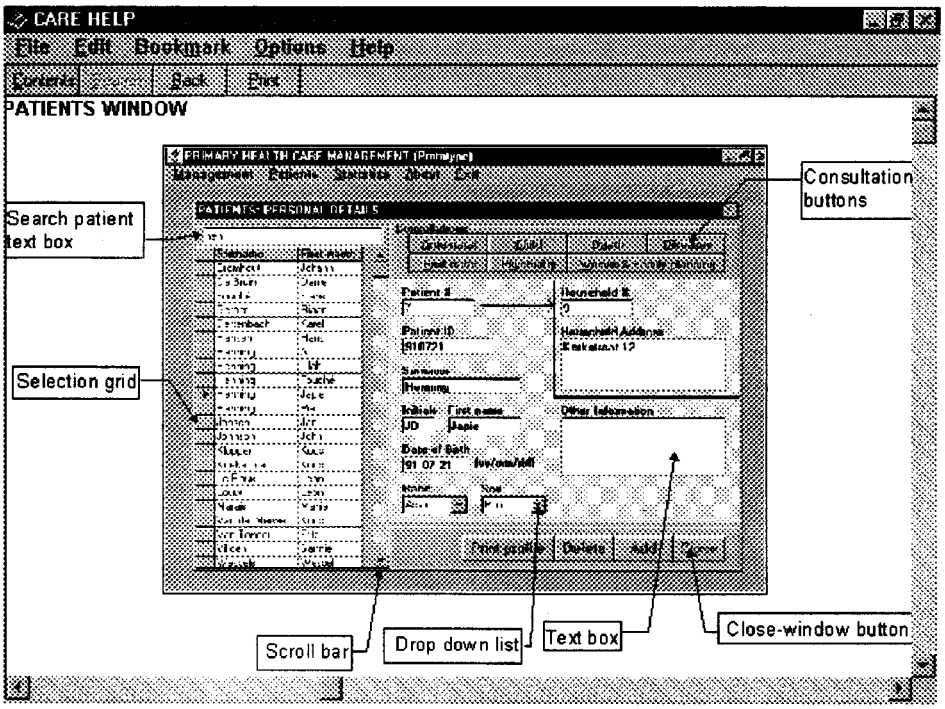


Fig. 6

1.3 THE SYSTEM

The system is included on stiffy disks at the back of this dissertation. To install, run SETUP.EXE on disk #1 in a WINDOWS environment.

2. EVALUATION OF A LIMITED SYSTEM

The service providers who piloted the prototype were interviewed and the following is a summary of their feed-back.

2.1 Advantages of a limited system

- All demographic details of a patient as well as his complete clinical history with regard to a specific service is available on a single screen (two windows).
- Although with only the essential data-fields, the system provides for all services rendered at primary health care level.
- Because of the limited data-set it is user-friendly, easy to learn, easy to manage and easy to maintain.

- Because of the normalised database design, future expansion is easy.
- All definitions are accessible through the front-end and need not be hard coded.
- An extended context-sensitive on-line help facility is available, aimed at the computer-illiterate user.
- It is relatively cheap.
- Because of the smaller but properly indexed database, access times are relatively quick.
- Because of the limited data set and extended use of pick lists, data entry is quick.
- Memo fields are available in which essential clinical data for which specific provision has not been made, can be entered.
- Because of the in-house development approach, the system conforms to users' needs.
- Statistical tallying is done in the background according to the indicators local nursing management has decided on.
- It provides information that will facilitate decision making from local level right through to top management level.
- The database is directly accessible without the need for a front-end user interface. Therefore, ad-hoc SQL-queries are possible.
- Training is done by the system-developers themselves at local level.
- Because of the in-house development approach, the developers are readily available for consultation.
- It provides all the statistical reports that the Free State nursing management requires.

2.2 Disadvantages of a limited system

- It only provides for a limited data set. A complete clinical record is not kept for each patient.
- The security of the system is limited.
- Audit trails are not available.
- Currently no written documentation is available.

If this principle is accepted by nursing management, some of the above disadvantages can be removed by adding security measures, audit trails and a user manual. The data-set will, however, only be expanded to include the essential data-elements.

CHAPTER 7

COMPUTERISATION OF THE STATISTICAL PROCESS

INTRODUCTION

A system could be developed where the set of tallies is reproduced on the screen. The nurse would use the mouse to make ticks in the appropriate check boxes. A prototype of such a system has been developed.

A system could also be developed in which the tally sheets would be adapted for reading by a computer scanner. These tally sheets can then be collected at a central point where a scanner could be used to enter the data into the computer. Two possible approaches exist and will be discussed in detail.

1. A COMPUTERISED TALLY SYSTEM

It is assumed that a computer is available on the nurse's desk..

1.1 The design

The database design for this system requires only one table. This table (see fig. 1) consists of a column for the clinic name, race and date together with a large number of columns for the number of incidences of each of the entries on the tally sheet:

Clinic	Race	Date	Number of ante-natal first visits before 20 weeks	Number of ante-natal first visits after 20 weeks	Number of ante-natal follow-up visits	Number of ante-natal referrals	Number of women with HB < 20	.....
Heidedal	Black	95-09-09	4	6	5	4	6	
.....	.....	.....	.....	.....	.....	.....	.....	.....

Fig. 1

A complete design is attached as Appendix D.

1.2 The user-interface

The clinic and race attributes have been implemented on the prototype with drop-down lists. That means that the nurse must click on the appropriate item in the list only. The date-attribute has the current date as default, but can easily be changed by the nurse. For each of the other attributes the nurse clicks a check box or option box as applicable. After every patient the nurse clicks on the "Accept" button and the appropriate totals are updated.

The prototype consists of a menu, four input screens and one screen for generating reports. The input screens are organised in such a way that related consultations appear on one screen:

- General (Diseases, nutrition, psychiatry, dental and geriatric)
- Women & children (Family planning, ante- and post-natal care, births, child health and immunisations)
- Health education
- School health

The ante-natal part on the tally sheet looks like this:

	BLACK	COLOURED	ASIAN	WHITE
First visits before 20 weeks	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
First vists after 20 weeks	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Follow-up visits	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Referrals	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000
Women with HB < 20	00000 00000 00000 00000 00000	00000 00000 00000 00000	00000	00000 00000 00000

Fig. 2

On the screen (fig. 3) it appears together with the other women & children related consultations:

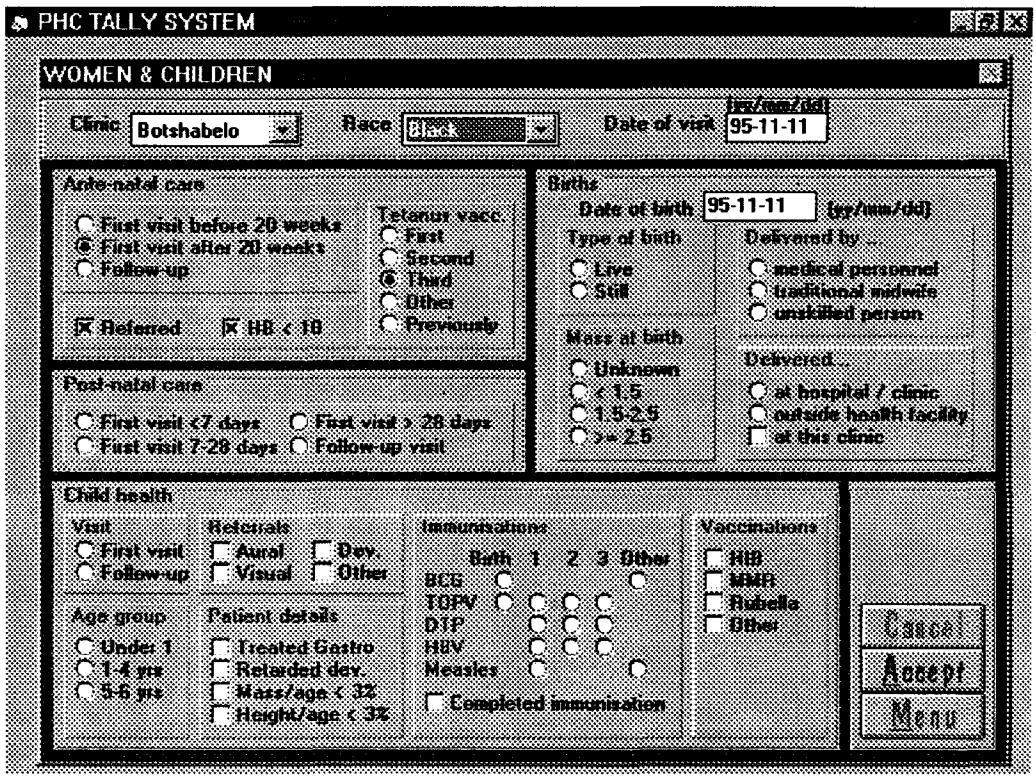


Fig. 3

In the above example an ante-natal visit was registered as a first visit after 20 weeks, a third tetanus vaccination was given, the patient was referred and her HB was less than 10. This was done by means of clicking with the mouse on the applicable check boxes (☒) and option boxes (⊙). It takes a couple of seconds only - the patient hardly notices that the nurse's attention is withdrawn.

1.3 Processing the data

Although the prototype provides for some processing, it is only useful for the nurse at a local level. The data in the table (fig. 1) can, however, be forwarded to a central computer either by means of a network or by the regular submitting of a floppy disk. At this central computer the data from all over the province would be collected, consolidated and processed.

2. A COMPUTERISED TALLY SYSTEM USING SCANNER CARDS FOR DATA-CAPTURE

This approach is similar to the previous one in that no electronic patient records are kept. The statistical indicators are captured without connecting it to a patient. The system differs from the previous approach in that it is not necessary to have a computer readily available during the service. The data-capturing is done on a revised tally sheet on a scanner card. Periodically these pages must then be sent to a central point where the data will be entered into a computer by means of a scanner. A computer program will process and summarise the data and generate reports with the contents and format according to the needs of nursing management.

2.1 One scanner-card per patient

In this case the scanner-card would be a reproduction of the screen in the computerised approach referred to above. It is possible to reduce the 18-page tally sheet to one page. The nurse now cross out the appropriate check boxes with a pencil rather than clicking it with a mouse. A separate page must be used for every patient.

The principle of such a system has been proposed to nursing management in the Free State. Bureau Oranje, the IT department of the provincial administration refined and implemented the idea. In appendix E an example of such a scanner card is depicted. This system will now be implemented in all clinics under the Free State Provincial Government.

This approach would, however, inevitably lead to a massive amount of paper but the advantage is that the nurse would have no manual tally sheet and no processing to do.

2.2 One scanner card per period

It is also possible to adapt the system to handle tallies taken over a period of time. In this case numbers will be entered in the appropriate fields in stead of mouse clicks/pencil marks.

This approach would use less scanner cards, but the nurse would still need a tally sheet to record the incidences and she would still have to add the ticks on the tally sheet and enter the totals on the scanner card periodically. The only advantage, although significant, is that the nurse would not have to produce statistical reports.

2.3 Conclusion

The advantage that the nurse don't have any manual tally to tick and summarise on the scanner card with the first approach, outweighs the advantage of less scanner cards with the second approach.

The day once a week that was previously devoted to processing statistical reports, can now be used for patient care. Furthermore, the statistical reports will now be much more accurate, because the human error-factor in the processing process has been eliminated.

CHAPTER 8

COMPARISON OF COMPUTERISATION APPROACHES

1. SUMMARY OF APPROACHES

The following diagram (fig. 1) gives on overview of the different approaches for implementing a set of nursing indicators for managing primary health care at clinic level discussed so far.

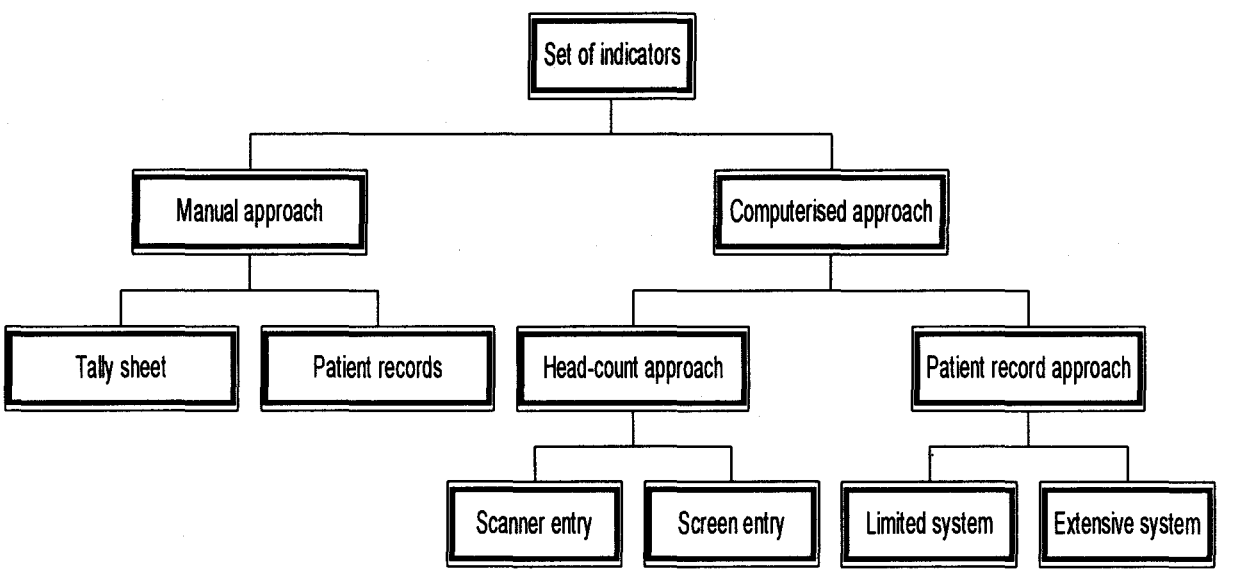


Fig. 1

2. COMPARISON OF COMPUTERISATION APPROACHES

2.1 Technical comparison

For the purpose of comparing the approaches, the three systems representing each one of the approaches are compared with regard to the criteria listed in the first column of the table on the next page.

System A : Head-count approach

System B : Comprehensive patient record based approach

System C : Limited patient record based approach

	SYSTEM A	SYSTEMS B	SYSTEM C
Approach	Head-count.Record number of incidences per case per district and per race.	Patient record system. Extensive demographic and clinical details of patient as well as management data are kept. All statistical counting is done in the background.	Patient record system. Only limited demographic and clinical data of patients are kept.
Ease of use	Easy to learn. Only a menu with four input screens and one screen for report generation. Very little typing necessary - most input is done with a mouse click.	Difficult to learn. All screens are based on the same principles. Once the user knows the system, navigating through the screens is quick and easy. Multilevel menus cause delays.	Moderate to learn. All screens are based on the same principles. Once the user knows the system, navigating through the screens is quick and easy. Multilevel menus are a bare minimum.
Data set	One table with less than 80 data elements. Every consultation adds about 300 bytes to the size of the database.	53 tables with 350 fields constituting ±270 bytes/patient and ±120 bytes/consultation. Because of the normalised relational structure of the database, no empty values are kept	28 tables with 114 fields constituting ±140 bytes per patient and ±20 bytes per consultation. Because of the normalised relational structure of the database, no empty values are kept.
Minimum hardware requirements	**Server**: 30 MB free space for 100 000 consultations **Client**: 386DX processor and 1MB free disk space. SVGA screen recommended.	**Server:** 16.5 MB free disk space required for 20 000 patients with an average of 5 consultations each. **Client::** 486DX2-66 processor and 1 MB free space on hard disk. VGA screen recommended.	**Server**: 4.6 MB free disk space required for 20 000 patients with an average of 5 consultations each. **Client**: 486DX2-66 processor and 1 MB free space on hard disk. VGA screen recommended.
Time utilisation	30 seconds per consultation. No tally sheets or statistical processing any more.	5 minutes on first visit, thereafter 1 minute per consultation. Tally sheets, patient records, cards, files and statistical processing are abandoned.	2 minutes on first visit, thereafter 30 seconds per consultation. Tally sheets, patient records, cards, files and statistical processing are abandoned.
Practicality as independent system	Data files submitted on floppy disk can easily be merged with data from other clinics at a central point.	Difficult to implement without network links to a central database server. The everyday movement of patients from one district to another, will result in incomplete clinical patient records. Frequent maintenance will be necessary on the local database to get rid of the records of inactive patients.	
Practicality in the absence of a computer	If adapted to record totals per incidence, i.e. not one incidence at a time, this system could be used in conjunction with tally sheets to effectively reduce the time devoted to processing of statistical data.	It is possible to implement the system if there is only one computer available at a clinic. It should also not waste the nurse's time to make a print-out of a patient's personal profile before a consultation because it is no longer necessary to look for a filed folder in a cabinet. If the clinic is, however, not equipped with a computer at all, the system would not work effectively.	

	SYSTEM A	SYSTEMS B AND C	
Flexibility	Extension of fields and data-elements can only be done by programmer. Selection of fields and records to be included in reports is in the hands of the user.	Management can add, change or remove definitions and codes themselves. The selection of fields and records to be included in reports is in the hands of the user.	Management can add, change or remove definitions and codes themselves.
Accuracy	The nurse must remember to record every consultation on the screen. If this is not done, the data might be inexact.	Because all patient data now lies on the computer, it is impossible to forget to record a consultation.	
Completeness of reports	Only the minimum data set can be taken into account for report generation because it is all that is captured.	Because a wide variety of clinical and other data is captured, a wide variety of dynamic and ad hoc reports can be generated from the data. With system C ad hoc reports can only be generated by a database specialist	

2.2 Feed-back from the users

System C was implemented in several clinics in the Free State. Because it was a pilot study, the patient cards and tally sheets had to be kept up to date and the computerised system was used in parallel with the manual system. In order not to burden the already overworked service providers too much, they were given permission not to use the computer system on busy days. Furthermore, every clinic only tested one module, e.g. psychiatry patients, antenatal patients or child-health.

The system was also given to several service providers and nursing managers to evaluate. They did not test it in practice but had a thorough look at it.

The initial response was very positive, but as the pilot progressed, the willingness of the service providers to co-operate diminished, partly because of the extra burden and partly because of their lack of computer-literacy.

3. SUMMARY OF ADVANTAGES AND DISADVANTAGES

The following is a summary of the most important advantages and disadvantages of the different computerisation approaches as it emerged form the previous chapters. Refer to the respective chapters for a more detailed discussion.

3.1 Manual approach

Advantages

- Familiarity
- Quick during consultations

Disadvantages

- Inaccurate
- Inflexible
- Incomplete
- Piles of paper work

3.2 Computerised approach

Advantages

- Increased accuracy
- Changes are easy to make
- Less paper work
- Tally system is abandoned
- Easy and versatile reporting of statistics
- Context sensitive help

Disadvantages

- Expensive hardware and software
- Nurses are computer illiterate
- Patients may feel neglected
- Time consuming during consultation

3.2.1 Head-count approach

Advantage

- Small and easy to obtain and maintain

Disadvantage

- Manual patient records must still be in place

3.2.1.1 Head-count approach with data-capturing done with a scanner-card

Advantage

- No processing by the nurse
- Easier during consultation
- Immediate available computer not essential

Disadvantage

- Processing must be done separately
- Massive amount of tally sheets

3.2.1.2 Head-count approach with data-capturing directly on computer

Advantage

- Processing is quick

Disadvantage

- Computer must be immediately available

3.2.2 Patient record approach

Advantages

- Manual patient records abandoned
- Statistical processing in the background

3.2.2.1 Limited computerised patient record system

Advantages

- Easy to use and maintain
- Quick access to patient record

Disadvantage

- Only limited data set

3.2.2.2 Comprehensive computerised patient record system

Advantage

- Full clinical history and demographic details of each patient

Disadvantages

- Navigating through menu-levels is time consuming
- Complicated

CHAPTER 9

A PROPOSED MODEL FOR COMPUTERISATION OF PRIMARY HEALTH CARE IN THE FREE STATE

1. INTRODUCTORY REMARKS

Although a patient-record oriented system needs more expensive hardware and at least one computer for every PHC team, the flexibility, time saving and increased accuracy makes it a much more feasible approach than a system counting incidences only. The only advantage that such a system has, is its ease of use.

The advantage that a patient-record computerised system has over the current manual system, is considerable. The improved accuracy, increased control by management, the fact that the hand-held patient records are abandoned as well as the fact that the nurse no longer has to process and submit periodical statistical reports are some of the most obvious examples.

However, the ease of use of the limited system makes it an attractive proposition. It was found that with even limited training, a computer illiterate nurse were able to manage it. On the contrary, the extensive system proved to be too much of a burden for nurses in practice and it proved to be contra-productive. Furthermore, it was found to be easier to implement the limited system in a clinic where there are only one computer shared by several nurses, than it was to implement the comprehensive system.

2. THE MODEL

2.1 The computerisation approach

The availability of computers and network facilities determines the computerisation approach that should be followed:

2.1.1 No computers available

If some of the clinics in a district do not have at least one computer the manual patient record system must stay intact in all the clinics. The processing of statistics can, however, be streamlined with the approach of **scanner cards**, discussed in the previous chapter.

2.1.2 At least one computer per clinic

Because the supplying of computers throughout the province will take some time, it is important that the system can be adapted to function in the absence of a computer on the nurse's desk top. If all clinics in the province are supplied with at least one computer, a **limited patient-record based system** should be implemented.

The most feasible approach in these circumstances seems to be the one discussed in paragraph 1.4 in chapter 3. When the patient arrives at the clinic, an assistant can record the basic and demographic information and enter it into the computer. The system should then make provision that a patient profile can be printed. The nurse updates this printed profile and the assistant updates the computer record from this profile at a later stage (see fig. 3 in chapter 3).

2.1.3 A computer for every service provider

The ideal situation is that every service provider will have direct access to an own computer. In this case the scenario discussed in paragraph 1.5 in chapter 3 holds.

The service provider registers a new patient on the computer while asking the appropriate questions to the patient. The service is provided and the clinical data is updated immediately. See fig. 4 in chapter 3 in this regard. Research has shown (par. 2.1, chapter 5) that, depending on the category of consultation and the number of data-fields to be completed, it is possible that a nurse would not loose more than one minute of direct contact with the patient while she is updating the computer record. To achieve this, however, the number of data-fields must be limited and the system must not be complicated. It is therefore important that, as in the previous case, a **limited patient-record based package** should be

implemented. It is also important that the patient will have a chair directly next to the computer (fig. 11, chapter 5).

2.2 Implementation

For the sake of getting everybody on board, a modular implementation approach should be followed. The system is implemented for, say, the psychiatry patients only. The manual system stays in place for the other services. Every month a new module can be implemented. In this way the service providers will be allowed ample opportunity to register their patients and to learn the system.

2.3 On-line / Off-line

As mentioned in the introductory remarks above, it is important that service providers at primary health care level will be trained in computer-literacy and get used to use the computer in their everyday tasks. Therefore it is more important to put a computer on every service provider's desk and train them how to use it efficiently than to spend millions in connecting all facilities.

In the ideal situation with every nurse having her own computer, a local area network should be installed in each clinic. This is because a different service provider would most probably attend to a patient on separate visits. Such a LAN is not too expensive, but if not possible, the service providers should be trained how to merge and redistribute the databases on a daily basis.

In an on-line environment, database file(s) could be stored on a file server accessible to every micro-computer at every clinic throughout the province. In such an environment the migration of patients does not cause a loss of their records. In the, most probable, case of an off-line environment the database file(s) from the local server must be sent periodically either electronically or on a disk by normal post to a central point where all the databases from all the clinics can be merged and redistributed. In such an environment, it is even more important that a limited system must be used because it is unlikely that a comprehensive

database with all patients from all over the Free State would fit on the hard disk drives of the file servers at the clinics.

2.4 Training

Because of the general lack of computer-literacy amongst the service providers, the training programme of the package should be preceded by or include a programme of general computer and Windows training. Experience during this study has furthermore shown that training in groups is not effective. The nurses should be attended to individually.

CONCLUSIONS

Although a questionnaire was developed and distributed to various service providers and clinics, very little feed-back was obtained and therefore no formal study results are available. The following conclusions result from informal evaluation methods such as site visits and interviews during the piloting of the limited system (chapter 6), meetings with service providers and nursing management and an on-site evaluation of a pre-written package (chapter 5).

In chapter 1 it was stated that the primary goals of this study were to

- develop a plan how to computerise PHC services;
- do the necessary research to prove or disprove that computerisation would improve the functionality of PHC personnel.

With regard to the first goal, the study showed that the flexibility of a patient-record approach (discussed in chapters 5 and 6), although more time consuming, is preferred to a head-count approach (discussed in chapter 7). Furthermore, the ease of use of a locally-developed, limited system (chapter 6) rather than a pre-written, extensive system (chapter 5) seems to be a much more feasible approach in a developing country with mostly computer illiterate nurses. The fact that it is less time consuming, conforms to local needs and does the statistical processing exactly as nursing management requires it in the background, counts in its favour. Furthermore, because of their personal involvement in the development phase, the eventual users will be positively inclined towards the system and willing to make it work.

Because of the limited formal feed-back obtained from the service providers, no definite conclusions can be made regarding the second goal mentioned above. However, based on the informal feed-back some general remarks can be made. It could be ground for further research to test these assertions formally.

It became clear that the large majority of service providers have a total misconception of the usefulness of a computer. For many of them the word 'computer' equals a solution to their

every problem. After a hands-on experience, however, they mostly come to the shocking realisation that if not applied correctly and efficiently, a computer can be bad for business. At primary health care level, it is possible that a service provider can see up to 40 patients per day, i.e. a patient every 12 minutes. In such an environment, updating computer records on a time consuming system is totally unpractical.

Furthermore, it seems that no vendor is currently able to present a package that fulfils in all the needs and requirements of management and service providers in the Free State that is simultaneously user-friendly and practically feasible. Generally spoken, although the service providers were impressed by the technology, the colourful screens, the vast amount of data available on each patient, etc. they were not willing to do away with the manual system in favour of any of the systems piloted. The principal reason being that they would have less time for patient care and not more. The service providers are, however, willing to give a limited, locally developed system a chance to prove itself.

It thus seems that there is a trade-off between user-friendliness and access times on the one hand and comprehensiveness on the other hand. If a computerised system will prove to be feasible in practice, it will be one with only the essential data elements according to local needs and not a comprehensive system.

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APPENDIX A

DESIGN OF A COMPREHENSIVE PATIENT-RECORD BASED COMPUTER SYSTEM

The comprehensive patient-record computer system that was developed as part of this study is discussed in chapter 5. Following is the high level, conceptual model of the system in the form of an entity-relationship diagram and a logical model in the form of a set of tables in third normal form, the relational model.

1. ENTITY RELATIONSHIP DIAGRAM

For the sake of simplicity, the ER-model has been subdivided into two parts: a clinical and a management part. The standard notation for an entity relationship diagram has been simplified in order to make it more readable. The diamonds for relationships have been replaced by numbers that are annotated separately. Many-many relationships have been replaced with an associative entity type. Cardinality ratios are indicated with an arrow head on the many-side. Attributes have been omitted in order to avoid cluttering. With this notation, the ER-diagram can be mapped directly into a relational model (set of tables).

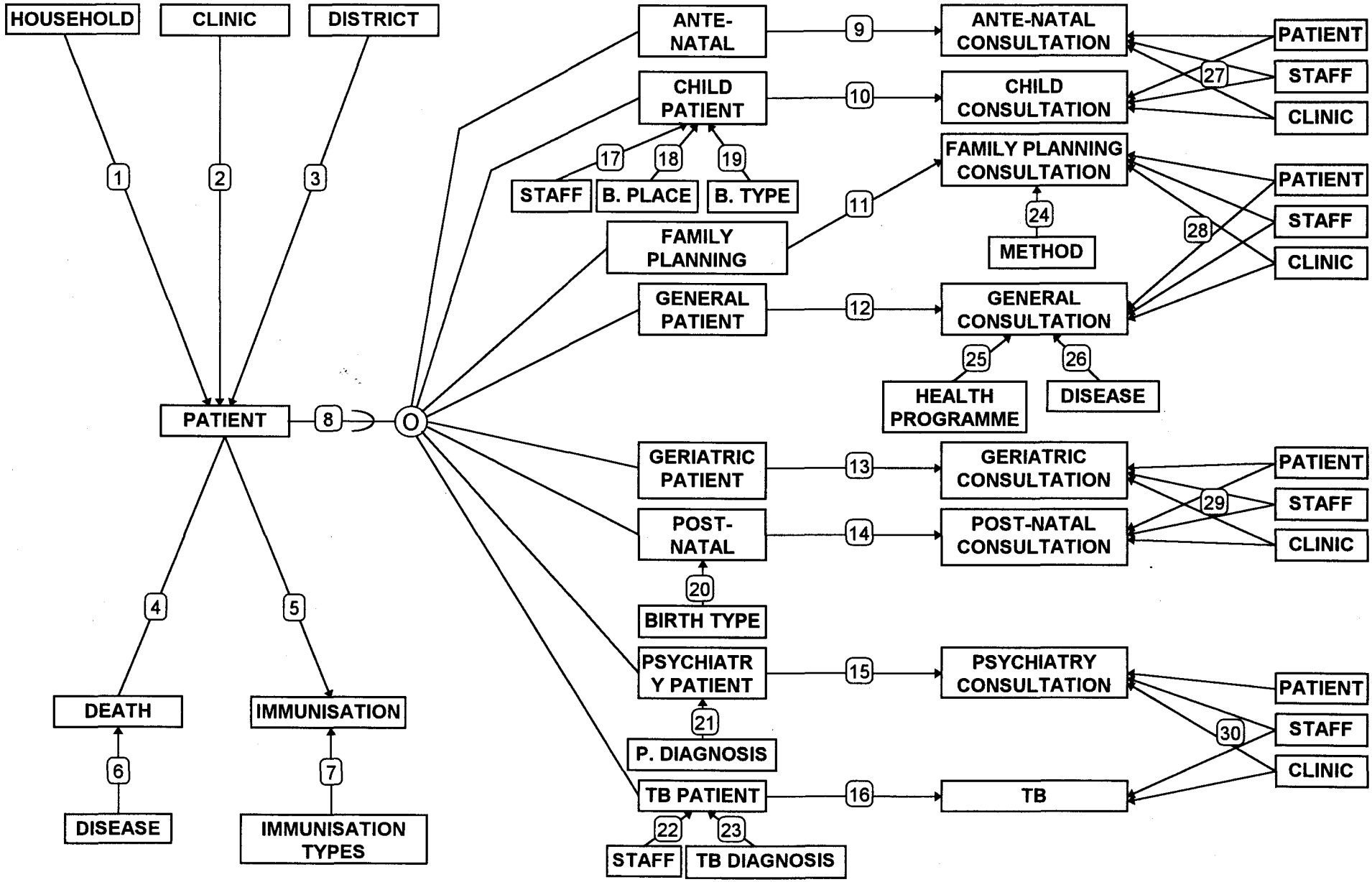
1.1 CLINICAL PART OF THE ER-DIAGRAM

The clinical part of the diagram is on page 88.

Following are the relationships. The entity type on the many-side of the one-many-relationships is mentioned first.

1 : PATIENT is part of HOUSEHOLD
2 : PATIENT is serviced by CLINIC
3 : PATIENT lives in DISTRICT
4 : PATIENT dies

1.1 CLINICAL PART OF THE ERD



5 : IMMUNISATION done on PATIENT

6 : DEATH is caused by DISEASE

7 : IMMUNISATION is of type IMMUNISATION TYPE

8 : Each of the entity types to the right of the ⓞ symbol is a specialisation of PATIENT and thus constitutes a set of sub-classes. The ⓞ symbol indicates that the subclasses are overlapping, i.e. the same patient can be a member of more than one of the subclasses.

9 : ANTE-NATAL CONSULTATION done with ANTE-NATAL PATIENT

10 : CHILD CONSULTATION done with CHILD PATIENT

11 : FAMILY PLANNING CONSULTATION done with FAMILY PLANNING PATIENT

12 : GENERAL CONSULTATION done with GENERAL PATIENT

13 : GERIATRIC CONSULTATION done with GERIATRIC PATIENT

14 : POST-NATAL CONSULTATION done with POST-NATAL PATIENT

15 : PSYCHIATRY CONSULTATION done with PSYCHIATRY PATIENT

16 : TB CONSULTATION done with TB PATIENT

17 : CHILD PATIENT birth supervised by STAFF

18 : CHILD PATIENT born at BIRTH PLACE

19 : CHILD PATIENT born BIRTH TYPE

20 : POST-NATAL PATIENT delivered BIRTH TYPE

21 : PSYCHIATRY PATIENT diagnosed with PSYCHIATRY DIAGNOSIS

22 : TB PATIENT supervised by STAFF

23 : TB PATIENT diagnosed with TB DIAGNOSIS

24 : FAMILY PLANNING CONSULTATION done by means of FAMILY PLANNING METHOD

25 : GENERAL CONSULTATION done as part of HEALTH PROGRAMME

26 : GENERAL CONSULTATION on diagnosis DISEASE

27 : ANTE-NATAL CONSULTATION paid by PATIENT

ANTE-NATAL CONSULTATION done by STAFF

ANTE-NATAL CONSULTATION done at CLINIC

CHILD CONSULTATION paid by PATIENT

CHILD CONSULTATION done by STAFF

CHILD CONSULTATION done at CLINIC

28 : FAMILY PLANNING CONSULTATION paid by PATIENT
FAMILY PLANNING CONSULTATION done by STAFF
FAMILY PLANNING CONSULTATION done at CLINIC
GENERAL CONSULTATION paid by PATIENT
GENERAL CONSULTATION done by STAFF
GENERAL CONSULTATION done at CLINIC

29 : GERIATRIC CONSULTATION paid by PATIENT
GERIATRIC CONSULTATION done by STAFF
GERIATRIC CONSULTATION done at CLINIC
POST-NATAL CONSULTATION paid by PATIENT
POST-NATAL CONSULTATION done by STAFF
POST-NATAL CONSULTATION done at CLINIC

30 : PSYCHIATRY CONSULTATION paid by PATIENT
PSYCHIATRY CONSULTATION done by STAFF
PSYCHIATRY CONSULTATION done at CLINIC
TB CONSULTATION done by STAFF
TB CONSULTATION done at CLINIC

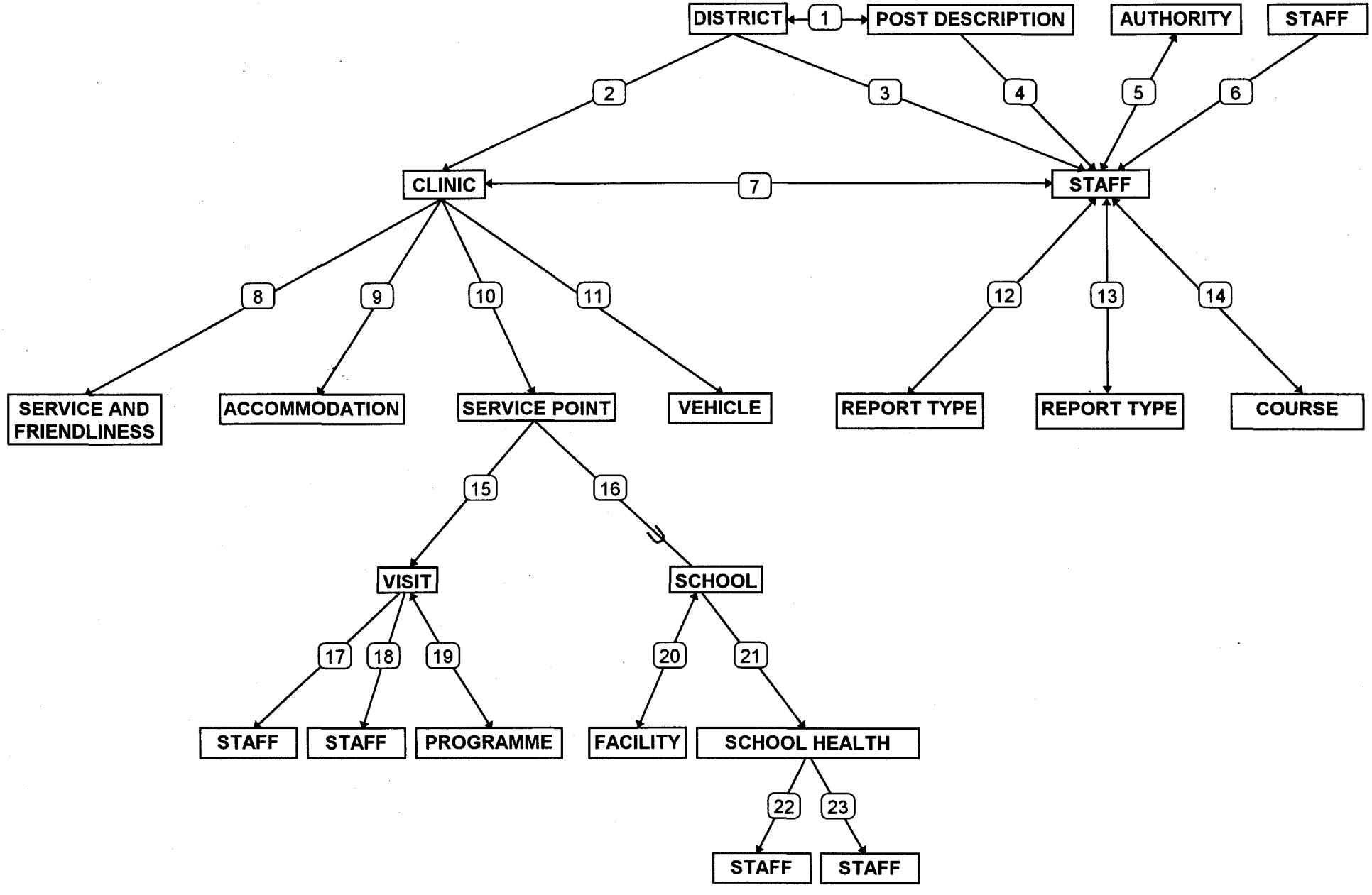
1.2 MANAGEMENT PART OF THE ERD

The management part of the diagram is on page 91.

Following are the relationships. The entity type on the many-side of the one-many-relationships is mentioned first.

1 : DISTRICT disposes of POST DESCRIPTION
2 : CLINIC is in DISTRICT
3 : STAFF lives in DISTRICT
4 : STAFF fills POST DESCRIPTION
5 : STAFF works under jurisdiction of AUTHORITY
6 : STAFF is supervised by STAFF
7 : STAFF works in CLINIC

1.2 MANAGEMENT PART OF THE ERD



8 : CLINIC disposes of SERVICE AND FRIENDLINESS

9 : ACCOMMODATION accommodates CLINIC

10 : SERVICE POINT is serviced by CLINIC

11 : VEHICLE is used by CLINIC

12 : REPORT TYPE completed by STAFF

13 : REPORT TYPE completed on STAFF

14 : COURSE done by STAFF

15 : VISIT done to SERVICE POINT

16 : SCHOOL is a specialisation of SERVICE POINT.

17 : STAFF is the nurse at VISIT

18 : STAFF presents at VISIT

19 : PROGRAMME is part of VISIT

20 : FACILITY possessed by SCHOOL

21 : SCHOOL HEALTH VISIT done to SCHOOL

22 : STAFF is the nurse at SCHOOL HEALTH VISIT

23 : STAFF presents at SCHOOL HEALTH VISIT

2. RELATIONAL MODEL

The ER-diagram above has been mapped into a relational model. The attributes are listed here together with the data types and some comments.

1.2.1 Definition tables

The first set of tables holds data that is not normally accessible to a service provider. Nursing management enters the appropriate values and then it is referred to by means of a foreign key in other tables. It is made available by means of pick lists to the service providers while entering data into the tables.

AUTHORITY

Code	STRING(5)
Name	STRING(30)

BIRTH PLACE

Place Code	STRING(1)	
Place	STRING(10)	

BIRTH TYPE

Type Code	STRING(1)	
Type	STRING(10)	

COURSE

CourseCode	STRING(2)	
Description	STRING(30)	E.g. 'AIDS', 'Assessment', 'STD', 'TB', etc.

DISEASE

Code	STRING(4)	
DiseaseName	STRING(255)	As in [31].

FACILITY

Code	STRING(1)	
Description	MEMO	Description of school facilities.

FAMILY PLANNING METHOD

MethodCode	STRING(3)
Method	STRING(20)

IMMUNISATION TYPES

ImmuCode	STRING(5)
ImmuDescription	STRING(40)
Weeks	INTEGER

POST

Code	STRING(2)	
Name	STRING(50)	Description of post level, e.g. 'Chief professional nurse', 'General assistant', etc.

PROGRAMME

Code	STRING(2)	
Description	STRING(50)	Description of health programme, e.g. Family planning, Child health, Geriatric health, etc.

PSYCHIATRY DIAGNOSES

Code	STRING(2)	
Description	STRING(20)	E.g. 'Anxiety complex', 'Depression', etc.

REPORT

ReportCode	STRING(2)	
ReportType	STRING(35)	E.g. 'Claims', 'Community profile', 'Polio campaign', etc. as defined in Mackenzie [20].

SERVICE AND FRIENDLINESS

Code	STRING(2)	
Description	MEMO	Description of E.g. 'Provide essential drugs', 'Mental health services', etc. as defined in NHIS/SA [28] and Mackenzie [20].

TB DIAGNOSES

Code	STRING(2)	
Description	STRING(25)	E.g. 'Primary', 'Pulmonary', etc. as in the Tuberculosis Register of the National Tuberculosis Control Programme.

1.2.2 District information

DISTRICT

Code	STRING(5)
Name	STRING(30)
Date updated	DATE
Geographical size	LONG
Population	LONG
Budget	DOUBLE
Community based rehabilitation?	BOOLEAN
Criteria for allocation of resources applied?	BOOLEAN
Implementing latest TB strategy?	BOOLEAN
Integrated health plan in place?	BOOLEAN
Organised system of continuing education?	BOOLEAN
Regular team meetings of health staff?	BOOLEAN
Strategic plan at disposal?	BOOLEAN
Estimated number of community health professionals	INTEGER
Estimated number of doctors	INTEGER
Estimated number of health professionals	INTEGER
Estimated number of midwives	INTEGER
Estimated number of nurses not in post category	INTEGER

1.2.2 Information regarding facilities

CLINIC

ClinicCode	STRING(5)	
Clinic Name	STRING(30)	
District Code	STRING(5)	Foreign key to DISTRICT.
Target area	STRING(10)	'Rural' or 'Urban'.
Mapped?	BOOLEAN	

CLINIC ACCOMMODATION

ClinicCode	STRING(5)	Foreign key to CLINIC
ClinicType	STRING(10)	
Condition	STRING(10)	
Improvement requested	DATE	

CLINIC SERVICES AND FRIENDLINESS

ClinicCode	STRING(5)	Foreign key to CLINIC.
ServiceCode	STRING(2)	Foreign key to SERVICE AND FRIENDLINESS

CLINIC VEHICLE

Reg. Number	STRING(10)	
Clinic Code	STRING(5)	Foreign key to CLINIC.
Vehicle type	STRING(15)	E.g. 'Mobile clinic', 'Sedan', 'Pod'
Vehicle condition	STRING(10)	E.g. 'Good', 'Reasonable', 'Poor'

1.2.3 Staff information

AUTHORIZES

AuthorityCode	STRING(5)	Foreign key to AUTHORITY.
StaffID	STRING(15)	Foreign key to STAFF.

CLINIC STAFF

StaffID	STRING(15)	Foreign key to STAFF.
ClinicCode	STRING(5)	Foreign key to CLINIC.

DISTRICT POSTS

PostCode	STRING(2)	Foreign key to POST.
DistrictCode	STRING(5)	Foreign key to DISTRICT.
Number of local posts approved	INTEGER	
Number of art. 30 posts approved	INTEGER	

REPORT BY EMPLOYEE

StaffID	STRING(15)	Foreign key to STAFF.
ReportCode	STRING(2)	Foreign key to REPORT.
Date	DATE	
In time?	BOOLEAN	
Up to standard?	BOOLEAN	

REPORT ON EMPLOYEE

StaffID	STRING(15)	Foreign key to STAFF.
ReportCode	STRING(2)	Foreign key to REPORT.
Date	DATE	

STAFF

ID	STRING(15)	
Surname	STRING(30)	
Initials	STRING(5)	
First Name	STRING(20)	
SupervisorID	STRING(15)	Foreign key to STAFF.
PostCode	STRING(2)	Foreign key to POST.
DistrictCode	STRING(2)	Foreign key to DISTRICT.
Qualifications	MEMO	
Experience	BYTE	
Basic training?	BOOLEAN	
Attended seminars?	BOOLEAN	
Busy with further study?	BOOLEAN	

STAFF COURSE

StaffID	STRING(15)	Foreign key to STAFF.
CourseID	STRING(2)	Foreign key to COURSE.

1.2.4 Demographical patient data

HOUSEHOLD

Household ID	STRING(15)	Foreign key to PATIENT.
Basic knowledge	BOOLEAN	Basic knowledge regarding hygiene principles
Adequate housing	BOOLEAN	
Adequate water	BOOLEAN	
Adequate sanitation	BOOLEAN	
Adequate sewerage	BOOLEAN	
Adequate refuse removal	BOOLEAN	
Environment clean	BOOLEAN	

PATIENT

Patient ID	STRING(15)	The number that uniquely identifies a patient.
Household ID	STRING(15)	Foreign key to HOUSEHOLD.
Surname	STRING(30)	
Initials	STRING(5)	
First name	STRING(20)	
Date of birth	DATE	
Address	MEMO	
District code	STRING(5)	Foreign key to the district this patient lives in.
Telephone	STRING(20)	
Code of service point	STRING(5)	Foreign key to CLINIC
Relationship to head of household	STRING(20)	E.g. Head, Husband, Grand mother, son, etc.
Sex	STRING(6)	'Male' or 'Female'
Race code	STRING(2)	Foreign key to the race of the patient.
Job	MEMO	
Other info	MEMO	

1.2.5 Clinical patient data

ANTENATAL PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT.
First visit date	DATE	
Gravida	INTEGER	
Para	INTEGER	
Expected date	DATE	
Return date	DATE	

ANTENATAL CONSULTATION

Key	Counter	Counter fields increment automatically
Patient ID	STRING(15)	Foreign key to ANTENATAL PATIENT.
Date	DATE	
ClinicCode	STRING(5)	Foreign key to CLINIC.
NurseID	STRING(15)	Foreign key to STAFF.
PayerID	STRING(15)	Foreign key to PATIENT.
Intervention	MEMO	
Time spent	INTEGER	
Referred	BOOLEAN	
Trimester	INTEGER	
PEM	BOOLEAN	
Anaemia	BOOLEAN	
Syphilis Test	BOOLEAN	
TT Vaccine	BOOLEAN	
STD Treatment	BOOLEAN	

CHILD PATIENT

Child ID	STRING(15)	Foreign key to PATIENT.
Mother ID	STRING(15)	Foreign key to PATIENT.
Return date	DATE	
Birth Supervisor	STRING(15)	Foreign key to STAFF.
Birth place	STRING(1)	Foreign key to BIRTH PLACE.
Birth type	STRING(1)	Foreign key to BIRTH TYPE.
Birth mass	SINGLE	
First Visit date	DATE	

CHILD CONSULTATION

Key	Counter	Counter fields increment automatically
Patient ID	STRING(15)	Foreign key to CHILD PATIENT.
Date	DATE	
ClinicCode	STRING(5)	Foreign key to CLINIC.
NurseID	STRING(15)	Foreign key to STAFF.
PayerID	STRING(15)	Foreign key to PATIENT.
Remarks	MEMO	
Time spent	INTEGER	
Height	INTEGER	
Mass	Single	
PEM	BOOLEAN	
Worm treatment	BOOLEAN	
Breastfeeding	BOOLEAN	
Breast milk sufficient Vit. A	BOOLEAN	
Retarded development	BOOLEAN	
Referred for development	BOOLEAN	
Referred for visual aid	BOOLEAN	
Referred for aural aid.	BOOLEAN	
Referred for other reason	BOOLEAN	
Referred	BOOLEAN	

DEATH

Patient ID	STRING(15)	Foreign key to PATIENT.
Cause Code	STRING(4)	Foreign key to DISEASE.
Date died	DATE	
Nurse ID	STRING(15)	Foreign key to STAFF.

FAMILY PLANNING PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT.
Return date	DATE	

FAMILY PLANNING CONSULTATION

Key	Counter	Counter fields increment automatically
Patient ID	STRING(15)	Foreign key to FAMILY PLANNING PATIENT.
Method code	STRING(3)	Foreign key to FAMILY PLANNING METHOD.
Date	DATE	
ClinicCode	STRING(5)	Foreign key to CLINIC.
NurseID	STRING(15)	Foreign key to STAFF.
PayerID	STRING(15)	Foreign key to PATIENT.
First visit?	BOOLEAN	
Remarks	MEMO	
Time spent	INTEGER	
Referred?	BOOLEAN	
Smear taken?	BOOLEAN	
Smear abnormal?	BOOLEAN	

GENERAL PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT.
Return date	DATE	

GENERAL CONSULTATION

Key	Counter	Counter fields increment automatically
Patient ID	STRING(15)	Foreign key to GENERAL PATIENT.
Programme code	STRING(2)	Foreign key to PROGRAMME.
Diagnosis code	STRING(4)	Foreign key to DISEASE
Date	DATE	
ClinicCode	STRING(5)	Foreign key to CLINIC.
Place	STRING(15)	E.g. 'Home visit', 'Seen at clinic', etc.
NurseID	STRING(15)	Foreign key to STAFF.
PayerID	STRING(15)	Foreign key to PATIENT.
First visit?	BOOLEAN	
Intervention	MEMO	
Time spent	INTEGER	
Below six	BOOLEAN	
Referred dental?	BOOLEAN	
Referred?	BOOLEAN	
TT Vaccine?	BOOLEAN	

GERIATRIC PATIENT

Patient ID	STRING(15)
Date of first visit	DATE
Return date	DATE

GERIATRIC CONSULTATION

Key	Counter	
Patient ID	STRING(15)	Foreign key to GERIATRIC PATIENT.
Date	DATE	Date of visit
Clinic code	STRING(5)	Foreign key to CLINIC.
Place	STRING(15)	E.g. 'Home', 'Clinic', 'Elsewhere'
Nurse ID	STRING(15)	Foreign key to STAFF.
Payer ID	STRING(15)	Foreign key to PATIENT.
Remarks	MEMO	
Time spent	INTEGER	Time spent in interaction with the patient.
Referred	BOOLEAN	

IMMUNISATION

Key	Counter	Counter fields increment automatically
Patient ID	STRING(15)	Foreign key to PATIENT.
Date	DATE	
ImmuCode	STRING(5)	Foreign key to IMMUNISATION TYPES.
ClinicCode	STRING(5)	Foreign key to CLINIC.

POSTNATAL PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT
Delivery date	DATE	
Delivery type	STRING(1)	Foreign key to BIRTH TYPE.
Return date	DATE	
First visit date	DATE	

POSTNATAL CONSULTATION

Key	Counter	
Patient ID	STRING(15)	Foreign key to POSTNATAL PATIENT.
Date	DATE	Date of visit
Clinic code	STRING(5)	Foreign key to CLINIC.
Nurse ID	STRING(15)	Foreign key to STAFF.
Payer ID	STRING(15)	Foreign key to PATIENT.
Remarks	MEMO	
Time spent	INTEGER	Time spent in interaction with the patient.
Referred	BOOLEAN	

PSYCHIATRY PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT.
Diagnosis	STRING(2)	Foreign key to PSYCHIATRY DIAGNOSES.
First visit date	DATE	
Return date	DATE	
Clinic Code	STRING(5)	Foreign key to CLINIC.

PSYCHIATRY CONSULTATION

Key	Counter	
Patient ID	STRING(15)	Foreign key to PSYCHIATRY PATIENT.
Date	DATE	Date of visit
Clinic code	STRING(5)	Foreign key to CLINIC.
Nurse ID	STRING(15)	Foreign key to STAFF.
Payer ID	STRING(15)	Foreign key to PATIENT.
Remarks	MEMO	
Time spent	INTEGER	Time spent in interaction with the patient.
Referred	BOOLEAN	

TB PATIENT

Patient ID	STRING(15)	Foreign key to PATIENT.
Registration date	DATE	
Clinic code	STRING(5)	Foreign key to CLINIC.
SupervisorID	STRING(15)	Foreign key to STAFF.
Disease	STRING(2)	Foreign key to TB DIAGNOSES.
Origin*	STRING(1)	'N', 'D', 'C', 'H' or 'E'
Category*	STRING(2)	'N', 'RC', 'RT', 'RI', or 'RF'
Decision*	STRING(20)	Basis of decision to treat.
Treatment outcome*	STRING(25)	E.g. 'Cured', 'Failure', etc.
Start date	DATE	Date treatment started
Stop date	DATE	Date treatment stopped
Discontinued	BOOLEAN	
Relapsed	BOOLEAN	
Return date	DATE	

* As defined in the Tuberculosis register of the National Tuberculosis Control Programme.

TB CONSULTATION

Key	Counter	
Patient ID	STRING(15)	Foreign key to TB PATIENT.
Date	DATE	Date of visit
Clinic code	STRING(5)	Foreign key to CLINIC.
Nurse ID	STRING(15)	Foreign key to STAFF.
Remarks	MEMO	
Time spent	INTEGER	Time spent in interaction with the patient.
Referred	BOOLEAN	
Sputum date	DATE	
Drugs	STRING(1)	[R]esistant or [S]ensitive
Smear	STRING(1)	[P]ositive or [N]egative
Culture	STRING(1)	[P]ositive or [N]egative

1.2.6 Information regarding venues and visits

SCHOOL

Code	STRING(5)	
Type	STRING(11)	'Pre-primary', 'Primary' or 'Secondary'
Running water?	BOOLEAN	
Adequate accommodation?	BOOLEAN	
Adequate sanitation?	BOOLEAN	
Adequate refuse removal?	BOOLEAN	

SCHOOL FACILITIES

School Code	STRING(5)	Foreign key to SCHOOL.
Facility code	STRING(1)	Foreign key to FACILITY.

SCHOOL HEALTH VISIT

School Code	STRING(5)	Foreign key to SCHOOL.
Date	DATE	
Nurse ID	STRING(15)	Foreign key to STAFF.
Presenter ID	STRING(15)	Foreign key to STAFF.
Remarks	MEMO	
Distance travelled	INTEGER	
Time travelled	INTEGER	
Time spent	INTEGER	
Boys examined	INTEGER	
Girls examined	INTEGER	
Boys screened	INTEGER	
Girls screened	INTEGER	
Boys followed up	INTEGER	
Girls followed up	INTEGER	
Boys treated	INTEGER	
Girls treated	INTEGER	
Boys referred	INTEGER	
Girls referred	INTEGER	

SERVICE POINT

Venue Code	STRING(5)	
Venue Name	STRING(30)	
Type	STRING(8)	E.g. 'Farm', 'In town', 'School'
Clinic Code	STRING(5)	Foreign key to CLINIC.
Adult males	INTEGER	
Adult females	INTEGER	
Teenage males	INTEGER	
Teenage females	INTEGER	
Child males	INTEGER	
Child females	INTEGER	
Percentage within one hour's travelling time from clinic		SINGLE
Percentage 1-2 hours travelling time from clinic		SINGLE

VISIT

Venue Code	STRING(5)	Foreign key to SERVICE POINT.
Date	DATE	
Nurse ID	STRING(15)	Foreign key to STAFF.
Presenter ID	STRING(15)	Foreign key to STAFF.
Programme Code	STRING(2)	Foreign key to PROGRAMME
Remarks	MEMO	
Distance travelled	INTEGER	
Time travelled	INTEGER	
Time spent	INTEGER	
Number attended	INTEGER	

VISIT PROGRAMMES

Venue Code	STRING(5)	Foreign key to SERVICE POINT.
Date	DATE	
Programme Code	STRING(2)	Foreign key to PROGRAMME.

APPENDIX B

DATA CAPTURE FORMS TO BE USED IN CONJUNCTION WITH THE COMPREHENSIVE PATIENT RECORD BASED SYSTEM IN THE ABSENCE OF A COMPUTER

These forms have been designed to fulfil in the statistical needs of the management of Primary Health Care in the Free State. It has been designed according to the minimum data set proposed by Mackenzie [19]. Although these forms could be used in a manual system as well, it has primarily been designed to act as data capturing forms for a computerised system. These forms do not replace the current patient record system. It serves only as a basis for sampling data.

Although it could seem that the nurse's administrative work load has been increased, the advantage lies in the fact that she does not have to process the statistics afterwards. A single person with only a limited amount of computer literacy can be appointed in each district to key in the forms as they are received from the nursing staff.

Single event forms

- The patient record is kept together with the forms of other members of the same household in a file. These files are then grouped according to the service point which can be a farm or rural area. These groups of files are then kept by a **PHC team**.
  - **Part 1** must be completed at the first visit of the patient.
  - **Part 2** must be completed if a person is a head of a household or if the patient is the first member of a household to be registered. In the last case, this person is also registered as the head of household. Every household must have one and only one head of household.
  - **Part 3** must be completed once the necessary details are available.
- The nurse record, must be completed once for every newly appointed nurse and then kept by the supervisor of a district.
- The form on district details should be completed and kept up to date by the district supervisor.

- The form on clinic details should be completed and kept up to date by the clinic supervisor.
- The forms on mobile service points and schools must be completed by and kept up to date by the appropriate clinic supervisor.

Periodical reports

- This form is kept by every employee who is responsible for subordinates. An entry is made on this form for every report received from or submitted on a subordinate. This form must be submitted to the data typist on a quarterly basis.

Daily tallies

- Ante-natal, Child health, Death details., Family planning, General consultations, Geriatric health, Immunisations, Post-natal, Psychiatry, Visits

A complete set of daily tallies must be kept by every nurse. An entry on a tally must be made on all the appropriate tallies with every consultation. At the end of each day the tallies must be handed in at the person responsible for typing into the computer. Every day should be started with a new set of tallies.

The **tuberculosis patient record** is only completed if one of the events on the form occur. For the other TB visits, an entry should made on the **general consultation tally** with diagn.code 27.

PATIENT RECORD

PART 1 : PERSONAL DETAILS

ID Number : _____-_____-____-__

Surname : _____

Initials : ____ First name : _____

Date of birth : ___-___-___ (yy-dd-mm)

Address : _____

Lives in district: _____ Telephone : _____

Lives on farm/area (number) : _____

Household: ID of the head of household : _____-_____-___-__
Relationship to the head of HH : _____

Sex : Male ☐ Female ☐

Race : _____ Job : _____

Other applicable information :

_____

PART 2 : HOUSEHOLD DETAILS

(This section should be completed only if the person is a head of household or if he/she is the first person of a household to be registered.)

Basic knowledge of the hygiene principles relating to water and sanitation : Yes ☐ No ☐

General housing conditions	**√ or ×**
Adequate housing	
Adequate water	
Adequate sanitation	
Adequate sewerage (waste water removal)	
Adequate refuse removal	
Environment is clean and not conducive to nuisances, health risks and vector activities	

PART 3 : BIRTH DETAILS

Mother ID : _____-_____-____-__

ID of delivery supervisor : _____-_____-____-__

Place of birth : ____ (1. Hospital; 2. Clinic; 3. Home; 4. Elsewhere)

Type of birth : ____ (1. Normal; 2. Caesarean; 3. Forceps; 4. Suction)

Mass at birth : _____ g

STAFF DETAILS

ID Number : _____-_____-____-__

Surname : _____

Initials : ____

First name : _____

Lives in district : _____(See list of codes at the opposite side of this form.)

Clinic or PHC Team codes : _____ _____ _____

Supervisor ID : _____-_____-___-__

Codes of authorities accountable to : _____ _____-_____-___ _____-_____-__

Qualifications : _____

_____

Post code : _____ (See list of codes at the opposite side of this form.)

Experience : _____ (Completed years)

Basic training completed : ☐

Attended seminars related to your functions: ☐

Busy with further study : ☐
(After you have finished study, update the 'Qualifications' field and erase this tick.)

Compulsory short in-service training courses completed:

Course	**√ or ×**	**Course**	**√ or ×**
AIDS		Psychiatry	
Assessment course		School health	
Family planning		Sexual transmitted infections	
Master card		TB	
Objective matrix			

Informal qualifications	**√ or ×**
Orientated on PHC concepts and principles Skilled in fitting and making prostheses	
Trained for care of those sexually and physically abused	
Trained in counselling	
Trained in diagnosis and management of conditions seen in PHC	
Trained for detecting substance abuse	
Trained in management and planning	
Trained in rehabilitation of people with visual or aural defects	

Magisterial districts with towns

BETHLEHEM REGION		BLOEMFONTEIN REGION		KROONSTAD REGION		WELKOM REGION	
A010 Bethlehem	Bethlehem	B010 Bethulie	Bethulie	K010 Heilbron	Heilbron	W010 Bothaville	Bothaville
A011	Clarens	B011	Springfontein	K020 Koppies	Koppies	W020 Brandfort	Brandfort
A012	Kestell	B020 Bloemfontn.	Bloemfontn.	K030 Kroonstad	Kroonstad	W021	Soutpan
A020 Ficksburg	Ficksburg	B030 Boshof	Boshof	K031	Edenville	W022	Verkeerdevlei
A030 Fouriesburg	Fouriesburg	B031	Dealesville	K040 Lindley	Lindley	W030 Hennenman	Hennenman
A031	Rosendal	B032	Hertzogville	K041	Arlington	W040 Hoopstad	Hoopstad
A040 Frankfort	Frankfort	B040 Botshabelo	Botshabelo	K042	Petrus Steyn	W050Odendaalsrus	Odendaalsrus
A041	Tweeling	B050 Clocolan	Clocolan	K043	Steynsrus	W051	Allanridge
A042	Villiers	B060 Dewetsdorp	Dewetsdorp	K050 Parys	Parys	W060 Theunissen	Theunissen
A050 Harrismith	Harrismith	B070 Edenburg	Edenburg	K060 Sasolburg	Sasolburg	W070 Ventersburg	Ventersburg
A051	Warden	B080 Excelsior	Excelsior	K061	Deneysville	W080 Virginia	Virginia
A060 Marquard	Marquard	B081	Tweespruit	K062	Oranjevillein	W090 Welkom	Welkom
A070 Reitz	Reitz	B090 Fauresmith	Fauresmith	K070 Viljoenskrn	Viljoenskrn	W100 Winburg	Winburg
A080 Senekal	Senekal	B091	Luckhoff	K080 Vredefort	Vredefort	W101 Wesselsbron	Wesselsbron
A081	Paul Roux	B100 Jacobsdal	Jacobsdal				
A090 Vrede	Vrede	B110 Jagersfontein	Jagersfontein				
A091	Cornelia	B120 Koffiefontein	Koffiefontein				
A092	Memel	B130 Ladybrand	Ladybrand				
		B131	Hobhouse				
		B140 Petrusburg	Petrusburg				
		B150 Philippolis	Philippolis				
		B151	Waterkloof				
		B160 Reddersburg	Reddersburg				
		B170 Rouxville	Rouxville				
		B180 Smithfield	Smithfield				
		B190 Trompsburg	Trompsburg				
		B200 Wepener	Wepener				
		B201	V Stadensrus				
		B211 Zastron	Zastron				

Clinic codes

A list of codes as provided by nursing mangement.

Codes of authorities

Use the code of the town as listed above for municipal authorities.
Further use the codes below for nursing authorities:
N1 : Provincial nursing authority
N2 : National nursing authority

Post codes and names

01. Nursing service managers
02. Chief professional nurse
03. Senior professional nurse
04. Professional nurse
05. Senior enrolled nurse
06. Enrolled nurse
07. Senior auxiliary nurse
08. Auxiliary nurse
09. General assistant
10. Other nursing staff
11. Senior community liaison officer
12. Community liaison officer
13. Senior specialised auxiliary service officer
14. Specialised auxiliary service officer
15. Pharmacist

STAFF REPORTS : Part A

Supervisor ID : _____

Reports received from employee

01.	Claims		08.	Nutrition	(Monthly)
02.	Community profile	(Yearly)	09.	Orders	
03.	Grievance	(ad hoc)	10.	Polio campaign	(ad hoc)
04.	Immunisation	(Monthly)	11.	Quarterly report	(Quarterly)
05.	Logs		12.	SOI	(Quarterly)
06.	Measles		13.	TB statistics	(Quarterly)
07.	Neo-natal tetanus				

Date received (yy-mm-dd)	Employee ID	Type of report	In time? (√ or ×)	Up to standard? (√ or ×)

STAFF REPORTS : Part B

Supervisor ID : _____

Reports on employee handed in by supervisor or contacts with employee

21. Nomination for merit award
22. Recommendation for rank promotion
23. Disciplinary action
24. Contact

Date handed in (yy-mm-dd)	Employee ID	Type of report

DISTRICT DETAILS

This form must be updated and submitted quarterly by the district supervisor.

District details as on : ___-___-___ (yy-mm-dd)
District code : _____
District name : _____
Geographical size : _____
Population : _____

General details	**√ or ×**
Annual budget	
Community based rehabilitation	
Criteria for allocation of resources applied	
Implementing new TB strategy	
Integrated health plan in place	
Organised system of continuing education	
Regular team meetings of health staff	
Strategic plan at disposal	

Number of posts

Code	**Category**	**Number of approved posts**	
		Local authorities	**Article 30**
01	Nursing service managers		
02	Chief professional nurses		
03	Senior professional nurses		
04	Professional nurses		
05	Senior enrolled nurses		
06	Enrolled nurses		
07	Senior auxiliary nurses		
08	Auxiliary nurses		
09	General assistants		
10	Other nursing staff		
11	Senior community liaison officer		
12	Community liaison officer		
13	Senior specialised aux. service officer		
14	Specialised aux. service officer		
15	Pharmacist		

Estimated number of other health workers

Category	**Number**
Community based health promoters	
Doctors	
Mental health professionals, incl. psychiatrists, mental health nurses, social workers, psychologists	
Midwives	
Nurses not included above	

CLINIC DETAILS

District code : _____

Clinic code : _____

Clinic name : _____

Services : _____

Friendliness : _____

Target population

Rural/Peri-urban/Urban : _____
Mapped : _____ (Yes/No)
Estimated population : _____ x 1000

Percentage of population within one hour (5 km) travelling of the clinic: _____
Percentage of population between one and two hours (10 km) travelling of the clinic: _____

Accommodation

Clinic type : _____ (Fixed clinic or Satellite)
Condition : _____ (Good/Acceptable/Poor)
Improvement requested : _____ (yy-mm-dd)

Vehicle

Type : _____ (Sedan/Mobile clinic/Pod)
Condition : _____ (Good/Acceptable/Poor)

Possible services at community health centres

01. CC : Community committee
02. ED : Provide essential drugs
03. FRM : Fertility regulation service for men
04. FRW : Fertility regulation service for women
05. GHS : Health services for persons 55+. (Geriatric services)
06. OMC : 24 Hours essential obstetric medical care.
07. MHS : Mental health services
08. RCHS : Minimum package of recommended comprehensive health services.
09. RFP : Reproductive and family planning services incl. screening for cervical cancer.
10. RSP : Referral system for those sexually or physically abused
11. RPA : Rehabilitation service for physically disabled
12. SDD : Screening service to detect disabilities
13. STD : Screen, diagnose, treat, counsel and provide partner notification service for HIV infection and STD.
14. TDH : Screen and treat people with diabetes and hypertension
15. TPM : 24 Hour availability of transport for referral of pregnant mothers
16. YS : Youth services

Judgement of clinic friendliness

21. AYF : Adolescent and youth friendly
22. BF : Baby friendly
23. MBF : Mother and baby friendly

MOBILE SERVICE POINTS

Clinic (or PHC Team) code : ____________________________

Stopping points

Code	Name	Target population	Code	Name	Target population

SCHOOLS

Clinic (or PHC Team) code : _____

Codes of programmes and services that schools may offer

1. School health programme
2. Life skill education programme
3. Dispose of trained peer educator
4. Prevention of tobacco use
5. STD/HIV education curricula

(Acc: Accommodation; RW: Running water; S: Sanitation; RR: Refuse removal)

School details		Programmes/services	Adequate facilities?			
Code	Name	(See list of codes)	Acc.	RW	S	RR

ANTE-NATAL FORM

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Note: If a Syphilis test was done, an entry must be made on the form for general consultations.

Patient details			Visit details		Gr.	Par	PEM (√ or ×)	Anaemia (√ or ×)	Iron (√ or ×)	Sylph. test (+/-)	TT (√ or ×)	Time spent	Referred (√ or ×)	Return (yy-mm-dd)
Number	Name	Payer ID	1st/FU	Trim										

Notes on Ante-natal form

Patient number
- Must be completed at every visit.

Patient name
- Must be completed at every visit.
- Need not be completed in detail as it would only be used to confirm that the number was taken down correctly.

Visit details
- Indication of whether it is a first (1st) or follow-up (FU) visit.
- Add 'H' if it is a home visit, e.g. 1stH or FUH.

Trimester : 1, 2 or 3 should be completed at every visit.

PEM : Indicate whether supplementary feeding was given.

Gravida and **Para** should only be completed at the first visit.

Anaemia and **Adequate iron supplies** should be completed at every visit (√ or ×).

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit.

CHILD HEALTH FORM

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Visit	H	M	PEM	Tr. worms	Breast feeding		Remarks	Time	Referred	Return
Number	Name	Payer ID	(1st or FU)	(cm)	(g)	√ or ×	(√ or ×)	(√ or ×)	Vit. A		spent	(√ or ×)	(yy-mm-dd)

Notes on child health form

Patient number
- Must be completed at every visit.

Patient name
- Must be completed at every visit.
- Need not be completed in detail as it would only be used to confirm that the number was taken down correctly.

Payer ID
- Should be completed at every visit if applicable.

Visit
- Indication of whether it is a first (1st) or follow-up (FU) visit.

Height and **mass** should be completed at every visit.

PEM : Indicate whether supplementary feeding was given.

Treated for worms : Indicate if special treatment was given

Breast feeding must be completed at every visit (√ or ×) together with an indication of whether the milk has a sufficient vitamin A content (√ or ×).

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit if applicable.

DEATH DETAILS

Date of death (yy-mm-dd)	Personal details		Cause of death (See list of codes)	Nurse ID
	Number	Name		

Notes on death form

Person's number
(To be completed for every entry.)

Person's name
(To be completed for every entry.)
This name need not be in detail. It only serves as a confirmation that the number was taken down correctly.

Cause of death
The code of the appropriate disease or case must be filled in here. If the cause is not listed, it should be specified in full.

FAMILY PLANNING

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Visit	Consultation details			Remarks	Time	Referred	Return
Number	Name	Payer ID	(1st or FU)	Method	Substance	Service		spent	(√ or ×)	(yy-mm-dd)

Notes on family planning form

Patient number must be completed at every visit.

Patient name must be completed at every visit. It need not be completed in detail as it would only be used to confirm that the number was taken down correctly.

Payer ID should be completed at every entry if applicable.

Visit : Indication of whether it is a first (1st) or follow-up (FU) visit.

Method is one of the following:

01. Post coital	03. Condoms	05. Injection
02. Vaginal	04. Oral	06. IUD inserted

Substance is one of the following:

01. Biphasil	04. Dalcept Short	07. Microval	10. Ovral
02. Condoms	05. Dalcept 375	08. Nordette	11. Petogen
03. Coppe T380	06. Depo Provera	09. Nur-Isterate	12. Trivasil

Service is one of the following:

01. Sterilisation post partum	02. Sterilisation interval	03. Sterilization male

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit if applicable.

GENERAL CONSULTATIONS

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Diagnosis (Use codes)	Intervention or other information	Time spent	Referred (√ or ×)	Return (yy-mm-dd)
Number	Name	Payer ID					

DIAGNOSTIC AND OTHER CODES

List of notifiable diseases by virtue of legislation

01. Acute flaccid paralysis
02. Acute rheumatic fever
03. Anthrax
04. Bruceliosis
05. Cholera
06. Congenital syphilis
07. Diphteria
08. Food poisoning
09. Haemophilus influenza
10. Haemorrhagic fevers of Africa
    101. Congo fever
    102. Dengue fever
    103. Ebola fever
    104. Lassa fever
    105. Marburg fever
    106. Rift Valley fever
11. Lead poisoning
12. Legionellosis
13. Leprosy
14. Malaria
15. Measles (rubeola)
16. Meningococcal infections
17. Paratyphoid fever
18. Pertussis
19. Plague
20. Poisoning from agricultural or stock remedy
21. Poliomyelitis
221. Rabies: Human case
222. Rabies: Human contact
23. Smallpox and any smallpox-like disease, excluding chicken pox
24. Tetanus
25. Tetanus neonatorum
26. Trachoma
27. Tuberculosis
28. Typhoid fever
291. Typhus fever:
    - Epidemic louse-borne
292. Typhus fever:
    - Endemic flea-borne
301. Virushepatitis A
302. Virushepatitis B
303. Virushepatitis Non-A
304. Virushepatitis Non-B
305. Virushepatitis:
    - Undifferentiated
31. Yellow fever

Other diseases and cases that must be recorded

41. Abortion rel. complications
421. Abuse: Child
422. Abuse: Female
43. Accidents
441. Alcohol: Moderate usage
442. Alcohol: Abuse
443. Motor vehicle injury related to alcohol
45. AIDS (Show symptoms)
46. Anaemia
47. Aural defect
471. Has hearing aids
48. Carcinoma of the cervix
49. Clinical depression
50. Congenital disorders
511. Counselling: Psychological
512. Counselling: Social
52. Diabetes
521. Severe complications
- Education : +E
53. Diarrhoea
54. Drugs used/abuse
55. Environmental health related disease
56. Fertility info/service
57. Gastro-enteritis
- CM informed : +I
- CM can appl. ORT: +O
58. Genetic disorders
59. Homicide
60. HIV test
- Positive : +P
- Negative : +N
61. Hypertension
62. Iodine deficiency
631. Injuries: Intentional
632. Injuries: Non-intentional
Maternal mortality
641. - Related to pregnancy
642. - Related to childbirth
643. - Related to puerparium
65. Mental disorder
66. Minor illnesses
671. Nutrition: Malnutrition
672. Nutrition: Under nutrition
- Suppl. feeding given : +S
68. Other (specify)
69. PAP Smear
- Smear taken : +S
- Test positive : +P
- Test negative : +N
- Treatment : +T
70. Poisoning (not incl. 11/20)
71. Rape
72. Respiratory problems
73. Routine examination
74. Schistosomiases
- Prophylactic treated : +P
- Infected : +I
Sexually active:
750. - No contraception
751. - Use condoms
752. - Use contraceptives
Sexually transmitted disease
761. Urethral discharge
762. Vaginal discharge
763. Genital ulcer
764. Pelvic inflammation
765. Inguinal swelling
766. Itching glans/foreskin
767. Scrotal swelling
768. Other
77. Smoking tobacco
78. Syphilis test
- Positive : +P
- Negative : +N
79. Suicide, incl. attempt
80. Trauma
81. Visual defect
811. Sign language abled
82. Vitamin A deficiency
821. Low serum
822. Sub-clinical

GERIATRIC HEALTH

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Visit	Service	Remarks	Time spent	Referred (√ or ×)	Return (yy-mm-dd)
Number	Name	Payer ID						

Notes on geriatric health form

Patient number must be completed at every visit.

Patient name must be completed at every visit. It need not be completed in detail as it would only be used to confirm that the number was taken down correctly.

Payer ID should be completed at every visit if applicable.

Visit : Indication of whether it is a first (1st) or follow-up (FU) visit.
Add 'H' if it is a home visit, e.g. 1stH or FUH.

Service is one of the following:
01. Screening for hypertension
02. Screening for diabetes
03. Other (specify)

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit if applicable.

IMMUNISATIONS

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Type of immunisation	Remarks	Time spent	Referred (√ or ×)	Return (yy-mm-dd)
Number	Name	Payer ID					

Notes on immunisations form

Patient number must be completed at every visit.

Patient name must be completed at every visit.
This name does not need to be in detail. It only serves as a confirmation that the number was taken down correctly.

Payer ID should be completed at every visit if applicable.

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit if applicable.

Type of immunisation

BCG
DPT : Diphteria, pertussis and tetanus vaccine
DT
HBV : Hepatitis B vaccine
HiB : HibTiter
MMR : Measles, Mumps, Rubella
MSL : Measles vaccine
Rubella
TOPV : Trivalent oral polio vaccine
TT : Tetanus

Recommended childhood vaccination schedule

Birth : TOPV0, BCG
6 weeks : TOPV1, DPT1, HBV1
10 weeks : TOPV2, DPT2, HBV2
14 weeks : TOPV3, DPT3, HBV3
9 months : MSL1
18 months : TOPV4, DPT4, MSL2
5 years : TOPV5, DT

POST-NATAL

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Please not that normally an entry should be made on the child health tally together with an entry here.

Patient details			Visit details		PEM	Remarks	Time	Referred	Return
Number	Name	Payer ID	(1st/FU)	Period	(√ or ×)		spent	(√ or ×)	(yy-mm-dd)

Notes on post-natal form

Patient number
- Must be completed at every visit.

Patient name
- Must be completed at every visit.
- Need not be completed in detail as it would only be used to confirm that the number was taken down correctly.

Payer ID
- Should be completed at every visit if applicable.

Visit details
- Indication of whether it is a first (1st) or follow-up (FU) visit.
- Add 'H' if it is a home visit, e.g. 1stH or FUH.

Period is one of <7, 7-28 or >28 (weeks) and should be completed at every visit.

PEM : Indicate whether supplementary feeding was given.

Gravida and **Para** should only be completed at the first visit.

Anaemia and **Adequate iron supplies** should be completed at every visit (√ or ×).

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

The **return date** must be completed at every visit if applicable.

PSYCHIATRY

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details			Diagnosis code	Visit	Remarks	Time	Referred	Return
Number	Name	Payer ID		(1st or FU)		spent	(√ or ×)	(yy-mm-dd)

Notes on psychiatry form

Patient number must be completed at every visit.

Patient name must be completed at every visit.
This name does not need to be in detail. It only serves as a confirmation that the number was taken down correctly.

Payer ID should be completed at every visit if applicable.

Diagnosis should be completed at the first visit of a patient only.

Visit must be completed at every visit.
- Indicates whether it is a first (1st) or follow-up (FU) visit.

Remarks
Any applicable information.
If a person should be registered as a defaulter, it should be indicated in this column.

Time spent is in minutes.

If the patient was **referred** it should be indicated (√ or ×).

Return date must be completed at every visit if applicable. It indicates the date at which a patient should report again.

VISITS

Nurse ID : _____-_____-___-__
Nurse name : _____
Clinic code : _____
Date : ___-___-___ (yy-mm-dd)

Farm/area/school		Dist. tra-	Time (minutes)		Programme	Purpose/	Number		Presenter
Number	Name	velled (km)	Travelled	Spent		Subject	att.	ref.	ID

Notes on visits form

Farm/area/school name
Need not be in detail as it is only used to confirm that the number was taken down correctly. If it is the first visit to a specific venue, form D should be completed as well.

Programmes

01. Family planning
02. Health education
03. Nutritional information
04. PHC

PATIENT RECORD : TUBERCULOSIS

Clinic or team name : _____

Date : ___-___-___ (yy-mm-dd)

Nurse ID : _____

Patient details		Case details				Sputum results				Treatment outcome	Remarks
Number	Name	Origin	Categ.	Decision	Code	W	S	C	R		

Notes on Tuberculosis form

Patient number and **Patient name** should be completed when a patient is registered for the first time. The patient name does not need not to be in detail. It only serves as a confirmation that the number was written correctly.

The next four columns should be completed when the patient is registered for the first time.

Patient origin

N : Not transferred in, treatment started at this clinic.
D : Transferred from a TB clinic in a different magisterial district.
C : Transferred from a different TB clinic within the same magisterial district.
H : Transferred from a hospital where TB treatment was started.
E : Transferred from elsewhere.

Patient category

N : A patient who has never been treated for TB or who has been treated for TB < 2 weeks.
RC : A patient who was previously treated for TB and declared cured as demonstrated by negative bacteriology at 2 or 6 months.
RT : A patient who was previously treated for TB and who completed a full course treatment, but for whom no bacteriology results were available.
RI : A patient who was previously treated for TB and who interrupted treatment for 2 months or longer over the total 6 months period (previously called 'defaulter').
RF : A patient who was previously treated for TB and who's sputum was still bacteriologically positive at 6 months (RF1), after 12 months (RF2), 18 months (RF3), etc.

Decision - Basis of decision to treat patient.

B : Bacteriology	T : Tuberculin skin test	X : X-ray
C : Clinical findings	H : History of contact	O : Other

Code - International code for disease

10. Primary	13. Meninges	16. Genito-urinary
11. Pulmonary	14. Intestines, Peritoneum	17. Other organs
12. Other resp. organs	15. Bones, Joints	18. Miliary

Sputum results (To be filled in on the date that the sputum results are available)

When : 0 : Pre-treatment; 2 : End of 2nd month; 6 : End of 6th month treatment
Smear : P : Positive; N : Negative
Culture : P : Positive; N : Negative
Drug **R**esistance : R : Resistant; S : Sensitive

Treatment outcome (To be filled in on the date one of the following events occur.)

Cured : A patient who has completed six months of TB treatment and who has a negative sputum smear or culture at 2 or 6 months.
Treatment com**P**leted : A patient who has completed 6 months of TB treatment and has responded well clinically but no sputum investigations were done at 2 and 6 months.
Treatment **F**ailure : A patient who has completed 6 months of TB treatment and who is still sputum smear or culture positive at the end of 6 months.

Treatment **I**nterrupted	: A patient who has not collected drugs for 2 months or longer over the 6 months treatment period.
Transferred **O**ut	: A patient who has moved to another clinic hospital or district.
Not Tuberculosis	: A patient who has been initially diagnosed as having TB and who has commenced treatment but was later found not to suffer from TB.
Died **TB** or **D**ied **O**ther	: Patient died from TB, (DTB) or other cause (DO).

Remarks : Drug resistance, e.g. RHR or SAD, amongst other applicable information.

APPENDIX C

DESIGN OF A LIMITED PATIENT-RECORD BASED COMPUTER SYSTEM

The limited patient-record computer system that was developed as part of this study is discussed in chapter 6. Following is the high level, conceptual model of the system in the form of an entity relationship diagram and a logical model in the form of a set of tables in third normal form, the relational model.

1. ENTITY RELATIONSHIP DIAGRAM

The standard notation for an entity relationship diagram has been simplified in order to make it more readable. The diamonds for relationships has been replaced by numbers that are annotated separately. Cardinality ratios are indicated with an arrow head on the many-side. Attributes have been omitted in order to avoid cluttering.

The ER-diagram is on page 143.

Following are the relationships. The entity type on the many-side of the one-many-relationships is mentioned first.

1 : PATIENT is part of HOUSEHOLD

2 : PATIENT dies

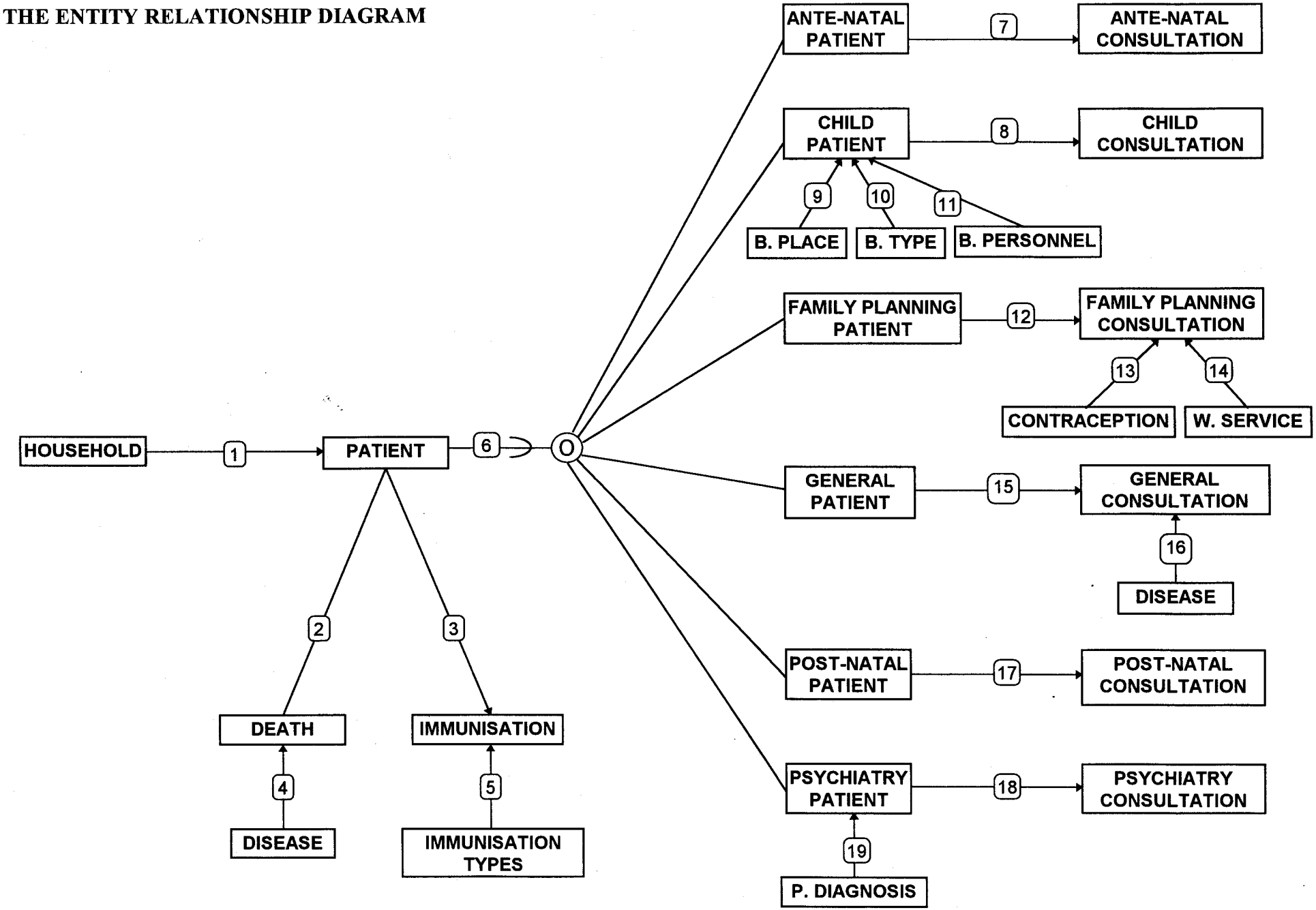
3 : IMMUNISATION done on PATIENT

4 : DEATH is caused by DISEASE

5 : IMMUNISATION is of type IMMUNISATION TYPE

6 : Each of the entity types to the right of the ⓞ symbol is a specialisation of PATIENT and thus constitutes a set of sub-classes. The ⓞ symbol indicates that the subclasses are overlapping, i.e. the same patient can be a member of more than one of the subclasses.

THE ENTITY RELATIONSHIP DIAGRAM



7 : ANTE-NATAL CONSULTATION done with ANTE-NATAL PATIENT
8 : CHILD CONSULTATION done with CHILD PATIENT
9 : CHILD PATIENT born at BIRTH PLACE
10 : CHILD PATIENT born BIRTH TYPE
11 : CHILD PATIENT birth supervised by BIRTH PERSONNEL
12 : FAMILY PLANNING CONSULTATION done with FAMILY PLANNING PATIENT
13 : FAMILY PLANNING CONSULTATION done with CONTRACEPTION
14 : FAMILY PLANNING CONSULTATION includes WOMEN SERVICE
15 : GENERAL CONSULTATION done with GENERAL PATIENT
16 : GENERAL CONSULTATION on diagnosis DISEASE
17 : POST-NATAL CONSULTATION done with POST-NATAL PATIENT
18 : PSYCHIATRY CONSULTATION done with PSYCHIATRY PATIENT
19 : PSYCHIATRY PATIENT diagnosed with PSYCHIATRY DIAGNOSIS

2. THE RELATIONAL MODEL

The ER-diagram above has been mapped into a relational model. The attributes are listed together with the data-types and some comments.

2.1 Definition tables

The first set of tables holds data that is not normally accessible to a service provider. Nursing management enter the appropriate values and then it is referred to by means of a foreign key in other tables. It is made available by means of pick lists to the service providers while entering data into other tables.

BIRTH PERSONNEL

PersonnelCode	String(1)	
Description	Memo	Indicates the category of medical official who was responsible at the birth.

BIRTH PLACE

PlaceCode	String(1)	
Place	String(10)	E.g. "Hospital", Clinic", Home" or "Elsewhere"

BIRTH TYPE

TypeCode	String(1)	
Type	String(10)	E.g. "Normal", "Forceps", Caesarean" or "Still"

CONTRACEPTIONS

MethodCode	String(2)	
Method	String(20)	e.g. "Oral", "Vaginal", "Depo", etc.

DISEASE CATEGORY

CategoryCode	String(1)	
Description	Memo	

DISEASE

Code	Byte	
DiseaseName	String(255)	A memo field could be used, but then it would not have been possible to sort on the field.
CategoryCode	String(1)	Foreign key to DISEASE CATEGORY

IMMUNISATION TYPES

ImmuCode	String(5)	E.g. "DPT1"
ImmuDescription	String(40)	E.g. "Diphteria, pertussis & tetanus"
Weeks	Integer	Indicate the age of the child when he should get this vaccine in weeks
Compulsory	Yes/No	

PSYCHIATRY DIAGNOSES

Code	String(2)	
Description	String(20)	E.g. "Anxiety complex", "Schizophrenia", etc.

WOMEN SERVICE

ServiceCode	String(2)	
Service	String(20)	E.g. "Abortion", "Cervical screening", etc.

2.2 Demographical patient data

HOUSEHOLD

Key	Long Integer	This value is the same of the key of the head of household.
Address	Memo	

PATIENT

Key	Long Integer	The number that uniquely identifies the patient. The system generates this number automatically and then display on the screen because the user must know it to register a patient to the correct household.
ID	Text	The patient's ID - optional
HouseholdKey	Long Integer	Refers to the key of the head of household.
Surname	String(30)	
Initials	String(5)	
FirstName	String(20)	
DateOfBirth	String(8)	All dates in the system is according to the short date format set in the Windows environment, e.g. yy/mm/dd.
Sex	String(6)	Takes either "Male" or "Female"
Race	Text(10)	Takes either "Asian", "Black", "Coloured", "White" or "Other"
OtherInfo	Memo	Any other demographic or chronic clinical information of the patient.

2.3 Clinical patient data

These tables are in sets of two. The first table identifies the patient and stores some chronic information. The second table stores data for every visit.

ANTENATAL PATIENT

Key	Long Integer	Foreign key to PATIENT
Gravida	Byte	To make provision for more than one pregnancy
Expected Date	String(8)	
FirstVisitDate	String(8)	
TT1	String(8)	Date of the first Tetanus vaccine
TT2	String(8)	
TT3	String(8)	

ANTENATAL CONSULTATION

Key	Long Integer	The first two attributes together are a foreign
Gravida	Byte	key to ANTENATAL PATIENT.
Date	String(8)	Date of ante-natal visit
Intervention	Memo	
Referred	Yes/No	
Anaemia	Yes/No	
TT	Yes/No	Indicate whether any other Tetanus vaccine apart from the obligatory three was given.

CHILD PATIENT

Key	Long Integer	Foreign key to PATIENT
MotherKey	Long Integer	Foreign key to PATIENT, indicating the mother of the child.
BirthPersCode	String(1)	Foreign key to BIRTH PERSONNEL
BirthPlaceCode	String(1)	Foreign key to BIRTH PLACE
BirthTypeCode	String(1)	Foreign key to BIRTH TYPE
BirthMass	Single	
DateUndernutr	String(8)	Date on which child was first diagnosed for under nutrition
FirstVisitDate	String(8)	
ImmuComplDate	String(8)	Date on which immunisation programme was completed

CHILD CONSULTATION

Key	Long Integer	Foreign key to CHILD PATIENT
Date	String(8)	Date of visit
Intervention	Memo	
Mass	Single	
Referred	Yes/No	Indicates whether child was referred to physician or hospital.

DEATH

Key	Long Integer	Refers to the key field in PATIENT.
DiseaseCode	Byte	Refers to the key field in DISEASE.
DateDied	String(8)	
Remarks	Memo	Any other applicable information.

FAMILY PLANNING PATIENT

Key	Long Integer	Foreign key to PATIENT

FAMILY PLANNING CONSULTATION

Key	Long Integer	Foreign key to FAMILY PLANNING PATIENT
Date	String(8)	Date of visit
ContraceptionCode	String(2)	Foreign key to CONTRACEPTIONS
ServiceCode	String(2)	Foreign key to WOMENSERVICE
Intervention	Memo	
Referred	Yes/No	

GENERAL PATIENT

Key	Long Integer	Refers to the key field in PATIENT.

GENERAL CONSULTATION

Key	Long Integer	Foreign key to PATIENT
Date	String(8)	
DiseaseCode	Byte	Foreign key to DISEASE
Intervention	Memo	
Referred	Yes/No	
TTVaccine	Yes/No	

IMMUNISATION

Key	Long Integer	Foreign key to PATIENT
ImmuCode	String(5)	Foreign key to IMMUNISATION TYPES
Date		

POSTNATAL PATIENT

Key	Long Integer	Foreign key to PATIENT
DeliveryDate	String(8)	Date of delivery
FirstVisitDate	String(8)	Date of first visit

POSTNATAL CONSULTATION

Key	Long Integer	Foreign key to POSTNATAL PATIENT
Date	String(8)	Date of visit
Intervention	Memo	
Referred	Yes/No	

PSYCHIATRY PATIENT

Key	Long Integer	Foreign key to PATIENT
DiagnosisCode	String(2)	Foreign key to PSYCHIATRY DIAGNOSES

PSYCHIATRY CONSULTATION

Key	Long Integer	Foreign key to PSYCHIATRY PATIENT
Date	String(8)	Date of visit
Intervention	Memo	
Referred	Yes/No	

APPENDIX D

DESIGN OF A COMPUTERISED TALLY SYSTEM

The computerised tally system that was developed as part of this study is discussed in chapter 7.

Only one table with a large number of data fields is used. The following three fields constitute the primary key of the table:

Clinic Name	STRING(30)
Race	STRING(8)
Date	DATE

Only data-fields for ante-natal visits, births and post-natal visits have been implemented in the prototype. It was enough to illustrate the principle.

The following fields are all of INTEGER type. Whenever a checkbox on the user-interface is clicked, the appropriate data-field in the table is incremented.

Field name	Category	Description
AN1	Ante-natal	First visit before 20 weeks
AN2		First visit after 20 weeks
AN3		Follow-up visits
AN4		Referrals
AN5		Women with HB>10
AN6		First TT vaccination
AN7		Second TT vaccination
AN8		Third TT vaccination
AN9		Other TT vaccination
AN10		Previous TT vaccination
B1	Birth	Delivered by medical personnel
B2		Delivered by traditional midwife
B3		Delivered by unskilled person
B4		Delivered at hospital or clinic
B5		Delivered outside health facility
B6		Delivered at this clinic
B7		Still births
B8		Live births
B9		Mass less than 1.5 kg
B10		Mass 1.5 - 2.5 kg
B11		Mass more than 2.5 kg
B12		Mass unknown
B13		Mother's age 10-14
B14		Mother's age 15-19
B15		Mother's age 20-34
B16		Mother's age 35-49
B17		Mother's age 50+
B18		Mother's age unknown
PN1	Post-natal	First visit before 7 days
PN2		First visit 7-28 days
PN3		First visit after 28 days
PN4		Follow-up visit

PERSONAL DETAILS

Date of Birth

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Population group

- O Black
- O Coloured
- O Asian
- O White
- O Unknown

Gender

- O Male
- O Female

ANTE-NATAL CARE

- O First visit at or before 20 weeks
- O First visit after 20 weeks
- O Follow-up visits
- O Referrals
- O Woman with HB < 10

POST-NATAL CARE

- O First visit before 10 weeks

CHILD HEALTH (under 5)

- O First visit
- O Follow-up visit
- O Referred

BIRTHS

- O Delivered by medical/nursing personnel
- O Delivered by traditional birth attendant
- O Delivered by other unskilled person
- O Delivered at hospital/clinic
- O Delivered outside health facility
- O Delivered at this clinic

Age group

- O Under 15
- O 15-19
- O 20+
- O Unknown

Mass

- O < 1.5 kg
- O 1.5 - 2.5 kg
- O > 2.5 kg
- O Unknown

OStill birth

IMMUNISATIONS (CHILDREN)

BCG

- O Birth
- O Other
- O All doses > 1 year

MEASLES

- O First
- O Other
- O All doses > 1 year

DTP

- O First
- O Second
- O Third
- O All doses > 1 year

HBV

- O First
- O Second
- O Third
- O All doses > 1 year

TOPV

- O Birth
- O First
- O Second
- O Third
- O All doses > 1 year

IMMUNISATION COMPLETED

- O Immunisation completed < 1 year
- O Immunisation completed < 5 year

UNDER NUTRITION

Mass

- O > 3 < 50 without oedema
- O > 3 < 50 with oedema
- O > 60% EWA < 3% without oedema
- O > 60% EWA < 3% with oedema
- O < 60% EWA without oedema
- O < 60% EWA with oedema

Food prescribed

- O First diagnosis of clinical under nutrition Food prescribed
- O First diagnosis of clinical under nutrition No food prescribed

IMMUNISATION (PREGNANT WOMAN)

- O First
- O Second
- O Third
- O Other
- O Previously immunised

FAMILY PLANNING

Client

- O Female first visit for year
- O Female follow-up visit
- O Visitor

Contraception

- O Post coital
- O Barrier
- O Oral
- O Injection

Services

- O IUD inserted
- O Abortion
- O Cervical screening

COMMUNITY PSYCHIATRY SERVICES

- O First visit (Newly diagnosed by psychiatrist)
- O Follow-up visit
- O Defaulter

SEXUALLY TRANSMITTED DISEASES

Syphilis test	
Pos.	Neg.
O	O

HIV test	
Pos.	Neg.
O	O

- O Urethral discharge
- O Vagiunal discharge
- O Genital ulcer
- O Pelvis inflammatory disease
- O Inguinal swelling
- O Itching glands/foreskin
- O Scrotal swelling
- O Other STD

DISEASES OR CAUSES OF DEATH

Date of birth

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Disease or cause of death

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

SUMMARY

This study is undertaken in the light of the current importance of the Reconstruction and Development Programme (RDP) and the SA government's commitment to better primary health care (PHC) for everybody. Primary health care services in South Africa should be rendered as effective and complete as possible with the manpower available. The government should therefore have exact knowledge about the current health situation in the country in order to make pro-active provision for better health services in the areas that need it most. Nursing management should thus have access to periodical reports regarding the incidence of epidemics, certain notifiable diseases, the death rate, general housing conditions and much more. It is therefore of the utmost importance that the service providers should capture and process statistical data accurately.

This study firstly analyses the current situation with regard to data capturing, processing, presentation and utilisation. The analysis refers to the manual system of patient carried records, tally sheets as well as the available infrastructure.

Nursing management in the Free State has a long term vision to implement a database system to service all fixed and mobile clinics. A complete patient record will be kept by the system and the complete clinical history of a patient will be available at each consultation. With such a system all the regular and ad hoc reports can be processed easily and accurately.

This study focuses on the process of computerising primary health care services. Some theoretical background on systems analysis and development are provided and thereafter three alternative approaches towards computerisation are proposed and investigated. For each of these proposals a prototype system was developed.

The first prototype is based on a patient record approach and includes a complete set of health indicators as well as other demographic and clinical data. The second prototype is based on a minimum data set that leads to more user-friendly system. Thirdly a prototype system that is

not based on a patient record but on head-count-approach was developed. This system resembles the current manual system of tally sheets.

The three alternatives are compared with regard to the issues of practicality, flexibility, ease of use, accuracy and completeness of statistical reports and efficiency of time utilisation. It is concluded that the flexibility of a patient-record approach, although more time-consuming, is preferred to a head-count approach. Furthermore, the ease of use of the second alternative in a developing country with mostly computer illiterate nurses makes it a much more feasible approach than a more comprehensive system.

Ways in which a computerised system can be implemented in an environment with limited hardware resources are also investigated.

The study concludes with a proposed model for the computerisation of primary health care in the Free State.

OPSOMMING

Die studie is onderneem in die lig van die huidige belangrikheid van die Heropbou en Ontwikkelingsprogram (HOP) en die SA regering se verbintenis tot beter primêre gesondheidsorg (PGS) vir almal. PGS-dienste moet so effektief en volledig moontlik gedoen word met die beskikbare mannekrag. Die regering behoort insae te hê omtrent die huidige gesondheidsituasie in die land om dienooreenkomstig pro-aktiewe voorsiening te maak vir beter gesondheidsdienste in dié gebiede wat dit die nodigste het. Verpleegdiensbestuur behoort dus toegang te hê tot periodieke verslae aangaande die voorkoms van epidemies, sekere aanmeldbare siektes, die tempo van sterftes, algemene behuisingstoestande en baie meer. Dit is daarom uiters belangrik dat diensverskaffers statistiese data akkuraat moet versamel en verwerk.

Die huidige situasie met betrekking to dataversameling, verwerking, voorlegging en benutting word eerstens ontleed. Die studie verwys na die handstelsel van pasiëntkaarte, merkkaarte sowel as die beskikbare infrastruktuur.

Verpleegdiensbestuur in die Vrystaat het 'n langtermyn visie om 'n databasisstelsel te implementeer om in alle vaste en mobiele klinieke toeganklik te wees. 'n Volledige pasiëntrekord sal deur die stelsel gehou word en die volledige kliniese geskiedenis van elke pasiënt sal by elke konsultasie beskikbaar wees. Met so 'n stelsel kan alle gereelde en ad hoc verslae maklik en akkuraat gegenereer word.

Die studie fokus op die proses van rekenarisering van primêre gesondheidsdienste. Teoretiese agtergrond met betrekking tot stelselontleding en ontwikkeling word verskaf en dan word drie alternatiewe benaderings tot rekenarisering voorgestel en ondersoek. Vir elkeen van die benaderings is 'n prototipe stelsel ontwikkel.

Die eerste prototipe is gebaseer op 'n pasiëntrekord benadering en sluit 'n volledige stel gesondheidsindikatore sowel as ander kliniese en demografiese data in. Die tweede prototipe is gebaseer is op 'n minimum datastel wat lei tot 'n meer gebruikersvriendelike stelsel. Derdens is

is 'n prototipe stelsel ontwikkel wat nie op pasiëntrekords gebaseer is nie, maar op 'n kop-telling-benadering sodat dit eintlik 'n gerekenariseerde merkkaart is.

Die drie alternatiewe word m.b.t. aspekte soos praktiese uitvoerbaarheid, buigsaamheid, akkuraatheid, volledigheid van statistiese verslae en effektiewe tydsbenutting vergelyk. Daar word tot die slotsom gekom dat die buigsaamheid van die pasiëntrekord-benadering, alhoewel meer tydrowend, verkies word bo 'n koptelling-benadering. Verder is die gevolgtrekking dat die eenvoud van gebruik van die stelsel wat op 'n minimum datastel geskoei is, dit 'n veel meer haalbare benadering maak in 'n land soos Suid-Afrika met meestal rekenaar-ongeletterde verpleegpersoneel.

Wyses waarop 'n gerekenariseerde stelsel geïmplementeer kan word in 'n omgewing met beperkte apparatuur en netwerkinfrastruktuur word ook ondersoek.

Die studie word afgesluit met 'n voorgestelde model vir rekenarisering van primêre gesondheidsorg in die Vrystaat.