EVALUATION OF THE MALARIA INFORMATION SYSTEM IN KWAZULU-NATAL

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A minithesis submitted in partial fulfilment of the requirements for the degree of Master of Public Health in the School of Public Health, Faculty of Community and Health Sciences, University of the Western Cape.

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KEYWORDS

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Data collection tools

Data accuracy

Data flows

Data analysis and interpretation

Data usefulness

ABSTRACT

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Malaria is a parasitic disease transmitted by mosquitoes. If no prompt action is taken, malaria infection can result in death. The Malaria Information System was established to assist in planning and making decisions about malaria control activities. As a disease surveillance tool, the Malaria Information System should be able to provide accurate, timely and useful information for rapid response particularly, during malaria outbreaks. Furthermore, in order to ensure that the Malaria Information System is adequate to assist in planning and making decisions regarding malaria control activities, the system should be evaluated regularly. However, since its establishment in the 1980s the Malaria Information System has never been evaluated. The researcher evaluated the Malaria Information System by conducting a rapid survey of key informants. In addition, the researcher assessed the Malaria Information System data quality through document review. The evaluation used selected components from the World Health Organization *Protocol for assessment of national communicable diseases surveillance system and response system* and the Centers for Disease Control and Prevention *Guidelines for evaluating public health surveillance systems.*

The assessment of the MIS data quality using general data accuracy checks found less than 10% of errors in three of the six fields detected with missing data items. The remaining three fields had overall 27% of errors each. Data accuracy checks using specific methods found no errors. Assessment of data quality using data validation found discrepancies between the MIS cases and the DOH Cases. During the years 1990 – 1997 the national malaria notification system reported 11- 67% less cases than the MIS Cases for South Africa. Major differences between these systems were reported in 1993, 1995 and 1996. A similar pattern of reporting was obtained for KwaZulu-Natal except that in 1991 there were no differences between the MIS cases and the DOH cases. Another difference is that the MIS cases reported 21% less cases in than the DOH cases in 2001. In Mpumalanga the two reporting systems were similar in 1992 and 1998-1999. All other years had discrepancies of 11-79%. In Limpopo the discrepancies were similar to KwaZulu-Natal and Mpumalanga except that the MIS cases were 18% less than the DOH cases in 2000.

The evaluation reveals that the Malaria Information System uses simple data processing tools, it is easily adaptable to new changes, it is acceptable and reliable and provides timely data for the Malaria Control Programme managers to make operational plans and decisions for malaria control. Furthermore, the electronic record review revealed negligible errors in the MIS database. The discrepancies in reporting of malaria cases that existed between the Malaria Information System and the national Department of Health notification system during 1990-1997 have improved greatly since 1998. Although the discrepancies in reporting in the provinces during 2000-2001 reached 20%, these are not reflected in the cases for South Africa as a whole. However, the magnitude of these discrepancies needs further investigation. This will ensure good quality of the MIS data not only in the provinces, but South Africa as a whole. Other recommendations include the MIS staffing, staff straining, computer support systems, database design and regular evaluation of the MIS.

March 2003

DECLARATION

I declare that EVALUATION OF THE MALARIA INFORMATION SYSTEM IN KWAZULU-NATAL is my own work, that it has not been submitted for any degree or examination in any other University, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Joyce Mahlako Tsoka Date 14/03/03

Signed JMTsoka

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CHAPTER 1 – INTRODUCTION

1.1 BACKGROUND

Malaria is a parasitic disease transmitted by the mosquitoes of the *Anopheles* species. As an acute disease, malaria requires prompt action to prevent deaths. In South Africa malaria is endemic to the provinces of KwaZulu-Natal, Mpumalanga and Limpopo. The highest incidence of malaria occurs in KwaZulu-Natal. Malaria is one of the 33 notifiable diseases in South Africa and therefore notification to the health authorities is a statutory obligation (Katzenellenbogen *et al*., 1997). Active surveillance is an important exercise to gather timely and accurate data for malaria control activities (WHO, 2000). The Malaria Control Programme field assistants collect data by visiting every household once in six weeks to actively seek malaria cases from symptomatic and asymptomatic patients.

The collected data is kept within the Malaria Information System (MIS) and used for planning and maintenance of malaria control activities in each of the three malaria endemic provinces. The MIS contains data on all the homesteads in the district; the name of the local area in which the homestead is located and where malaria was detected; the names of household members; malaria clinical data of each household member; the name of the facility where laboratory diagnosis and treatment for malaria was undertaken and many more data elements. The Malaria Control Programme Offices in the Jozini Health District collates all malaria data for the province of KwaZulu-Natal. The Malaria Research Programme of the Medical Research Council (MRC) Durban administers the automated version of the MIS. Like all public health surveillance systems, the MIS should be evaluated periodically to ensure that rapid response of malaria control is carried out efficiently and effectively (CDC, 1988).

However, since its inception in the 1980s, the MIS has never been evaluated. The proposed study provided an opportunity to evaluate the MIS in KwaZulu-Natal using the research facilities available at the MRC Durban. The findings from this study will provide useful information for the malaria information officers to guide them to collect relevant and accurate information. Malaria Control Programme managers will use the results to define their indicators that will be used in decision-making regarding malaria control at the local level (Jozini Health District), regional (Jozini/Empangeni Health Region) and at provincial levels (KwaZulu-Natal). At the national level, the information will assist the Malaria Advisory Board and the national Directorate for Communicable Diseases Control to define national goals, targets and indicators regarding malaria control in South Africa.

1.2 THE RESEARCH PROBLEM

Although it is a requirement for each public health surveillance or communicable disease surveillance system, the Malaria Information System (MIS) in KwaZulu-Natal has never been evaluated since its establishment in the 1980s.

1.3 AIM

To determine whether the MIS is adequate to assist in planning and support decision-making for efficient and effective malaria control activities.

1.4 OBJECTIVES

A. To describe the MIS in terms of:

1. Tools used in collecting and collating the MIS data
2. The components and data elements of the MIS dataset
3. The type and characteristics of indicators used for establishing the MIS

4. The methods applied to check data accuracy
5. Information flow, analysis, interpretation and reporting

B. To assess the quality of the MIS data

C. To evaluate the MIS performance and usefulness based on data from the first two objectives in terms of simplicity, flexibility, data quality, acceptability, sensitivity, representativeness, timeliness and stability

D. To make recommendations to the Malaria Control Programme managers

1.5 RESEARCH HYPOTHESIS

The MIS in KwaZulu-Natal Province is inadequate to perform properly and provide good quality, timely and useful information for planning and decision-making regarding malaria control activities.

1.6 DELIMITATION OF STUDY AREA/ASSUMPTIONS ON WHICH THE RESEARCH RESTS

The proposed study was based on the World Health Organization (WHO) *Protocol for assessment of communicable disease surveillance and response systems* and the Centers for Disease Control and Prevention (CDC) *guidelines for evaluation of public health surveillance systems* (WHO, 2000; CDC, 2001). Although both of these information assessment tools recommend evaluation of all the components of a public health surveillance system, this evaluation of the MIS focussed on a review of information collected through active surveillance. An evaluation of all the components of the MIS would involve a great deal of time, human and financial resources.

Due to constraints of these resources, the proposed study evaluated the information process component of the MIS comprising data collection, transmission, processing and analysis; interpretation and use. For the same reasons, an assessment of health facilities, laboratories, case detection, epidemic preparedness, financial resources, physical infrastructure and logistics was not undertaken. It was decided to focus on the information process component because it is the major component of the MIS. Furthermore, while the WHO calls for an integrated approach to disease surveillance and to assessment of disease surveillance systems, only the MIS was evaluated since this system is run independent of the district health information system in the malaria endemic districts of South Africa.

An interpretivistic approach was followed to determine and assess the indicators, timeliness, data collection tools, analysis, interpretation and usefulness of the MIS data. An interpretivistic approach was suitable for this part of the study because the researcher aimed to qualitatively interpret data gathered by interviewing key informants involved with the running of the MIS. The key people are the malaria field assistants and their field supervisors, who are responsible for collecting the MIS data at household level. This also includes the malaria information officers who are responsible for managing and maintaining the MIS data. The Malaria Control Programme managers use the MIS data to make decisions regarding malaria control activities.

The researcher followed a positivistic approach to perform data accuracy checks and data validation of the MIS using quantitative methods since the researcher was interested in assessing the quality of the MIS data. The researcher performed data accuracy checks on a random sample of electronic records selected from the MIS dataset. Data validation involved a comparison of malaria cases from the MIS database and malaria cases reported by the Department of Health notification system.

1.7 THESIS OUTLINE

The thesis comprises five chapters. Chapter 1 provides a background, the research problem and aims of the study. Chapter 2 reviews literature on public health information systems and public health surveillance systems. Chapter 3 describes the methodology and techniques used to determine the efficiency of the MIS in planning and decision-making for malaria control. Chapter 4 presents the results of the evaluation of the MIS. Chapter 5 provides an interpretation of the results and assessment of the MIS in terms of simplicity, flexibility, acceptability, sensitivity, representation, timeliness and usefulness of the MIS information. The chapter concludes by providing recommendations for the MIS to function efficiently and effectively.

CHAPTER 2 – LITERATURE REVIEW

2.1 CHAPTER OVERVIEW

Chapter 2 reviews literature on public health information systems. The chapter begins by a brief review of malaria. Then introduces public health information systems as part of health information systems. The relationship between public health information systems and public health surveillance is also discussed. The discussion continues with public health surveillance systems and communicable disease surveillance systems as tools for public health surveillance. The chapter concludes by discussing evaluation of public health surveillance systems and communicable disease surveillance systems.

2.2 MALARIA AS A PUBLIC HEALTH PROBLEM

Malaria is a disease caused by the *Plasmodium* species parasite. The disease is transmitted through the bite of infected female mosquitoes of the *Anopheles* species. Malaria is an acute illness with an incubation period of seven days or longer. The most severe form is caused by *P. falciparum,* in which variable clinical features include fever, chills, headache, muscular aching and weakness, vomiting, cough, diarrhoea and abdominal pain. Other symptoms related to organ failure may supervene, followed by coma and death. Early diagnosis and appropriate treatment can be life-saving. *Falciparum* malaria may be fatal if treatment is delayed beyond 24 hours. Malaria is a worldwide problem responsible for more than three million deaths every year. More than 90% of these deaths occur in Sub-Saharan Africa (WHO, 2002).

The disease is distributed throughout the tropics. In South Africa malaria is concentrated in areas along the borders with Mozambique, Swaziland and Zimbabwe (le Sueur *et al.*, 1996; Sharp & le Sueur, 1996). Therefore, malaria is endemic to the provinces of KwaZulu-Natal, Mpumalanga and Limpopo that are adjacent to these borders. The highest incidence of malaria occurs in KwaZulu-Natal (le Sueur *et al.*, 1996; Sharp & le Sueur, 1996). Malaria transmission in South Africa is seasonal with the transmission season occurring during the months of September to June (le Sueur & Sharp, 1996). Due to the seasonal transmission, the people in malaria endemic areas have a low level of immunity, thereby requiring that continuous malaria control measures are in place. In order to carry out malaria control activities efficiently and effectively, accurate, timely and useful information is required. Active surveillance is an important exercise to collect such information.

2.3 INTRODUCTION TO HEALTH INFORMATION SYSTEMS AND PUBLIC HEALTH INFORMATION SYSTEMS

Health information systems cover acute care, clinical support, primary health care and business functions. Health information systems are used extensively in hospitals to record information on patient admissions, prescriptions, doctor's visits and to assist in calculating the cost of services provided. Public health information systems are used extensively to collect, process, analyse and provide reports, for example, on communicable diseases (Smith, 2000). Public health information systems have been defined to include a variety of data sources essential to public health action. Public health information systems are often used for surveillance. However, public health information systems differ from surveillance systems in that public health information systems lack some critical elements of surveillance systems. For example, public health information systems may not focus on specific outcomes and are not ongoing or not directly linked to public health practices (Thacker & Stroup, 1994).

2.4 PUBLIC HEALTH SURVEILLANCE SYSTEMS AND COMMUNICABLE DISEASE SURVEILLANCE SYSTEMS

Public health surveillance is the ongoing, systematic collection, analysis, interpretation and dissemination of health data used in public health action to reduce morbidity and mortality and to improve health (CDC, 1988; Buehler, 1998; Teutsch & Thacker, 1995; Thacker, 2000). Public health surveillance activities are generally authorized by legislators and carried out by public health officials. Public health surveillance systems have been developed to address a range of public health needs. Communicable disease surveillance is a part of public health surveillance (CDC, 2001). Information on priority communicable diseases is critical for effective and rapid control. Many countries have developed surveillance capacities to monitor diseases with a high burden, to detect outbreaks of epidemic-prone disease and monitor progress towards national or international control or eradication targets (Thacker *et al.*, 1996). The WHO (2000) states that communicable disease surveillance is a national function and therefore a multi-disease (integrated) approach to disease surveillance should be followed.

However, this approach may not always be appropriate for some communicable diseases such as malaria, which require specific information needs for prompt action. In such cases, specialized BSC surveillance systems may be necessary. The Malaria Information System (MIS) in South Africa provides a good example of a specialized surveillance system (Katzenellenbogen *et al.*, 1997). Public health surveillance systems and communicable disease surveillance systems are aimed at providing accurate, timely information for rapid response, particularly during epidemics. These systems should be evaluated regularly to ensure that they are serving a useful public health function and are meeting the systems' objectives (CDC, 1988; WHO, 1999).

2.5 EVALUATION OF PUBLIC HEALTH SURVEILLANCE SYSTEMS

The CDC states that public health surveillance systems should be evaluated periodically to ensure that problems of public health importance are being monitored efficiently and effectively. The CDC further states that evaluation should include recommendations for improving quality, efficiency and usefulness. Evaluation of public health surveillance systems focuses on how well the system operates to meet its purpose and objectives. Therefore, evaluation of public health surveillance systems should involve an assessment of system attributes, including simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness and stability (CDC, 2001).

Simplicity of a public health surveillance system refers to both its structure and ease of operation. A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel or allocated funds. Data quality refers to the completeness and validity of the data recorded in the public health surveillance system. Examples of evaluation of data quality include examining the percentage of 'unknown' or 'blank' responses to items on surveillance forms, comparing data values in the surveillance system with true values through a review of sampled data, a special record linkage, or patient interviews (CDC, 2001; 1998; Klevens *et al*., 1999; Phillips-Howard *et al*., 1990). Acceptability reflects the willingness of persons and organizations to participate in the surveillance system. Sensitivity of surveillance systems can be defined at case reporting level or at the outbreak level. At the former level sensitivity measures the proportion of cases of a disease detected by the surveillance system. At the outbreak level, sensitivity refers to the ability to detect outbreaks, including the ability to monitor changes in the number of cases over time. Predictive value positive is the proportion of reported cases that actually have the disease under surveillance (CDC, 2001).

A public health surveillance system is said to be representative if the system accurately describes the occurrence of a disease over time and its geographic and demographic distribution in the population. Timeliness reflects the speed between steps in a public health surveillance system. Stability refers to the reliability and availability of a public health surveillance system. Reliability is defined as the ability to collect, manage and provide data properly without failure (CDC, 2001). Smith (2000) suggests that evaluation of information sources is important to the user and should be unbiased, valid, reliable, consistent and timely.

2.6 METHODS TO EVALUATE PUBLIC HEALTH SURVEILLANCE SYSTEMS

Many criteria to evaluate public health information systems and public health surveillance systems exist. The evaluation involves verification of data quality or description of the attributes of a public health surveillance system (Abdool Karim & Abdool Karim, 1991; Butchart *et al.*, 2001; Evans *et al.*, 2001; Herbst *et al.*, 1999; Kahn *et al.*, 1996; Klevens *et al.*, 1999; Johnson *et al.*, 1997; Phillips-Howard *et al.*, 1990). Some studies have evaluated data by comparing values in the surveillance system with true values through a review of sampled data (Johnson *et al.*, 1997; Kahn *et al.*, 1996; Klevens *et al.*, 1999).

A review of sampled data is possible if the records selected have the same details as those that are being compared with, and also if other sources of data are available. Other workers have verified data quality by interviewing patients whose data are contained within the surveillance system (Klevens *et al.*, 1999; Phillips-Howard *et al.*, 1990). Data validation by interviewing patients selected by their medical history may be problematic in cases where the patients have died or moved to another place.

To overcome the data constraints, it is possible to validate data by comparing two sources of data using the number of confirmed cases of a disease over time or geographically (Abdool Karim & Abdool Karim, 1991). Other evaluations have attempted to determine cost-effectiveness of systems and focussed mainly on the computerized components and financial resources involved in running such systems (Evans *et al.*, 2001; Herbst *et al.*, 1999). However, many economic studies are complex in nature and apply theoretical models, which may not be practical.

Studies that have evaluated public health surveillance systems describing the attributes of the systems have often based the assessment on either the *Guidelines for evaluating surveillance systems* (CDC, 1988) or the *Protocol for the assessment of national communicable disease surveillance and response systems* (WHO, 2000) or both tools (Butchart *et al.*, 2001; Opio *et al.*, 2000). The CDC guidelines were published to promote the best use of public health resources through development of efficient and effective public health surveillance systems. The guidelines have been updated to address the need for the integration of surveillance and health information systems. This includes establishment of data standards and the electronic exchange of health data.

The updated guidelines also address changes in the objectives of public health surveillance to facilitate the response of public health to emerging health threats (CDC, 2001). The CDC guidelines describe six tasks involved in evaluation of a public health surveillance system (Appendix 1). The *first task* is the planning stage where stakeholders are engaged to provide input to ensure that the evaluation addresses appropriate questions and assesses pertinent attributes. This also ensures that the findings of the evaluation will be acceptable and useful. In the *second task* the evaluators should describe the surveillance system in terms of the public health importance of the disease under surveillance, the purpose and operation of the system and the resources used to operate the system. The *third task* involves defining the evaluation design by determining the purpose of the evaluation, specifying the questions that will be asked by the evaluation, determining standards for assessing the performance of the evaluation and deciding what will be done with the information produced from the evaluation. The *fourth task* requires the evaluators to gather credible evidence regarding the performance of the public health surveillance system. This task involves indicating the level of usefulness and a description of the attributes of the system such as simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness and stability. In the *fifth task* the evaluators should analyse, synthesize, interpret and judge the gathered evidence in order to justify the conclusions and make recommendations regarding the performance of the public health surveillance system.

The *final task* is to ensure use of evaluation findings and share lessons learned (CDC, 2001). The *Protocol for the assessment of national communicable disease surveillance and response systems* was developed to assist the WHO African region member states to assess their communicable disease surveillance systems (WHO, 2000). This assessment is a requirement for each country before adopting the integrated communicable disease surveillance strategy (WHO, 1999). The WHO protocol emphasizes that evaluation of public health surveillance systems should be undertaken by the national department of health in consultation with WHO representatives.

Such an evaluation is suitable for evaluation of health information systems or public health surveillance systems on a large scale such as district health information systems or national health information systems. Evaluations based on the WHO protocol could result in major delays, because the assessment involves large teams (internal and external), long planning stages and extensive assessment processes and various phases. Moreover, evaluation of health information systems and public health surveillance systems depends on the nature of these systems and also on available resources in each country. For specialized public health surveillance systems like the MIS, which are designed for operational planning and prompt decision-making, local assessment is essential. Nonetheless, the WHO protocol could be adopted to suit evaluation of local public health surveillance systems such as the MIS. This chapter reviewed literature on public health surveillance systems as part of public health information systems. The importance of regular evaluation of public health surveillance systems to ensure efficiency and effectiveness of the systems was emphasized. Readily available tools designed for such a purpose by the WHO and the CDC respectively simplify the evaluation.

CHAPTER 3 – METHODOLOGY

3.1 CHAPTER OVERVIEW

Chapter 3 presents a description of the methods and techniques used to collect data under five main headings of the research design; the study population, data sources and sampling; data collection; data analysis and limitations of the data.

3.2 RESEARCH DESIGN

The study was a descriptive case study using qualitative and quantitative methods. The design is regarded as appropriate for answering the research question since the researcher sought to describe the MIS at the level of data generation and usefulness.

3.3 STUDY POPULATION, DATA SOURCES, AND SAMPLING

The study population comprised 10 malaria field assistants, two data capturers, two malaria field supervisors, two malaria information officers each from Jozini and Richards Bay and three Malaria Control Programme managers from Jozini Health District (one local and one regional) and Richards Bay. Purposive sampling was used to select the study participants as they represented the people involved with the MIS data collection, processing, dissemination and usage. Due to financial and time constraints, only key informants in Ubombo district involved with the MIS data were interviewed. Ubombo district is selected as the main study site because together with Ingwavuma district carries the highest burden of malaria in KwaZulu-Natal.

Furthermore, the Jozini Office located in Ubombo district collates the MIS data for the province of KwaZulu-Natal. Simple random sampling was used to select one malaria area out of the nine geographically demarcated malaria areas in Ubombo. The malaria field assistants and the malaria field supervisors interviewed are responsible for data collection in the selected area of Mbazwana. Other sources of data included copies of the MIS data collection forms, weekly and monthly reports provided by the Malaria Control Programmes in Jozini and Richards Bay.

The MRC Durban supplied a copy of the MIS data input screen, the MIS electronic data for the year 2000 and total malaria cases for the years 1990-2001 by province and month. The researcher obtained malaria notification cases for the years 1990-1997 from the *Epidemiological Comments* publications of the national Department of Health and for the years 1998-2001 from the *National Malaria Update,* an electronic monthly report of the national Department of Health.

3.4 DATA COLLECTION

The researcher used qualitative and quantitative methods to collect the data. The qualitative methods involved interviews with key informants using semi-structured interview schedules. The researcher and a trained research assistant conducted the interviews during 4-6 September 2002. The key informants included the Malaria Control Programme managers, malaria information officers and data capturers from the Malaria Control Programme in Jozini and Richards Bay offices. The interviews in the field in Mbazwana area involved malaria field assistants and their field supervisors.

3.4.1 Semi-structured interviews with the malaria field assistants and the malaria field supervisors

The researcher and a trained research assistant used interview schedules (Appendix 2) to elicit information from the malaria field assistants who collect data at household level and their supervisors in the Mbazwana area (70 km from Jozini). The malaria field assistants were asked questions that addressed the type and design of tools used to collect and collate the MIS data; frequency and personnel involved in collecting the MIS data. The researchers also asked about methods used for data accuracy checks. In essence these interviews covered objective A. Interviews were conducted in Zulu by the researcher and the research assistant since all the malaria field assistants communicate in Zulu. The malaria field supervisors were asked questions that involved the work of the malaria field assistants and the malaria field supervisors, data flows from the field and the methods and frequency of performing data accuracy checks. These questions addressed objective A. The interviews were conducted in both Zulu and English.

3.4.2 Semi-structured interviews with the data capturers and the malaria information officers

The researcher interviewed the data capturers and the malaria information officers at the Malaria Control Programme in Jozini and Richards Bay offices. The questions sought information regarding the type (input, process, output or outcome) and characteristics of indicators used for establishing the MIS. The interviews also attempted to determine methods used for data accuracy checks, data flows, analysis, and interpretation and reporting of the MIS (Appendix 2). The questions addressed objective A. The researcher interviewed the data capturers in both English and Zulu and communicated with the malaria information officers in English.

3.4.3 Semi-structured interviews with the Malaria Control Programme managers

These interviews were conducted in order to determine the relevance and importance of the MIS dataset. The MIS data was assessed for the requirements of the development of a minimum dataset. Information pertaining to information flows; analysis, interpretation, reporting and frequency of reporting and timeliness were also collected. The interviews included questions on the frequency of report generation and assessed the usefulness of the MIS information (objective A) (Appendix 2).

The Malaria Control Programme manager for Jozini Health District was interviewed first and a further interview was carried out with the Regional Malaria Control Programme manager for Jozini/Empangeni and then the Malaria Control Programme manager in Richards Bay. The questionnaires for these interviews were based on the WHO and CDC guidelines for evaluation of public health surveillance systems. All interview schedules contained both open and closed-ended questions. The interview method was chosen because it generates a high response rate and promotes face-to-face interaction between the interviewer and the interviewee.

3.4.4 Record review for data accuracy checks

This section addresses Objective B and used electronic records from the MIS database to assess data accuracy.

General data accuracy checks

The researcher conducted general data accuracy checks in September 2002 to determine the quality of the MIS dataset. A statistician from the MRC Biostatistics Support Unit used the SPSS statistical program to select and group into 12 months 12388 malaria cases reported by active surveillance for the year 2000 from the MIS database. Every fifth record was selected in each month.

Systematic sampling was considered appropriate to select a sample of records large enough to be able to achieve the research objective. The resulting 2473 records were used for general data accuracy checks. Data for each month was allocated to a separate file to allow ease of manipulation. Four of the 29 data fields of the MIS dataset were not being used for data collection and the fields contained no data in all the records. The assessment of data accuracy excluded these fields. The researcher used *sort ascending and sort descending* tools of the MS Access to assess every record in each month for completeness by identifying missing data items.

The researcher used the filter *by selection* tool within MS Access to calculate the total number of missing data items in each of the selected 25 data fields of the MIS dataset. It was expected that data of high quality would have a few missing data items. Similarly, the researcher checked data fields for properly entered data such as the date, sub-district and area of reporting where a malaria case was detected. Since the assessment was done on active cases where malaria field assistants come into contact with the malaria patients, it was expected that at least all gender fields would be completed. None of the data fields required any checking of arithmetic values. MS Excel was used to calculate total numbers and percentages of each of the errors detected within each field for all 12 months.

Specific data accuracy checks

The researcher performed specific data accuracy checks in September 2002. A statistician from the MRC Biostatistics Support Unit used the SPSS statistical program to select a 10% random sample in each month from the 12388 MIS malaria cases. A simple random sampling was used because we needed a few records and this method was relevant in this regard. This resulted in 1296 records. The following specific accuracy checks were used within MS Access using the *sort ascending and sort descending* and *query* tools.

- *Time-trend consistency*: to detect any unexplained changes in trends of malaria.

- *Time-trend variation*: to assess for any changes in the number of malaria cases.
- *Minimum-maximum values*: to detect any unrealistic values above maximum and below minimum for age, date, area section, blood smear, week number, malaria season and method of detection fields.
- *Comparison*: between magisterial districts, areas, months, gender and age.
- *Parts vs. whole*: total number of malaria cases in each area or magisterial district to add up to the total for the magisterial district or health district.
- *Preferential end-digits*: to assess whether the numbers were realistic or made up by the data collectors using 0 or 5.

The fields checked using each specific data accuracy check are shown in Table 1. MS Excel was used to calculate total numbers and percentage of errors found by each specific data accuracy method and for each field where possible.

Table 1 MIS dataset fields used in specific data accuracy checks

Field	**Fields used in each method**					
	Time-trend consistency	Time-trend variation	Min-max values	Comparisons	Parts versus whole	Preferential end-digits
Notifdate			X			
Bloodsmear no.			X			
Malaria season			X			
Year			X			
Weekno.			X			
Month	X	X	X	X	X	
Sex				X	X	
Age			X	X	X	X
Method of detection			X			
Noti area				X	X	
Notimagi. district				X	X	
Notiheldis				X	X	
Section			X		X	
No. errors						

3.4.5 Record review for data validation

Data validation is very important for decision-making since it was shown that of the 8580 cases diagnosed in the Jozini Health District in 1997, only 7525 were notified to the provincial Department of Health (Knight, 1998).

The researcher performed data validation of the MIS data using a modified method to that described by Abdool Karim & Abdool Karim (1991) for Hepatitis B. The researcher obtained malaria cases for the years 1990-2001 from the MIS database (MIS cases) of the MRC Durban and compared with malaria case notifications reported to the Department of Health. The sources for malaria notifications were *Epidemiological Comments* (1990-1997) and the *National Malaria Update* for the years 1998-2001 (DOH cases). All the DOH cases were entered into the MS Excel under the fields; year, province and month of notification.

The researcher aggregated the MIS cases to form the same field names as those in the DOH cases. The researcher then used MS Excel to compare the discrepancies in the total number and percentages of malaria cases reported in the MIS and the DOH calculated by year, province and month. The objective here was to determine the level of under-reporting or over-reporting of malaria cases by the statutory notification system and compare KwaZulu-Natal to national reporting and reporting in other provinces using the MIS.

3.5 DATA ANALYSIS

3.5.1 Analysis of qualitative data from the interviews

Since the researcher was not interested in the number of responses, but the emerging issues, the data was explored in detail for common themes. The researcher sorted and coded the data by hand and analysed the data according to content.

3.5.2 Analysis of quantitative data

For data accuracy checks of the MIS, simple counts of the number and percentage of records with blanks, typing and spelling errors were produced within MS Excel.

Similarly, the same exercise was done for the number and percentage of records with errors found when applying each of the specific methods of data accuracy checks. Because there was no cut-off point for the percentage errors for assessing data quality, the researcher decided to set the limit of 10%. Any percentage above this limit was regarded as unacceptable. For validation of malaria cases, the researcher determined the difference in the number of malaria cases between the MIS cases and the DOH cases by subtracting the number of DOH cases from the MIS cases. Then the difference was expressed as a percentage.

3.5.3 Summary

In this present study, all the CDC evaluation tasks were followed to achieve the objectives of the study. The first task was addressed in the planning stages. The Malaria Control Programme managers and the national Department of Health and the MRC were consulted during the proposal development. Objective A, which corresponds with the CDC task two, is addressed in the background and results section by describing the MIS. The part that was omitted in the description of the system is the funding of resources. This was not considered necessary, as the MIS is not run by a private organization but by the public sector as part of health service provision through the district health system. The third CDC task was achieved by formulating the aim, objectives and in the methodology section of the study.

Objective C, which corresponds with the fifth CDC task, is addressed by combining objectives A and B and uses criteria in the fourth CDC task as a guide for the discussion. All attributes of the MIS are described except predictive value positive. This attribute could not be evaluated since the data on malaria negative cases are needed. These data were not available at the time of the study. The last CDC task was achieved by the preparation of this mini-thesis and a report will be sent to the stakeholders and the Malaria Control Programmes in the three malaria endemic provinces of South

Africa. The data will also be shared at public health conferences and published in peer-reviewed journals.

3.6 LIMITATIONS OF THE DATA

The MIS data used for data accuracy checks had limitations in that three fields were left blank to indicate both unknown items and missing items. This made checking of data errors difficult since the number of blanks representing each of the unknown items and blank items was not known. The data on malaria cases obtained from the national Department of Health was also limited because the data contained only totals of malaria cases by year, province and month. It was not possible to use these data to identify the exact missing malaria cases in each of the MIS and DOH since no other details were available to allow further comparisons. To be able to carry out data validation the researcher aggregated the MIS cases into the same fields as those in the DOH cases. This allowed comparison of malaria cases by year, province and month of reporting between the MIS cases and the DOH cases.

CHAPTER 4 – RESULTS

4.1 CHAPTER OVERVIEW

Chapter 4 presents results under three main sections. The first section outlines a description of the respondents. Section two uses responses from the interviews and documents obtained from the Malaria Control Programmes to describe the MIS under seven sub-sections namely; data collection and collation tools, components and data elements of the MIS, MIS indicators, data accuracy checks, data flows, data analysis and interpretation and data reporting, timeliness and usefulness. The final section presents results of a quantitative assessment of the MIS data quality using general and specific data accuracy checks and validation of malaria cases.

4.2 RESPONDENTS AND THEIR RESPONSIBILITIES WITHIN THE MIS

Table 2 shows the 19 respondents and their responsibilities within the MIS. These respondents comprise 10 malaria field assistants, two malaria field supervisors, two data capturers (Jozini), two malaria information officers (one from Jozini and one from Richards Bay) and three Malaria Control Programmes managers (one each from Jozini and Richards Bay and one regional Jozini/Empangeni). The educational level of the malaria field assistants ranged from none to standard 10. The educational level of the malaria field supervisors ranged from standard eight to standard 10. The malaria information officers had a standard eight to a tertiary diploma in Environmental Health. The Malaria Control Programme managers had a diploma to a Bachelor of Technology (B.Tech) in Environmental Health. The malaria field assistants, malaria field supervisors and the malaria information officers have mentioned that they receive additional training regarding their jobs on a regular basis.

The work experience of the Malaria Control Programme personnel ranged from two to 25 years. The malaria field assistant visits 15-20 households on a daily basis to collect data on symptomatic, asymptomatic, and confirmed malaria patients; to test for malaria using malaria rapid tests; to make blood smears and to educate the household members on malaria control. The purpose of active surveillance is to reduce the malaria parasite reservoir in the population. In each visit, the names and ages of all household members and their movements in the last six weeks are collected.

The malaria field assistant screen suspected malaria patients using a *KAT-Quick Malaria Rapid Test*® (KAT Medical (Pty) Ltd, Weltenvreden Park, South Africa). This test involves finger pricking and putting a drop of blood on a test strip. The results of the test are available within 15 minutes. The rapid test is designed to test for the presence of *Plasmodium falciparum* malaria. In addition to rapid testing for malaria, the malaria field assistant makes blood smears from household members at random, whether they show clinical signs of malaria or not. The smears are sent to the laboratory in Jozini. The health education on malaria includes transmission, symptoms, prevention and treatment. The malaria field assistants do not dispense drugs, but refer malaria patients to primary health care facilities. The malaria field assistants are also involved with the annual spraying of the homesteads with insecticide.

The malaria field supervisor oversees fieldwork activities of the malaria field assistants. The data capturers are responsible for entering the MIS data into the MIS database. The malaria information officer in Richards Bay works both as a data capturer and a malaria information officer. The malaria information officer manages the MIS data and produces reports for management and presentations. The Malaria Control Programme managers are responsible for using the MIS information to make decisions regarding malaria control activities at district, health region or provincial level.

Table 2 Description of the respondents

Respondent	Number	Educational level
MFA	10	Standard 0-10
MFS	2	Standard 8-10
Data capturers	2	Standard 10
MIO (Jozini)	1	Dip. Environmental Health
Data capturer/ MIO (Richards Bay)	1	Standard 10
MCPM (Jozini)	1	B.Tech. Environmental Health
MCPM (Richards Bay)	1	Diploma Public health
MCPM (Jozini/Empangeni)	1	B.Tech. Environmental Health
Total	**19**	

MFA =malaria field assistant, MFS = malaria field supervisor
MIO = malaria information officer,
MCPM = Malaria Control Programme manager

4.3 DESCRIPTION OF THE MIS

The Malaria Control Programmes do not have a manual of how the MIS operates. The researcher interviewed the above-mentioned respondents in order to be able to describe and assess the tools and components of the MIS. The following sections describe the MIS.

4.3.1 Data collection and collation tools

The malaria field assistants use paper forms to collect data manually from each homestead during active surveillance. For passive surveillance nurses at health facilities or malaria field assistants at the malaria camps collect data also on paper forms from patients presenting with malaria at these facilities. For each homestead visit, the malaria field assistant carries malaria field equipment comprising an A5 notebook, pens, microscopic blood slides, and rapid test kits for screening of malaria. The malaria field assistant travels on a bicycle normally, but on foot in sandy areas. The malaria equipment is carried in a bag designed for field purposes. Data are written in the notebook during fieldwork and transferred to the forms once the malaria field assistant reaches Malaria Control Programme field offices (or camps as they are known) within a day or two after collection.

The MIS data collection forms are left in the Malaria Control Programme field offices to protect the forms from damage by harsh weather conditions and to avoid inconvenience of carrying large volumes of data collections forms. There are six types of forms used in the collection and collation of the MIS data (Table 3). The Mal1A and Mal1 forms are used for administrative purposes to record the daily and weekly activities of the malaria field assistants. The Mal2 form is the core tool used to collect data for the MIS database (Appendix 3). The Mal3 and Mal4 forms are used to investigate positive cases and also to report laboratory results of positive cases.

The Mal3A form is a statutory malaria notification completed by the hospitals, clinics and the Malaria Control Programme personnel for malaria positive patients. This form is sent to the national Department of Health. The data capturers in the Malaria Control Programme in Jozini use MS Access to enter the MIS data into a computer. The data capturers have received in–house training on how to use the MS Access database, MS Word and MS Excel software at least once during their employment. There is no local software support system. Any problems regarding data entry systems are communicated telephonically to the software support system and the MIS database manager based at the MRC Durban.

Table 3 Data collection and collation tools for the MIS

Type of form	Used for	Used by	No. data fields
Mal1	Weekly report of active surveillance	MFA	19
Mal1A	Daily summary of MFA activities	MFA	20
Mal2	Case detection weekly survey	MFA	16
Mal3	Case investigation report	MFA	39
Mal3A	Statutory malaria notification	MFA & Hospitals	21
Mal4	Laboratory report on retake blood smear from a confirmed malaria case	Laboratory staff & Pathologist or MCPM to refer a malaria case	21

MFA =malaria field assistant
MCPM = Malaria Control Programme manager

4.3.2 Components and data elements of the MIS dataset

The information process of the MIS consists of data collection, transmission, processing and analysis, and information production for use in planning and management of malaria control services. The management structure comprises resources such as data collectors, data processors, planners, entomologists, pathologists and epidemiologists. The data collectors include malaria field assistants, malaria field supervisor, data capturers and laboratory technicians. Data processors refer to malaria information officers and statisticians. The planners are the Malaria Control Programme managers and field team leaders. The software support system and the MIS data management resources are based in the MRC Durban.

Other resources within the data management component are hardware, software, finance and organizational rules. The hardware available includes computers, printers, telephones, fax machines and photocopiers. The software used to manage the MIS data refers to Windows, MS Office, e-mail facilities and Internet. Organizational rules comprise operational procedures for management, supply and maintenance of equipment and definitions of staff responsibilities. For example, each malaria field assistant is responsible for about 800 homesteads and he must visit at least 15-20 homesteads per day.

There are 29 MIS data elements or fields within the MIS database (Appendix 4). The 29 fields contain data from Mal2, Mal3 and Mal4 data collection forms. These data are entered on a pre-designed data input screen within MS Access. Nineteen fields are pre-coded and the data capturer just selects from a drop-down list or ticks. The first five fields are related to identification of the case. Fields 6-19 are patient identifiers such as name, sex, age, area and district of notification. Field 20 is the survey ID. Field 21 identifies the type of parasite that caused the malaria infection. Fields 22-24 identify the origin of malaria infection (source of infection, magisterial district and health district of infection). Fields 25-27 provide data on malaria case follow-up results from the laboratory (date, smear number and type of parasite detected). The last two fields present data on clinical diagnoses of malaria and the outcome of the malaria infection. Figure 1 shows the MIS information filter of the 29 fields within government structures. At the national level only four fields are utilized, the total number of malaria cases and deaths by province and year. The provincial level uses the total number of malaria cases and deaths by health regions and health districts. The number of data elements increases with the level of decentralization. This is reflected in the weekly and monthly reports. However, the number of data elements will depend on the needs of the user.

4.3.3 MIS indicators

The above data elements are collected and processed to determine the indicators shown in Table 4. The first two indicators, number of reported cases of malaria and the case fatality rate were set by the national Department of Health and are linked to the following targets (Department of Health, 1999):

a) to reduce the number of reported cases of indigenous malaria by 10% per year.

b) to reduce morality due to malaria by 10% of noted cases per year.

These targets are specific, measurable, appropriate for malaria control, realistic and time-bound (SMART) (Department of Health, 1999). The two indicators linked to these targets are outcome indicators and are calculated by processing of the data elements above. Other indicators mentioned by the regional Malaria Control Programme manager are: origin of infection, malaria parasite type, epidemiological investigation results, number of houses visited, number of people screened for malaria, number of positive cases followed, performance of staff member.

Figure 1 The MIS information filter

International: WHO

Cases	Deaths

National: Pretoria

Province	Year	Cases	Deaths

Provincial: Pietermaritzburg

Health region	Health district	Year	Cases	Deaths

Health district: Jozini

Mag district	Year	Month	Method of detection	Parasite type	Death

Magisterial district: Ingwavuma

Case No.	Date	Gender	Age	Detection Method	Notif. area	Parasite type	Symptoms	Death

Malaria area: Ndumu

Method of detection	Survey ID	Parasite type	Facility	Farm name	Notif Area	Notif Mag. district	Notif helth Reg.	Sector	Section	House no.	Source infection	Source Mag. Dist	Source health reg.	
Regional Office	Symptoms	Dead	Blood smear date	Follow uo	Notif. date	Case no.	Follo w up date	Follow up smear no	First name	Surname	Sex	Age	Smear no	Labref no.

While some indicators such as the number of reported malaria cases, case fatality rate, number of homes visited, number of positive cases followed are self-explanatory, other indicators require explanation. Origin of infection refers to whether the patient was infected in South Africa or a neighbouring country such as Mozambique or Swaziland. Malaria parasite type refers to the species of the *Plasmodium* parasite causing malaria (*falciparum, ovale, malariae,* or *vivax*). Malaria parasite type is detected by laboratory results. The performance of staff is measured from the number of homesteads visited and the number of people screened for malaria per day or week. The Malaria Control Programme managers use the performance of staff to indicate the amount of work done by staff members.

Case investigations provide data for the epidemiological investigation results. The epidemiological investigation results and performance of staff members (malaria field assistants) are process indicators and the remaining five are output indicators. All the indicators are useful, reliable, appropriate, valid, and easy to measure, sensitive and specific (WHO, 1994). Useful means that they are used to measure some result. Reliable means that the indicator will give the same result if used by different people. Appropriate implies that it is the best way to measure the result. A valid indicator measures what it is intended to. For example, case fatality rate measures malaria mortality. Easy to measure means that the data use to produce the indicator is easy to collect and process.

The data collected by the malaria field assistants are processed to produce these indicators. A sensitivity and specific indicator reflects changes in the events, for example changes in malaria incidence. The indicators enable the MIS to function properly. Firstly, the MIS include provision of information for local malaria control activities. Secondly, the MIS data is used for malaria surveillance locally, provincially and nationally. The third function of the MIS is to detect and monitor epidemics.

This is achieved by the number of malaria cases and deaths collected weekly, per health region, health district, magisterial district, area, and section and per health facility. The MIS data also helps decision-makers to monitor and evaluate the success of control measures. For example, the number of malaria cases and deaths, the type of parasite detected will indicate whether the control measure being used such as the DDT is working or not. Then decision-makers and policy-makers would then plan and decide on appropriate strategies.

Table 4 Types of indicators used in the MIS

Indicator	**Type of indicator**	**Characteristics**					
		U	R	A	V	E	S
Number of reported malaria cases	Outcome	Y	Y	Y	Y	Y	Y
Case fatality rate	Outcome	Y	Y	Y	Y	Y	Y
Origin of infection	Output	Y	Y	Y	Y	Y	Y
Malaria parasite type	Outcome	Y	Y	Y	Y	Y	Y
Epidemiological investigation results	Process	Y	Y	Y	Y	Y	Y
Number of homes visited	Output	Y	Y	Y	Y	Y	Y
Number of people screened for malaria	Output	Y	Y	Y	Y	Y	Y
Number of positive cases followed	Output	Y	Y	Y	Y	Y	Y
Performance of staff member	Process	Y	Y	Y	Y	Y	Y

URAVES = useful, reliable, appropriate, valid, easy to collect, sensitive and specific

4.3.4 Data accuracy checks

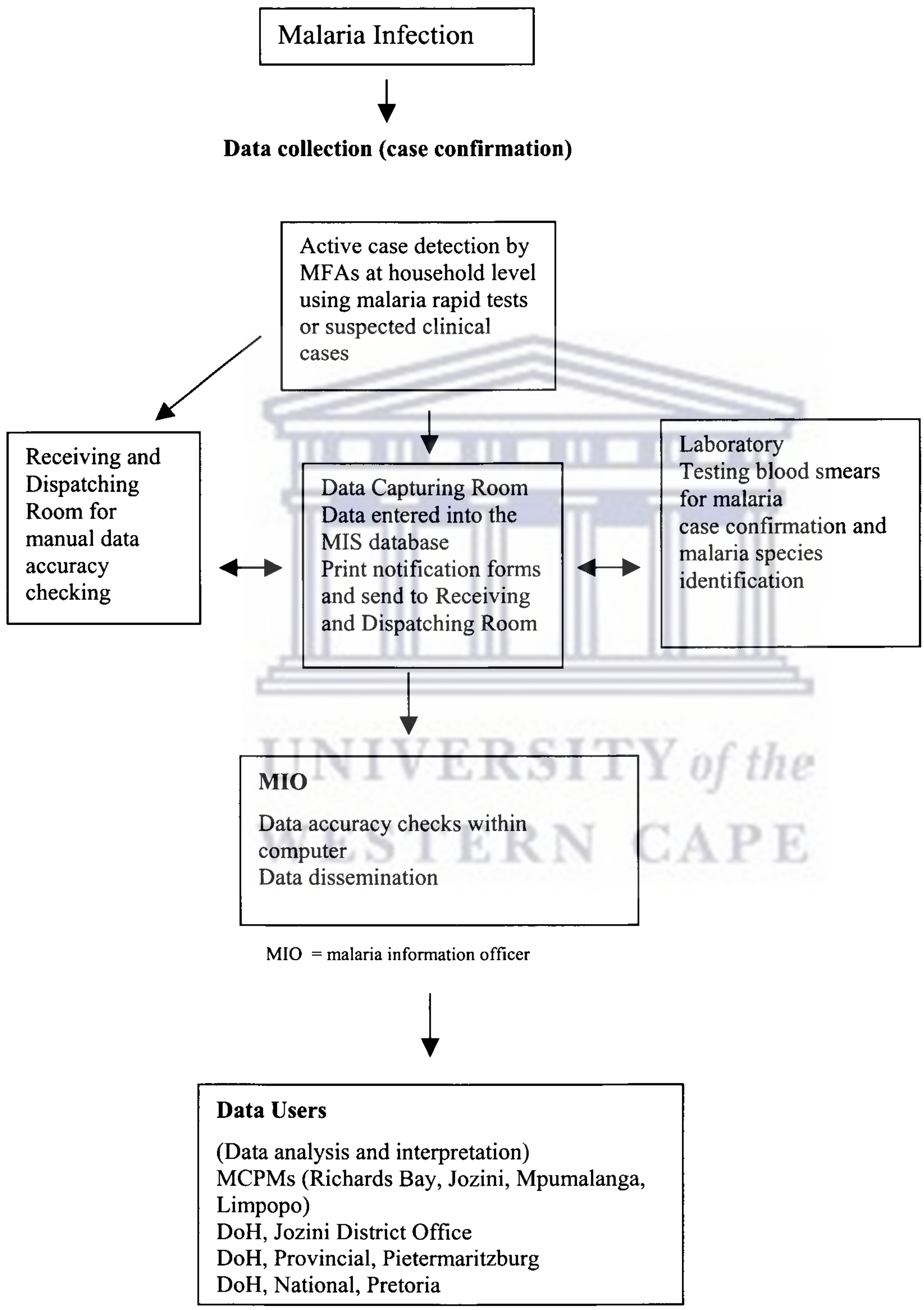
After the malaria field assistants have collected the MIS data from the homesteads on Mondays and Tuesdays, the malaria field assistants transfer the data to malaria collection forms on Wednesdays. The malaria field assistants then submit the data to the malaria field supervisor. On Thursdays the malaria field supervisor performs general data accuracy checks manually by checking for spelling errors, completeness, whether data items are entered in the right fields, date, age, gender, malaria area, malaria area and section. The malaria field supervisor also checks whether the data on the forms correspond with the labels on the blood smears collected for screening of malaria. The malaria field assistants complete the forms and the malaria field supervisor performs data accuracy checks at the Malaria Control Programme camps. The malaria field supervisor sends the checked data collection forms to the Malaria Control Programme Statistics section in Jozini Office on Fridays.

The quality control officer at the receiving and dispatching room in the Statistics section performs general data accuracy checks in a similar way to the malaria field supervisor. The quality control officer then sends the data collection forms to the data capturers, to be entered into the MIS database. Once the data capturers have entered the data into the computer, the malaria information officer uses general data accuracy checks to determine the arithmetic of the cases, proper dates and field completion. The malaria information officer then uses specific data accuracy checks to determine time trends consistency; trend variation; minimum and maximum values of ages, dates, years and number of screened malaria patients; and comparisons of the number of malaria cases by areas, sub-districts, months and malaria transmission seasons.

4.3.5 Data flows

Figure 2 shows the data flow chart for malaria case detection and investigation data collected by the malaria field assistants on Mal2, Mal3 and Mal4 forms. The malaria field assistants submit the forms to the malaria field supervisor who performs data accuracy checks. The malaria field supervisor sends the forms to the receiving and dispatching section in Jozini offices for checking and verification. The receiving and dispatching section then sends the forms to the data capturers to be entered into the computer. When the data capturers enter the data, the computer system allocates each malaria case a survey ID. The data capturers send the data collection forms together with blood smears to the laboratory technologists to test for malaria and to identify the type of malaria parasite that caused the infection. The laboratory staff sends the test results and the forms back to the data capturing room. The data capturers enter all malaria positive blood smears from the forms into the MIS database as cases. The malaria information officer accesses the data and performs data accuracy checks and sends the data in a report form to the Malaria Control Programmes, the provincial and national departments of health, and other users who request the MIS information.

Figure 2: The Malaria Information System data flow chart



MCPMs = Malaria Control Programme managers
DoH = Department of Health

4.3.6 Data analysis and interpretation

Analysis of the MIS data is carried out locally by the malaria information officer who uses MS Access or Excel programs to produce aggregated data of number of malaria cases and deaths per area (20 demarcated malaria geographical areas) and district. When necessary the data is analysed by age, gender and month. The malaria information officer carries out data analysis on a weekly and monthly basis for production of reports. The Malaria Control Programme managers analyse the data into graphs and tables in MS Excel on a demand basis. The malaria information officer and the Malaria Control Programme managers interpret the data by determining which areas, districts, age groups and gender and months are highly affected by malaria.

Apart from data produced in the weekly and monthly reports, all other users do their own data analysis and interpretation. The national Department of Health interprets the MIS data by producing tables and graphs showing the number of cases and deaths by month, province and year. The users themselves undertake graphical presentation of data. The MRC, Health GIS Unit, produces malaria distribution maps when required. The malaria distribution maps are used to enhance visual clarity.

4.3.7 Data reporting, timeliness and usefulness

The Malaria Control Programme in Jozini office is charged with the responsibility of storing, analysis, retrieving and communicating the MIS information. The malaria information officer produces written weekly reports printed on paper showing the total numbers of malaria cases and deaths by district. Monthly reports are produced in the same way but include the total malaria cases and deaths by week, method of detection and magisterial district. The written reports produced by the malaria information officer are distributed through a fax machine to different users. These users include the Malaria Control Programmes, the Jozini Health District Office directorate, and provincial and national departments of health, the MRC and the HSRC. The national Department of Health produces a monthly report, *The National Malaria Update* (Appendix 5). This report is published on the government website (http://196.36.153.56/doh/issues/malaria/updates).

4.4 MIS DATA QUALITY

The results are presented under each of the methods used to assess quality of the MIS data.

4.4.1 General data accuracy checks

Table 5 presents results from the assessment of quality of the MIS data using general data accuracy checks for each of the 25 MIS data fields that were checked. A personal communication with the MIS database manager revealed that the structure of the MIS database is being revised. This includes decisions regarding the four fields with no data. The results show that none of the data fields in all the 2473 electronic records sampled, required assessment of the arithmetic values. Again, all the data were correctly entered in the right places or data fields. Six of the 25 fields (24%) had missing data items.

The field Farmname had seven blanks (2% errors) in January. The fields Section and Housenumber had missing data items in all months except in October. The percentage of data errors in the two fields was higher in December than in all other months (Table 5). The fields Source of infection, Source magisterial district and Source health district had missing data items in all 12 months. The percentage of errors in these three fields ranged from 10% to 49% throughout the months. The annual percentage of errors was the same for all three fields. It was not possible to differentiate between missing data items and unknown data items for the three fields as blanks represented both the unknown and missing data items.

The same applies to the field Age. In this field, blanks are used to represent unknown age. The percentage of errors was less than 20% for January to March, but was above 30% from April to August and December. The percentage of errors for September to November was above 25% but less than 30%. The overall percentage of errors for all the months combined is 0.3% for the field Farmname, 5% for the field Section and 7% for the field Housenumber. The overall percentage for each of the remaining three data fields is 27%.

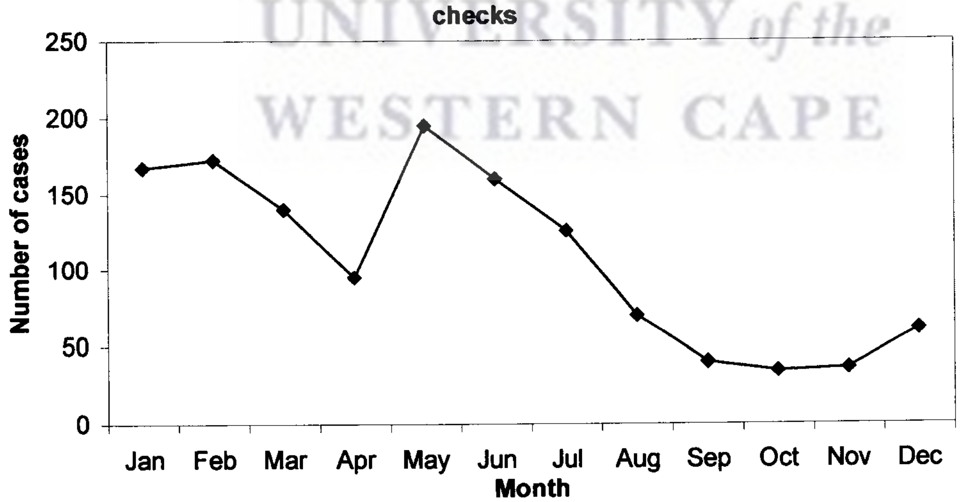
Table 5 Errors in the MIS data detected by general accuracy checks

Month	Total in Month	Farm name	Section	House number	Source of infection	Source magisterial district	Source health district
	Number of errors (%)						
Jan	328	7 (2)	11 (3)	25 (8)	48 (15)	46 (14)	46 (14)
Feb	345	-	9 (3)	25 (7)	34 (10)	35 (10)	35 (10)
Mar	272	-	17 6)	24 (9)	46 (17)	46 (17)	46 (17)
Apr	185	-	16 (9)	19 (10)	70 (38)	70 (38)	70 (38)
May	393	-	29 (7)	36 (9)	137 (35)	137 (35)	137 (35)
Jun	313	-	6 (2)	11 (3)	105 (33)	105 (33)	105 (33)
Jul	242	-	13 (5)	14 (6)	77 (32)	77 (32)	77 (32)
Aug	130	-	4 (3)	5 (4)	59 (45)	59 (45)	59 (45)
Sep	63	-	2 (3)	4(6)	18 (29)	18 (29)	18 (29)
Oct	52	-	-	-	13 (25)	13 (25)	13 (25)
Nov	55	-	3 (5)	4 (7)	14 (25)	14 (25)	14 (25)
Dec	95	-	17 (18)	19 (20)	47 (49)	47 (49)	47 (49)
Total	**2473**	**7 (0.3)**	**127 (5)**	**186 (7)**	**668 (27)**	**667 (27)**	**667 (27)**

4.4.2 Specific data accuracy checks

Figure 3 presents number of malaria cases in each month in the sample of 1296 electronic records used for an assessment of quality of the MIS data using specific data accuracy checks for 14 fields. Assessment by time-trend consistency shows that malaria cases increase from January to March, decrease in April and increase from May to July slowly dropping as expected. Malaria cases for April are lower than expected. This does not represent an error. In March 2000, KwaZulu-Natal experienced floods. During floods the larvae of the malaria-transmitting mosquitoes were swept away from the breeding sites. This reduced the numbers of mosquito populations and thus malaria transmission, as it is seen in April. Another reason for this low number of cases in April is that in March the same year the Malaria Control Programme started to use DDT insecticide to spray houses. This also reduced the numbers of mosquito populations spreading malaria. Data accuracy check applying time-trend variation shows a slight decrease in malaria cases between May and June. No inaccuracies were detected using time-trend consistency method.

Figure 3 Sample of malaria cases used for specific data accuracy checks



Use of minimum-maximum values for notification date, malaria season, year, week number, month, age, section and method of detection were entered properly within the range of values required for each field. The range for malaria area section is normally 1-10, but in some places the values are entered as 'P1-P4' or 'ORS'. This does not represent an error, but sections in the Pongola magisterial district. The maximum age field was entered as '999'. This is not an error, but it is used in the case where the age of the malaria patient is not known. The maximum value in the data was 90 years if data accuracy checking excluded the value of '999'. This age falls within the range of expected ages for the population covered by the MIS.

Data accuracy checks using comparisons reveal that during the months of January to July the number of malaria cases were above 100 except in April. Normally there is a sharp decrease from June to November. As expected, comparison of malaria cases by area shows a high number of cases in Makanis, Muzi, Ndumu, Magwanga and Sihangwana. This corresponds with reports on the incidence of malaria in the Jozini Health District (Martin *et al*., 2002; le Sueur *et al*., 1997; Sharp & le Sueur, 1996) (Appendix 6). Comparison by magisterial district shows that 780 of malaria cases occurred in Ingwavuma, 499 in Ubombo, 14 in Pongola and one in Ngotshe. Comparison by health districts reflects that the Jozini Health District had more malaria cases than other health districts.

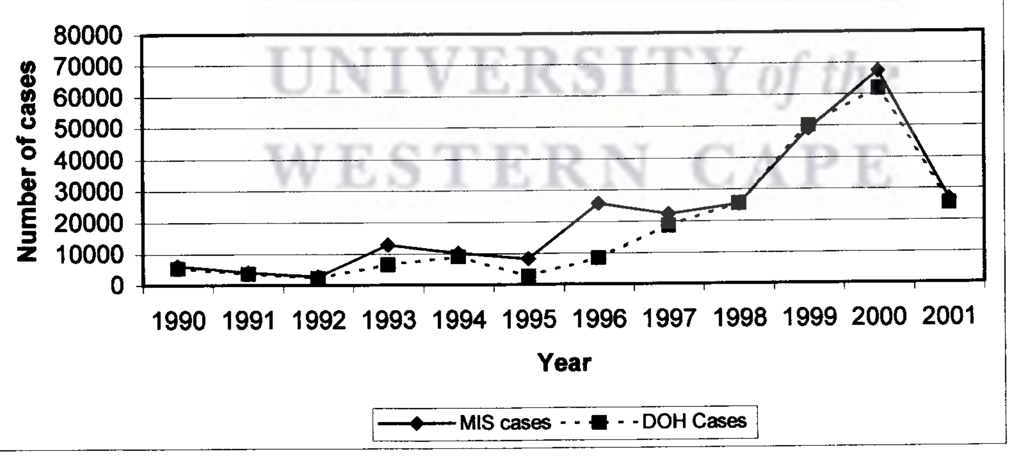
Comparison by age group shows that the highest number of malaria cases occurred in the 5-9 (194 cases) and the 10-14 (234 cases) year age groups. Comparisons by sex reveals that 58% of malaria cases occurred in females than in males. All these comparisons represent expected values and therefore not errors. The researcher used parts versus whole to check data accuracy in the field names month, sex, age, notification area, and notification magisterial district and notification health district. The totals in each field category add up to the total in that field reflecting no error.

Preferential end-digits checking method was applied to check for data accuracy in age field. No errors were found in this field.

4.4.3 Validation of malaria case notifications

The quality of the MIS data was assessed by comparing malaria case notifications reported by the national Department of Health published in the *Epidemiological Comments* and the *National Malaria Update* (1990-2001) (DOH cases) with malaria cases stored in the MIS database (MIS cases). Figure 4 shows annual malaria cases for South Africa for 1990-2001. The pattern of malaria incidence is similar for both the MIS cases and the DOH. However, the DOH reported lower numbers of malaria cases from 1993 to 1997. Appendix 7 shows malaria cases for the same years for South Africa for each data source including the differences in the number of malaria cases and the percentage differences between the two sources.

Figure 4 Annual malaria cases for South Africa 1990-2001



In all the years except 1998 and 1999 the number of malaria cases reported in the MIS cases exceeded the number of malaria cases reported in the DOH cases. Major differences between the two reporting systems occurred in 1993, 1995 and 1996.

During these years the percentage of the differences between the MIS cases and the DOH cases ranged from 49% in 1993 to 67% in both 1995 and 1996. Similarities in reporting between the MIS cases and the DOH cases occurred during 1998-2001. The magnitude of the differences in reporting during this period was less than 10% (Appendix 7). Figure 5 shows annual malaria cases in each of the MIS cases and the DOH cases for KwaZulu-Natal Province from 1990 to 2001. Appendix 8 shows the discrepancies in reporting between the MIS cases and the DOH cases for KwaZulu-Natal Province from 1990 to 2001. A similar pattern of reporting as for the national total malaria cases occurs in KwaZulu-Natal except that in 1991 the two systems reported similar numbers of malaria cases. Another difference between the MIS cases and the DOH cases is that the DOH reported 21% more cases than the MIS in 2001 in KwaZulu-Natal (Appendix 8).

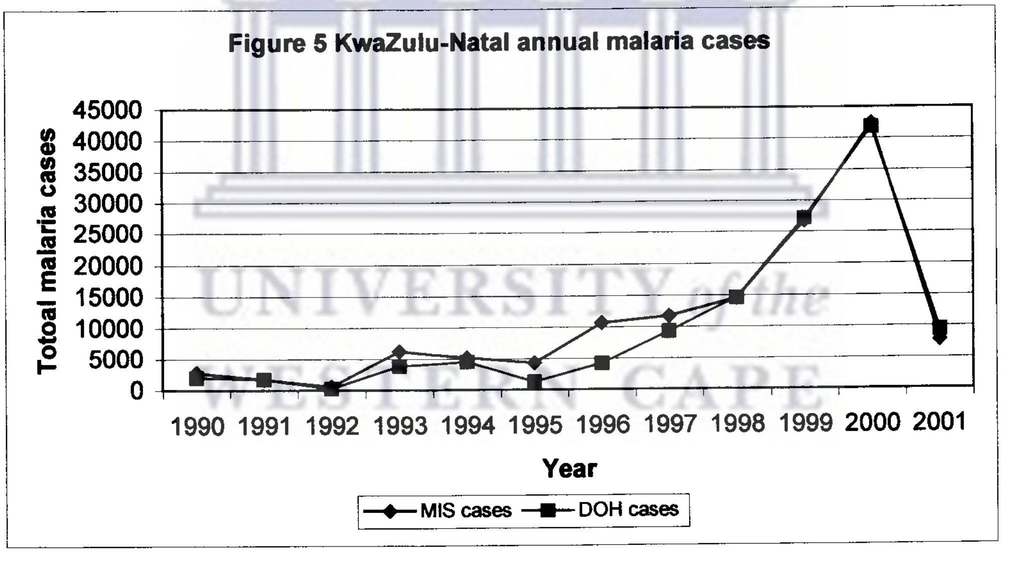


Figure 6 presents annual malaria cases for Mpumalanga Province for the years 1990-2001 in each of the MIS cases and the DOH cases. Appendix 9 shows the discrepancies in reporting between the MIS cases and the DOH cases for Mpumalanga Province for the same years. The pattern of reporting of malaria cases in Mpumalanga is similar to that of KwaZulu-Natal Province. There magnitude of the discrepancy in reporting was above 10% in all the years except in 1992 and 1998-1999.

Greater differences in reporting between the MIS cases and the DOH cases occurred in 1991, 1993, 1995 and 1996. The difference between the two provinces is that in 2000 and 2001 in Mpumalanga the MIS reported 18% and 23% respectively more cases than the DOH.

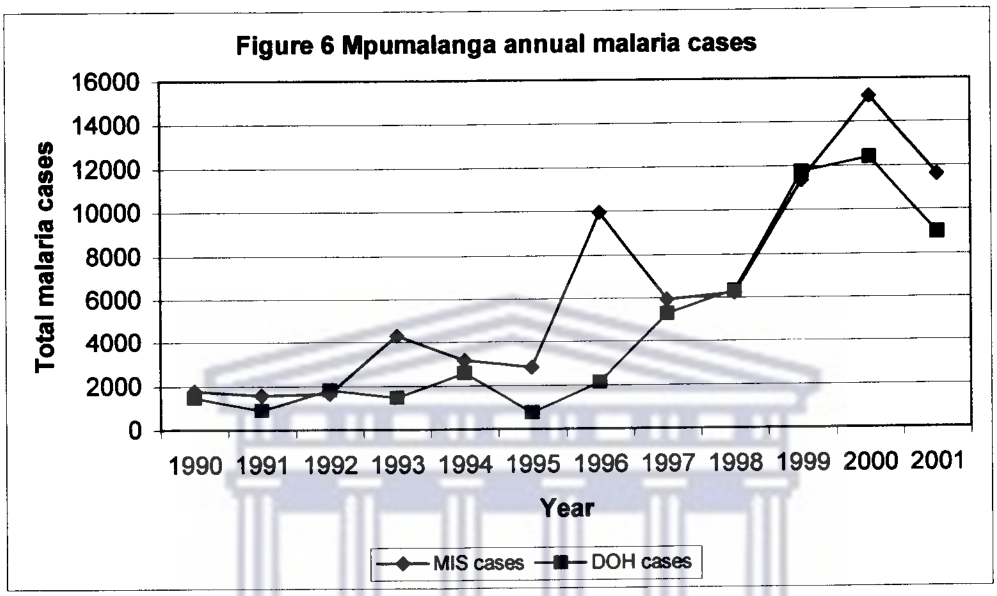


Figure 7 shows annual malaria cases for 1990- 2001 in each of the MIS cases and the DOH cases for Limpopo Province. Appendix 10 shows the discrepancy in reporting between the MIS cases and the DOH cases for Limpopo Province for the same period. The pattern for Limpopo Province is similar to that of KwaZulu-Natal, Mpumalanga and national for all the years except 1990 and 1994. In these years the number of malaria cases were similar in both the MIS cases and the DOH cases. The two systems also reported a similar number of cases in 1998-1999 and 2001. The greatest discrepancies in reporting occurred in 1992-1993 and 1995-1996. In 2000 the pattern of reporting was similar to Mpumalanga in that there were 22% more malaria cases in the MIS cases than in the DOH cases (Appendix 10).

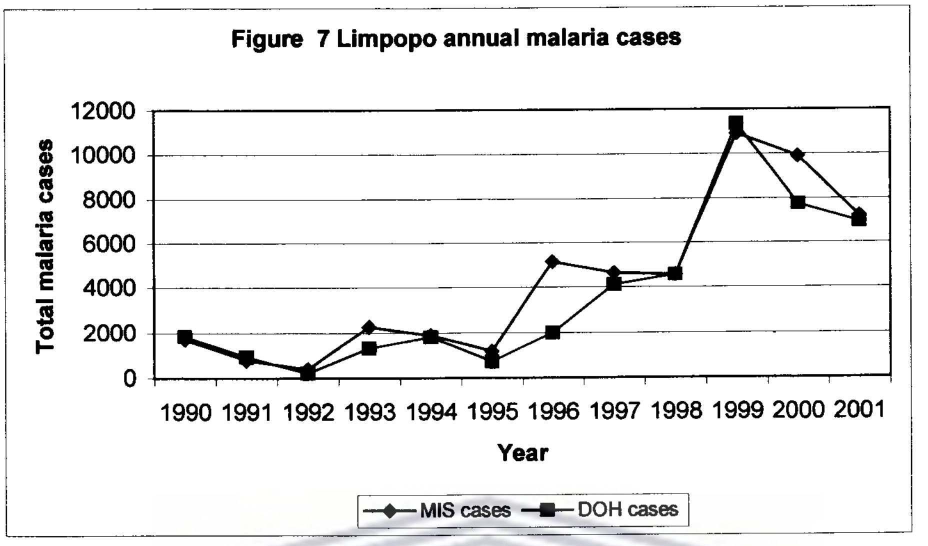


Table 6 presents a comparison of the monthly between the MIS cases and the DOH cases for KwaZulu-Natal Province for 1998-2001. In 1998 both the MIS cases and the DOH cases were similar in all months. In 1999 differences in reporting between the MIS cases and the DOH cases existed in March, June, July, September, October and December. The magnitude of these differences was, however lower than 40%. Similar reporting of malaria cases between the MIS and the DOH occurred in the year 2000 in all months except December. The MIS reported a few malaria cases than the DOH in 2001 in March and June – September. During these months the percentage of the differences in reporting between the two systems ranged from 49% to 387%. In November and December 2001 The MIS reported more cases than the DOH.

Chapter 4 presented a description of the respondents of the rapid survey of key informants. Then described the MIS components based on the responses from the rapid survey and document review. The chapter concluded with results from the assessment of the MIS data quality. Chapter 5 provides a synthesis and interpretation of the results. The researcher uses this interpretation to assess the MIS as a public health surveillance system.

Table 6 Monthly discrepancies between the MIS cases and the DOH cases for KwaZulu-Natal Province, 1998-2001

Month	Difference in malaria cases between the MIS and the DOH (%)			
	1998	1999	2000	2001
Jan	-9 (-1)	-15 (-1)	48 (1)	-119 (-6)
Feb	-6 (0)	-60 (-3)	32 (1)	-56 (-4)
Mar	-6 (0)	-454 (-14)	50 (1)	-456 (-49)
Apr	-5 (0)	267 (10)	0 (0)	-41 (-3)
May	66 (3)	118 (2)	-83 (-1)	-70 (-9)
Jun	-1 (0)	-570 (-20)	10 (0)	-313 (-62)
Jul	0 (0)	503 (18)	294 (7)	-168 (-49)
Aug	0 (0)	-43 (-3)	-61 (-3)	-104 (-62)
Sep	-9 (-3)	-308 (-31)	-58 (-8)	-426 (-387)
Oct	0 (0)	411 (28)	-13 (-1)	5 (5)
Nov	-6 (-1)	-31 (-4)	60 (5)	21 (12)
Dec	-2 (0)	-314 (-21)	331 (22)	95 (34)

CHAPTER 5 – DISCUSSION

5.1 CHAPTER OVERVIEW

Chapter 5 focuses on Objective C, which corresponds with the fifth CDC task. The chapter provides an assessment of the performance of the MIS in terms of the criteria listed in the fourth CDC task: simplicity, flexibility, data quality, acceptability, sensitivity, representativeness, timeliness, reliability and availability and usefulness of the MIS information.

5.2 SIMPLICITY OF THE MIS

Simplicity of a public health surveillance system refers to both its structure and ease of operation (CDC, 2001). The MIS is simple in that the data flow is straight forward with a few lines of response. For example, the MIS starts with the malaria field assistants, who collect the data, then pass them on to data receiving and dispatch section to check for accuracy. The data receiving and dispatch section sends the data to the data capturers, the malaria information officer and then to the Malaria Control Programme managers and other users. There are only 16 data items collected on the malaria data collection form (MAL2).

The form is easy to use as some data fields are pre-coded and it is legible. Many malaria field assistants who identify malaria cases in the field have no formal education, but were trained to use the portable malaria equipment. The data are entered into an already available data input screen, which is simplified by drop-down lists. The MS Access and MS Excel software used to enter and manage data are easy to use.

Data capturers had only matric level education and in-house training on the software, but can use the software and produce reports. Minimal staff training requirements in operating the system is needed. The problem is that although the computer systems change all the time, the data capturers mentioned that they have received training in computer skills only once during their employment. During introduction of new computer programs, the data capturers have to adapt to these changes without receiving training in these new programs. This could result in delays and could affect the reliability and availability of the MIS.

The MIS uses computers to store, retrieve, analyse and present data, and this has numerous advantages (Campos-Oucalt, 1991; Martin *et al.*, 2002; WHO, 1994). For example, it would have been an almost impossible task to sort, process, analyse, manage and present the more than 35 000 malaria cases that occurred in the year 2000. The WHO (1994) recommends that the computerized component of an information system should be operated with local resources. With the exception of the GIS experts and information technology support service that is based at the MRC Durban, the MIS is operated with local human resources.

However, the fact that the information technology support system is located more than 300 km from the Malaria Control Programme offices in Jozini means that the computer support may not be available when required. This could affect the data capturing process and the timeliness of the MIS data. Another problem is that the malaria information officer responsible for the MIS in Richards Bay is also performing data capturing duties. This could slow down the information process component of the MIS and therefore affect the reliability and the availability of the MIS. The amount of the MIS information communicated to decision-makers in the weekly and monthly reports is restricted to total malaria cases and deaths by district, and method of case detection.

This avoids excessive accumulation of forms and reports often generated during data processing and production using modern techniques such as photocopying and faxing (WHO, 1994).

5.3 FLEXIBILITY OF THE MIS

A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds (CDC, 2001). For example, it was simple to accommodate a spatial aspect of the MIS (GIS component) into the system in the early 1990s without additional malaria field assistants and resources except training the malaria field assistants on how to use a hand-held global positioning system (GPS) to map the homesteads they visited (le Sueur *et al.*, 1997; Martin *et al.*, 2002). The MIS is also able to adapt to forever changing computer hardware and software. For example, initially the MIS data was entered into the Dbase IV package and maps were produced within lower versions of Windows and MapInfo packages. Currently the MIS data is processed within Windows 2000 using MS Access, MS Excel and MapInfo Professional 6.

5.4 MIS DATA QUALITY

Assessment of the MIS data quality using general data accuracy checks revealed that there were no errors in the majority of the MIS data fields. The researcher found a negligible amount of errors in three of the six fields detected with missing data items. This would not affect the MIS data quality dramatically. The other three fields, which relate to the source of malaria infection, had 27% errors. The missing data items were left blank because many malaria patients cannot identify the place where they have acquired malaria infection. These people are afraid of being identified as illegal immigrants since there is a free movement between the South African, Mozambican and Swaziland borders. The information on the source of malaria infection is required to determine whether the source is local or imported. This information is important to Malaria Control Programme managers to provide proper control measures, as these differ according to country. However, the use of blanks within the MIS is confusing because a blank space is used to indicate both the missing data items and unknown answers. It was not possible to determine from the 27% of missing data items which ones represented unknown answers and the actual errors. All other fields checked had minimal errors and it is therefore, expected that these three fields would have a similar percentage of errors.

No errors were detected when using specific data accuracy checks. Personal communication with the MIS database manager indicates that plans to restructure the MIS database are underway. The plans will involve all stakeholders and the people include in the collection, data capturing and management of the MIS data. This will include technical people to help with the design of the MIS database. The researcher hopes that the inconsistencies that were detected in the MIS dataset will be addressed soon. This will further enhance the quality of the MIS data.

What is of concern is the fact that there were discrepancies between the national Department of Health malaria case notification system and malaria cases stored in the MIS database. The greatest discrepancies in reporting occurred during the years 1993-1996 which coincides with the transformation of the South African national health system. This transformation included integrating all previous departments of health into one system. Data reported in both the MIS cases and the DOH cases were similar for the years 1998-1999 indicating improvements in the reporting systems. However, in the years 2000-2001 the magnitude of the discrepancy between the two reporting systems was approximately 20% in each of the three provinces. This discrepancy is unacceptably high. The aggregated pattern for national malaria cases in the two reporting systems were however, similar and so the differences in absolute numbers may not affect planning and decision-making at this level. Furthermore, these discrepancies were noted when the MIS cases and the DOH cases were compared by month in KwaZulu-Natal for the years 1999-2001. Although the results of the data accuracy checks revealed insignificant errors in the MIS dataset, the magnitude of the discrepancies in reporting of malaria cases in the respective provinces in the years 2000-2001 is unacceptable. At the national level these discrepancies are hidden by the aggregation of malaria cases. At the provincial level the problem of the discrepancies in reporting of malaria cases could affect allocation of resources and result in wastage or under-supply. This problem requires urgent attention. In spite of these discrepancies, there are reasons to believe that the MIS provides good quality data. First, the fact that the MIS information is being used, means that it is easy and quicker to detect errors by the users of information. This may also lead to rapid improvements in data quality (WHO, 1994).

Secondly, the WHO (1994) states that supervision of data collection activities is important to maintain the quality of a service, as well as for improving staff morale, knowledge of skills through on-the-job training. The malaria field supervisors who are in turn supervised by team leaders who report to the Malaria Control Programme managers supervise the malaria field assistants in the field. This ensures that quality data are collected. Finally, the work practices contribute to collection of accurate data. For instance, the malaria field assistants collect data on Mondays and Tuesdays and then pass the data on to the malaria field supervisor, thus minimizing the probability of recall bias (preferential end-digits).

5.5 ACCEPTABILITY OF THE MIS

Acceptability reflects the willingness of the persons and organizations to participate in the surveillance system (CDC, 2001). The MIS is acceptable in that the level of participation by all stakeholders (the communities, the data collectors and data users) both internally and externally is high. The malaria field assistants mentioned that they were never refused entry into any household indicating that the community members accept the system. The malaria field assistants, malaria field supervisors and other people involved with data collection for the MIS mentioned that they accept the system and understand its purpose. Most personnel have been working with the MIS for as long as 25 years. The MRC has been fully committed with the MIS for the past 14 years. The MRC has been involved with training of the Malaria Control Programme staff. Other roles of the MRC include assistance with the development of the computer-based MIS and designing of the MIS data entry screen. This indicates that the MRC as one of the participants in the MIS is accepting the system. However, the involvement of the MRC with the MIS does not mean that the MIS is completely dependent on the MRC. Should the MRC decide to withdraw, the MIS will still continue to exist.

The Malaria Control Programme managers who use the MIS information mentioned that the MIS is "100% relevant" for malaria control activities. The reporting of data is timely and the health facilities are also involved in collecting data on passive malaria cases. There is also a growing public interest in South Africa and internationally regarding malaria which impacts heavily on tourism and development in South Africa. This has ensured that reports of the MIS information are regularly published in the media such as the radio, television and newspapers (Mail & Guardian, 2000; Sunday Times, 2001).

5.6 SENSITIVITY OF THE MIS

Sensitivity here refers to the ability of the MIS to detect malaria outbreaks including the ability to monitor changes in the number of cases over time (CDC, 2001). The MIS is sensitive in that the data is collected, analysed and reported weekly while at the same time case investigations are carried out on all malaria cases reported.

The epidemiological and geographical component of the MIS enables the system to detect outbreaks and monitor malaria cases, particularly during the malaria transmission season. For example, the MIS was able to detect the major outbreaks that affected South Africa since 1996. The malaria outbreaks have been monitored with further research, regional collaboration, local and international mobilization. Changes in malaria control policy only came to place in 2000/2001 after the major outbreak in 1999/2000 malaria season, which resulted in more than 300% increase in malaria cases.

This is not because the MIS was not sensitive to outbreaks. The reason is that research was going on to test alternative drugs to replace the existing drugs that have developed resistance. Another reason is that change in policy is a lengthy process that involves both political and international approval, particularly the use of DDT. The Malaria Advisory Committee decided that the homesteads located in areas with a high incidence of malaria should be sprayed with DDT insecticide since the mosquitoes have become resistant to the pyrethroid insecticide that was currently being used. Another example is that a new drug replaced the existing malaria treatment drug.

5.7 REPRESENTATIVENESS

The MIS is representative in that it accurately describes malaria cases over time (week, month, malaria season and year) and describes malaria distribution in the population by place (province, district and malaria control area) and person (age and gender). For example, it is possible to show that malaria in KwaZulu-Natal is restricted to those districts along the borders (Ingwavuma and Ubombo). Furthermore, that the highest burden of malaria occurs in Ingwavuma District, which is, located closer to Mozambique and Swaziland. It is possible to show that within Ingwavuma there are four malaria areas, which carry the highest burden of malaria such as Ndumu, Makanis etc. (Martin *et al.*, 2002; Sharp & le Sueur, 1996).

It is also possible to show that the age groups mostly affected by malaria are children and the elderly and that the malaria season occurs during the months of September-June. Apart from being implemented in the Mpumalanga and Limpopo Provinces, the MIS has also been established in other Southern African countries such as Zambia, Mozambique and Swaziland.

5.8 TIMELINESS

The MIS data is timely in that it is reported weekly so that actions can be followed up. Malaria patients detected by active surveillance are referred to health facilities for treatment. Timeliness is an important factor given the nature of malaria disease, which requires prompt action to prevent deaths. To avoid delays in data reporting and treating malaria ceases, the malaria control field assistants use rapid malaria diagnostic tests to detect cases and refer for treatment. The active surveillance component of the malaria surveillance makes it possible for the data to be collected timely and actions be taken promptly. Even passively detected malaria cases are reported weekly. The reports to Malaria Control Programme managers and the provincial and national Departments of Health are produced weekly and monthly. These reports are transmitted electronically by fax, which also enhances timeliness of data reporting.

5.9 RELIABILITY AND AVAILABILITY (STABILITY)

The MIS is very reliable in that it is able to collect, manage and provide data without any failure and has been in operation since the 1980s. Furthermore, it is available when needed. Although, the Malaria Control Programme computer system in Jozini is occasionally disturbed by power failure, particularly during the rainy season, the MIS is fully supported both in terms of parts, service and amount of time required to repair the system. Since the MIS is run independent of the district health information system, the resources (human, hardware and software and finances) used to manage the MIS are committed for this purpose only. Therefore, there is no problem of shortage of such resources due to competition with the district health information system. This ensures reliability and availability of the MIS so that necessary public health action can be taken. The MIS data is available to the public in a summary form on the MRC (http://www.malaria.org.za) and the national Department of Health websites for those who wish to check information or analyse it.

5.10 MIS DATA USEFULNESS

The MIS is simple, flexible, acceptable and reliable and therefore, useful for public health action. The indicators within the MIS are useful, reliable, appropriate, valid, easy to measure and specific. The targets, which these indicators measure, are specific, measurable, appropriate, and reliable and time-bound (SMART). The MIS data is used to detect malaria cases, permit accurate diagnosis, prevention and timely treatment. It also provides estimates of the magnitude of malaria morbidity and mortality including factors associated with transmission of malaria. It is also possible to detect trends in changes in malaria transmission including malaria outbreaks. The MIS information allows the Malaria Control Programme managers to carry out operational plans for malaria control (Appendix 11).

The Provincial Malaria Control Programme managers use the MIS information to monitor the malaria situation in KwaZulu-Natal and to allocate resources, while the national Sub-Directorate for Control of Vector-borne Diseases uses the MIS information to assess the malaria situation in South Africa. For example, during the 1999/2000 malaria season when South Africa was affected by the worst malaria epidemic from those experienced in the earlier years, due to both drug and insecticide failures (Bredenkamp *et al*., 2001; Hargreaves *et al*., 2000), a change in policy took place based on data from the MIS. First, the DDT insecticide was reintroduced to replace the pyrethroid-based insecticide that had failed to control a re-emerging species of mosquito that spread malaria. Secondly, *Co-Artem*®, a new drug for malaria treatment was introduced to replace *Fansidar*®, a first line malaria treatment drug that demonstrated 60% treatment failure (Bredenkamp *et al*., 2001). Apart from being used for malaria control activities, the MIS data is used by a number of other organizations and other public sectors such as Eskom who used the MIS to design electrification projects in the Jozini Health District, Departments of Public Works and Water Affairs for water planning projects and Tourism (le Sueur *et al*., 1997). The MIS data has stimulated a number of research projects intended to lead to control of malaria both at local, regional and international levels (Curtis *et al*., 1999; Goodman *et al*., 2001; Mnzava *et al*., 2001; Kleinschmidt *et al*., 2001).

CONCLUSIONS

The MIS is not subjected to many of the problems that are commonly seen in many routine health information systems such as collection of large volumes of data that are not used. The MIS is a simple, flexible, acceptable, reliable and sensitive system and provides timely data for addressing an important public health problem, malaria. The MIS data quality is satisfactory, but there is room for improvement. However, to ensure a continued efficiency and effectiveness of the MIS and to enhance data quality a few recommendations are suggested below.

RECOMMENDATIONS

- The Malaria Control Programme in Jozini is responsible for storage, analysis, retrieving and communicating the MIS information from all other districts in KwaZulu-Natal. However, this task rests on the shoulders of one malaria information officer, who also has other duties within the Malaria Control Programme as an environmental officer. It is recommended that at least one person be allocated to assist the current malaria information officer. This person could be responsible for the MIS in the Jozini Health District and the current malaria information officer could be responsible for the overall management of the MIS in KwaZulu-Natal. This will ensure reliability and availability of the MIS even when the current malaria information officer is absent on other matters involving malaria control.

- The malaria information officer responsible for the MIS in the Malaria Control Programme in Richards Bay is also responsible for data capturing. This could affect the reliability and availability of the MIS data. It is recommended that at least one person be appointed to assist with data capturing process so that the malaria information officer could be responsible for management of the MIS data. This will ensure that the MIS data is available when needed.

- The data capturers in Jozini have indicated that they have received training in software once during their employment with the Malaria Control Programme. Regular training of data capturers is recommended for them to be able to cope with developments in computer systems that occur all the time.

• A computer software support system is needed at the local level to ensure reliability and availability of the MIS. This person could attend to simple problems and then the computer support system in the MRC Durban could attend to major system problems. It is also recommended that a knowledgeable technician implement change in the MIS database that would allow the system to reap the many rewards of standard relational database design.

• Since it is not possible to differentiate between missing items and unknown items in some of the fields within the MIS dataset, it is recommended that a code be used to represent unknown items. This would simplify the process of data accuracy checking.

• The discrepancy in reporting of malaria cases between the MIS cases and the DOH cases seem to have improved during 1998-1999 at both the provincial and the national levels. However, the magnitude of the discrepancy in reporting of malaria cases between the MIS cases and the DOH cases in 2000-2001 is concealed by the aggregation of the totals at the national level. At the provincial level, this discrepancy in reporting of malaria cases for these years is of such a great magnitude that it requires immediate investigation.

• The Malaria Control Programmes do not have a manual of how the MIS operates. It is therefore, recommended that a manual be developed. This manual should state objectives and indicators of the MIS and include procedures of how data is collected and managed; components; data elements; definitions and plans for training.

• The MIS needs to be evaluated regularly by people outside the system, but in collaboration with all the stakeholders. This will ensure that the MIS promote the best use of public health resources.

- Further research on data accuracy checks is recommended. This could compare the laboratory diagnostic results conducted at the clinics and the malaria laboratory in Jozini with results from the rapid malaria tests conducted in the field by the malaria field assistants. This would reduce mis-diagnosis and over- or under-reporting of malaria cases, thereby avoiding wastage or under-supply of resources.

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APPENDIX 2 INTERVIEW SCHEDULES

Interview schedule for malaria field assistants (MFAs)

Evaluation of the malaria information system (MIS) in KwaZulu-Natal

1. General

1.1 Date of collection your data collection activities--

1.2 Have you ever been denied entry into a household --

1.3 What were the reasons for not allowing you into the households --

----

1.4 Respondent position--

1.5 How long have you been working as a MFA?--

1.6 Highest level of education of respondent--

1.7 Duties of respondent as a MFA--

----

2. Assessment of data collection tool and system acceptability

2.1 When do you visit each homestead? --

2.2 How often do you visit each homestead? --

2.3 How many homesteads do you visit per day--

2.4 What happens if there is no one in the homesteads--

2.5 If you need to return, how soon will that be?--

2.6 Is there anyone supervising --

2.7 What other problems are you faced with when you visit the household?--

----

2.8 How do you get to each homestead?--

2.9 What materials do you need to collect data?--

2.10 How do you carry the materials to the homesteads?--

2.11 Have you ever received any training since you joined the MCP as a MFA?--

2.12 What type of training was that?--

2.13 Do you know why you are collecting this information?--

----

3. Data flow and data use

3.1 What do you do with the data collection forms after filling them in?--

----

3.2 Who checks the forms for accuracy?--

3.3 How are the data checked for accuracy?--

THANK YOU FOR YOUR ASSISTANCE!!

Interview schedule for Malaria Control Field Supervisors (MFSs)

Evaluation of the malaria information system (MIS) in KwaZulu-Natal

1. General

1.1 Date of collection --

1.2 Respondent position--

1.3 How long have you worked as a MFS---

1.4 Age of respondent --

1.5 Highest level of education of respondent--

1.6 Duties of respondent as a MFS--

2. Supervision of MFAs

1.1 How many field assistants are you responsible for?---

2.2 How often do the field assistants get training---

2.3 What is the duty of a field assistant--

2.4 How many areas are you responsible for?-------- ---

2.5 Which areas are you responsible for?---

2.6 Please describe your daily activities? ---

2.7 How often do you have feedback from your field assistants? ---

----

2.8 Do you have to go to the field yourself?--

2.9 When are you required to go to the field ---

2.10 What happens to the data collection forms when the field assistants have returned from the field?-----------------

----

2.11 Who checks for data accuracy of the forms?---

2.12 How are the data accuracy checks done?---

2.13 How often are the data accuracy checks done?---

2.14 How many types of forms are used to collect and report the MIS data ---

----

2.15 Do you have any comments that you think would improve the data collection process of the MIS and the malaria control in general?-

----

THANK YOU FOR YOU ASSISTANCE!!!

Interview schedule for malaria information officers (MIOs)

Evaluation of the malaria information system (MIS) in KwaZulu-Natal

1. General

1.1 Date --

1.2 Respondent position--

1.3 Highest level of education of respondent---

1.4.Duties of respondent as a MIO--

1.5 Do you have any previous training that you have received relating to your current duties-----------

----

----

2. Data collection tools

2.1 How many forms are used to collect data for MIS---

2.2 Name the forms--

2.3 Who designed the data collection forms?--

2.4 Who designed the computer data input screen?--

2.5 Where do the MFA get the data collection forms?--

2.6 What happens to the data collection forms from the field?---

----

(Include a copy of the information flow diagram if possible)

3. Data accuracy and analysis

3.1 Who checks the data for errors, spelling and quality after collection?---------------------------------

3.2 How are data errors, spelling and quality checked?--

3..3 Who enters the data into computer?--

3.4 How long does it take before data is entered into a computer after collection?------------------------

----

3..5 How are data managed after collection?---

3.6 What computer programs are used to manage (enter and store) and analyse MIS data?---------------

----

3.7 Who analyses the data?---

3.7 How is data analysis done?--

3.9 How often is data analysis done?--

3.10 What happens to the data after analysis?--

----

4. Data interpretation, data timeliness, reporting and dissemination

4.1 Who interprets the data?---

4.2 Who produces the reports? ---

4.3 How many types of reports are produced?---

4.4 Name the types of reports ---

4.5 In what form are these reports produced? ---

4.6 How often are these reports produced? --

4.7 How are the reports distributed--

4.8 To whom are the reports distributed--

4.9 Are the reports produced timely when required? ---

4.10 If no, why?--

4.11 Do you have any comments (problems or suggestions) regarding the MIS that would help improve the system -------------------------------------

----

THANK YOU FOR YOUR ASSISTANCE!!!

Interview schedule for Malaria Control Programme Managers (MCPMs)

Evaluation of the malaria information system (MIS) in KwaZulu-Natal

1. General

1.1 Date ----------

1.2 Respondent position----------

1.3 Highest level of education of respondent----------

1.4 Duties of respondent as a MCPM----------

2. Data elements, indicators and relevance

2.1 Who designed the MIS data collection forms?----------

2.2 Which indicators within the MIS are used to show improvements in malaria situation? ----------

2.3 Why have you chosen these indicators? ----------

2.4 What are the objectives of the MIS?----------

2.5 Is the MIS data relevant to achieve the goals of the MCP?----------

2.6 Do you have a field manual and guidelines for collection of the MIS data?----------*(ask for a copy of the manual)*

2.7 How many types of forms are used to collect and report the MIS data ----------
(ask for copies)----------

3. Data flow, analysis, interpretation

3.1 How many staff members are involved in the MIS data collections and maintenance?----------

3.2 Please give the staff position and numbers in the table below (*these are given as a guide please fill in the correct positions that apply to your area, please do not include the spray men)*

Position	Total number	Responsible for (numbers)	
		Staff	Areas or sections
Malaria Control Managers			
Malaria team leaders			
Malaria field supervisors			
Malaria surveillance agents			
Malaria information officers			
Malaria statistics officers			
Laboratory technicians			
Data capturers			

3.3 Who analyses the MIS data ?--

3.4 How is data analysis carried out?--

3.5 How often is data analysis carried out?--

3.6 Who interprets the MIS data?--

3.7 For what purpose is the interpretation done?--

3.8 How often do you produce reports?--

3.9 How many types of reports are produced?--

3.10 Are the reports produced timely to make any decisions based on the information within the reports--

----

3.11 Who is responsible for producing the reports?--

3.12 How are the reports distributed?--

4 Data usefulness

4.1 Who uses the MIS data? --

4.2 What are the MIS data used for?--

4.3 In what form is the data used?--

4.4 What type of decisions do you make based on the MIS data ?--

----

4.5 Has the MIS been used to influence policy?--

4.6 If yes, please specify--

4.7 Comments (problems or suggestions) that would improve the MIS data

----

THANK YOU FOR YOUR ASSISTANCE!!!

APPENDIX 3 MIS DATA COLLECTION FORM (MAL2)

MAL 2

CASE DETECTION SURVEY : WEEKLY REPORT

☐ SPECIAL SURVEY
☐ PASSIVE DETECTION
☐ MASS BLOOD EXAMINATION
☐ ACTIVE SURVEILLANCE
☐ EPIDEMIOLOGICAL SURVEY

CASE NO.: ______________

LAB. REF. NO.: ______________

SUB-OFFICE: ______________ DISTRICT: ______________ WEEK

WEEK ENDING: ______________

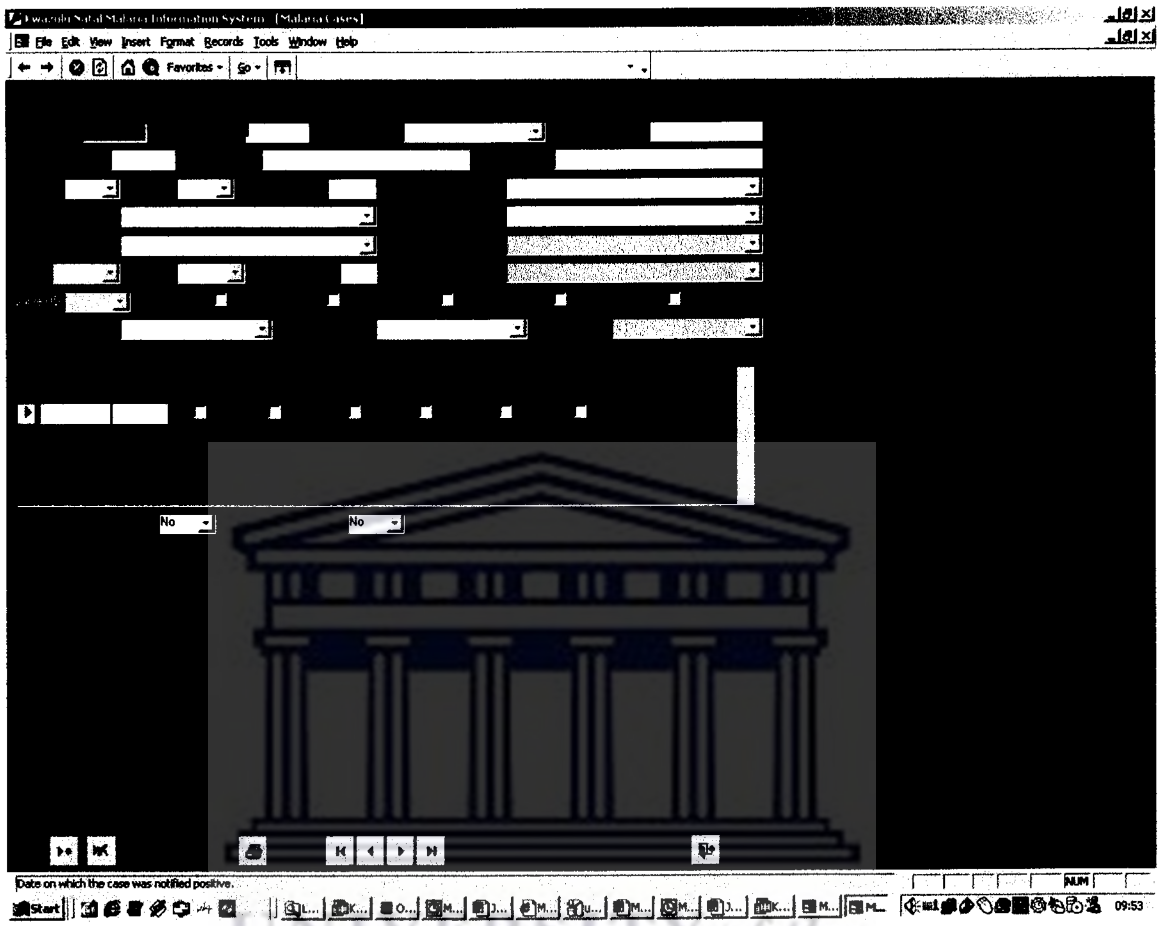
DATE	AREA/ FARM NAME	SECT NO.	HIS NO.	BLOODSMEAR TAKEN FROM NAME	AGE	SEX	SMEAR NO	SMEAR TAKEN BY	RESULT					S WS H	V1 V2
									NEG	PF	PM	PO	MIX		

NB (a) If smear is taken in a farming area the name of the farm must be given under the area (column 2)
(b) Smears should preferably be taken on suspected cases (ie persons from) neighbouring states and people with a temperature.

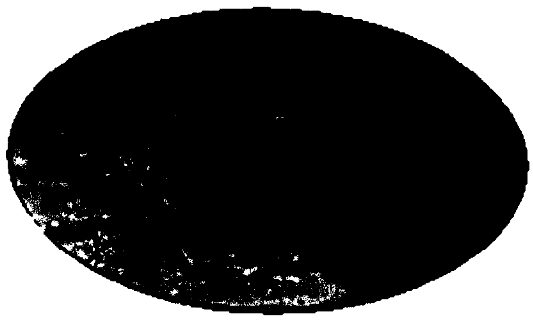
S = SICK WS = WAS SICK H = HEALTHY
V1 = VISITED V2 = VISITOR

SMEARS TAKEN BY: ______________

APPENDIX 4 THE MIS DATA INPUT SCREEN



APPENDIX 5 MONTHLY REPORT OF THE NATIONAL DEPARTMENT OF HEALTH



NATIONAL MALARIA UPDATE

June 2002

Welcome to the 4th National Malaria Update.

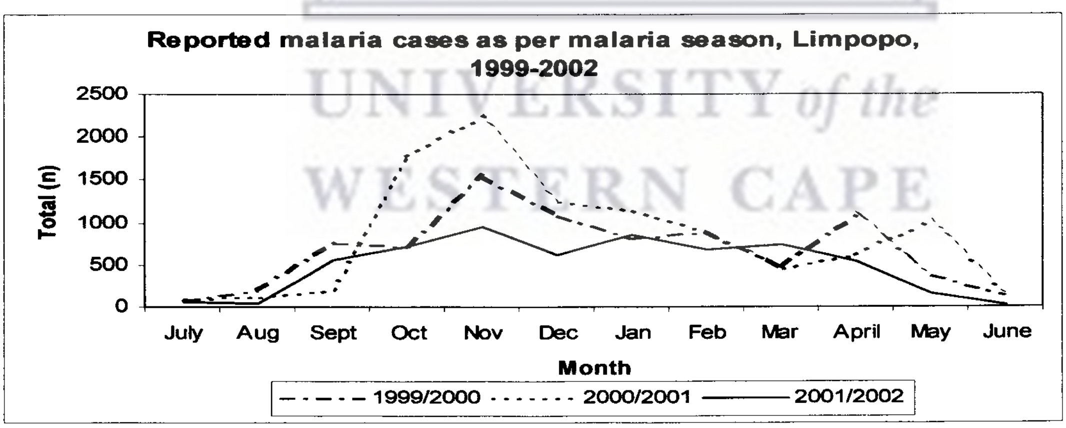
This update serves to represent the current national malaria case and death trends. In addition it provides feedback to a range of persons involved in the malaria programmes. The figures presented are subject to modification and thus changes in previous month data may occur.

For this edition, malaria cases and deaths for the three malaria affected provinces in South Africa as well as for the rest of the country are presented. The total number of malaria cases reported as per malaria season for 1999/2000, 2000/2001 and 2001/2002 are provided below. In South Africa, malaria transmission occurs from October to May and is therefore defined as the "malaria season". However, annual comparisons of data is recorded and graphed presented from July to June. The provinces have been consulted for comments regarding the general trends. Inputs or comments regarding the data interpretation are welcomed.

This update is the last one for the 2001/2002 malaria season. However, the figures presented for June may alter due to changes made after follow-ups have been conducted and data has been cleaned. The analysis of the 2001/2002 season will be conducted in the following update. Please note that no data was received from the rest of the country hence it was not included in this update. Generally, the number of reported cases for June is considerably lower than that of May as a result of it being low malaria transmission period. Provincial malaria programmes are winding down with staff making use of this time to take leave.

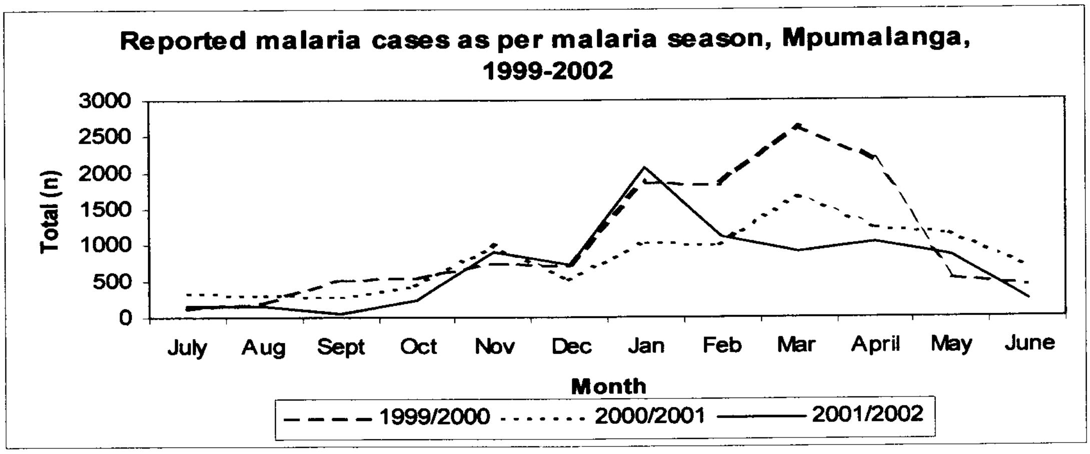
<u>Limpopo</u>

For the month of June, 14 malaria cases were reported. This figure is 12 times lower than that reported for June 2001. It is expected that the number of reported malaria cases for June will increase following the incorporation of late reported data. From July 2001 – June 2002, 71 deaths were notified resulting in a case-fatality rate of 0.8%. This rate is higher than the National target of 0.5%. The reason for this increased case-fatality rate needs to be investigated. A few factors that affect case-fatality rate include: inappropriate case management, and late reporting to a health facility. Several amendments were made to previously reported data for the month of March, April and May with additional cases and deaths having been reported.
Current activities include: servicing of pumps, preparation for spraying and training and cross-border collaboration with Zimbabwe. All malaria microscopists were vaccinated against Hepatitis B.



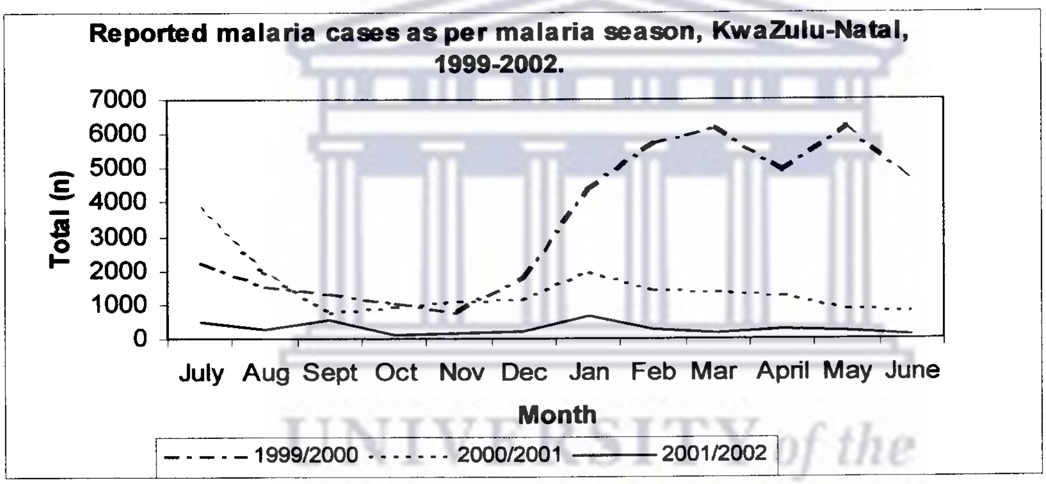
<u>Mpumalanga</u>

A total of 226 cases were reported in Mpumalanga for the month of June. A high number of cases 67% (151/226) are still being reported from the Tonga health district. More than half (57%) of these reported cases from the Tonga district are from three facilities - namely; Tonga Hospital (reported 24), Komatipoort Municipal Clinic (reported 44) and Strydomblock Muncipal Clinic (reported 18). One death was reported from the Tonga hospital, Tonga district. Only one case was reported from Sabie.
The case fatality rate for the current season is 0.3%.

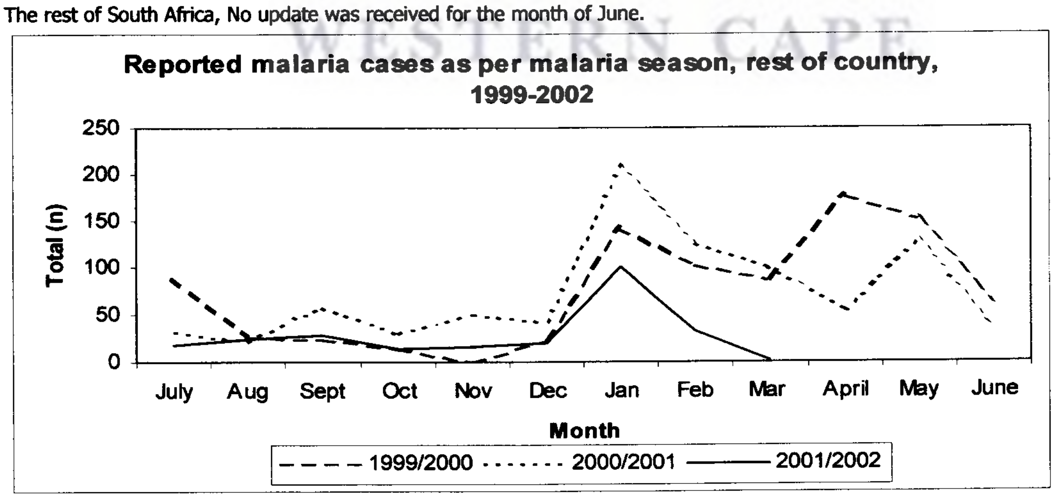


<u>KwaZulu-Natal</u>

A total of 99 malaria cases were reported for June 2002. More than half (55%) of these reported cases were from the South. The majority of passive malaria cases reported from the South are from occupants in the Durban and Pietermaritzburg area whilst the active cases are from farm laborers in the surrounding area. A large number of these passive and active cases are imported from neighbouring countries. The number of reported cases in the Ingwavuma area has decreased by 77% (103 to 24). One death was reported fro Benedictine in Pongola for June. Malaria control duties as well as health education continue in the area.

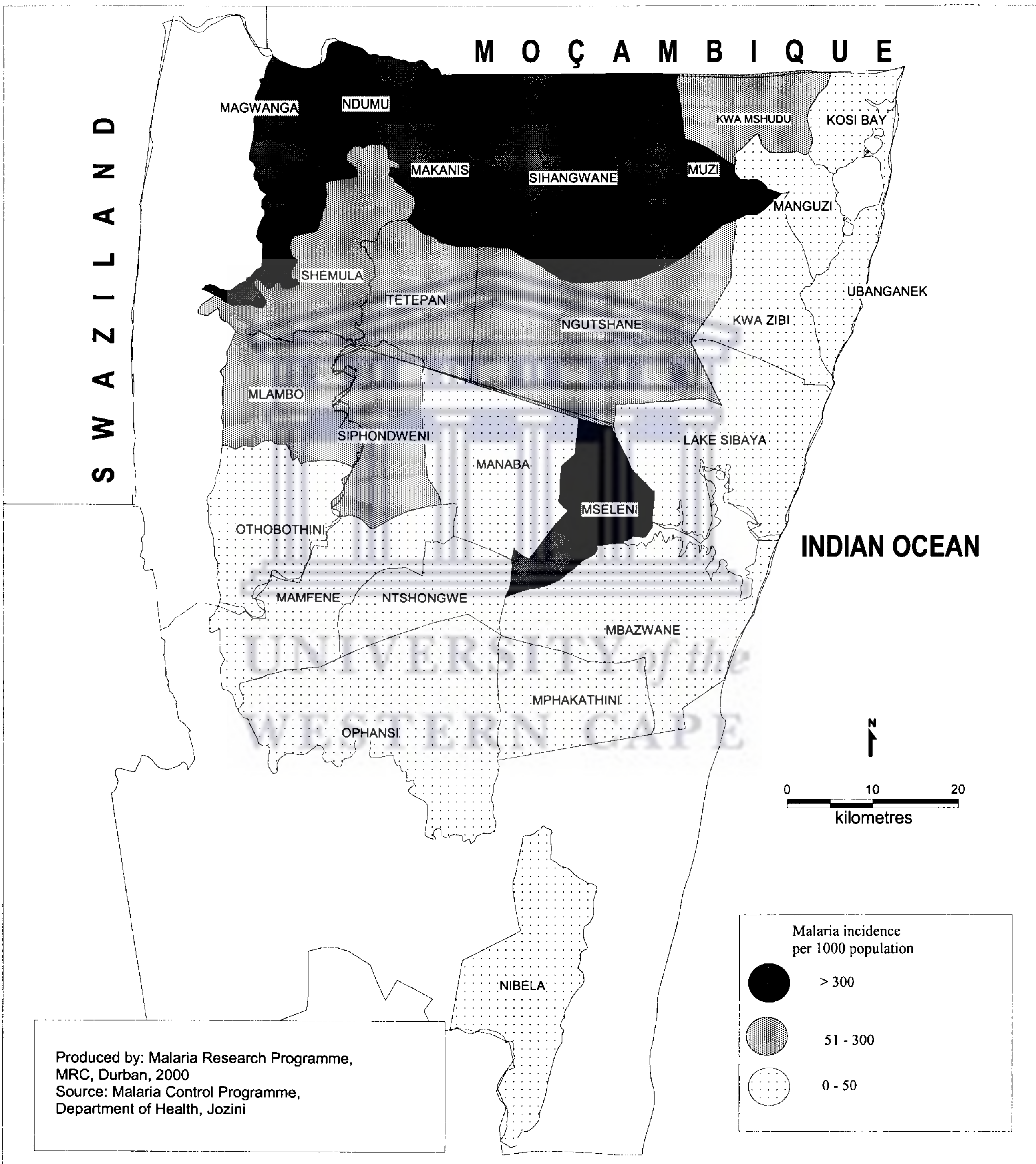


The rest of South Africa, No update was received for the month of June.



Compiled by the National Malaria Control Programme, National Department of Health, with the assistance of the Provincial Malaria Control Programme Managers
Please contact Ms Johnson for any enquiries at tel no: (012) 312-0046 or e-mail: johnsc@health.gov.za

APPENDIX 6 MALARIA CASE INCIDENCE IN JOZINI HEALTH DISTRICT, 1998/1999



APPENDIX 7 DISCREPANCIES IN REPORTING OF MALARIA CASES BETWEEN THE MIS CASES AND THE DOH CASES FOR SOUTH AFRICA, 1990-2001

Year	MIS cases	DOH cases	Difference	% Difference
1990	6212	5372	840	14
1991	4087	3565	522	13
1992	2614	2322	292	11
1993	12825	6583	6242	49
1994	10254	8921	1333	13
1995	8251	2718	5533	67
1996	25732	8406	17326	67
1997	22261	18694	3567	16
1998	25310	25480	-170	-1
1999	49022	50321	-1299	-3
2000	67482	61934	5548	8
2001	26630	25337	-1293	-5

APPENDIX 8 DISCREPANCIES IN REPORTING OF MALARIA CASES BETWEEN THE MIS CASES AND THE DOH CASES FOR KWAZULU-NATAL PROVINCE, 1990-2001

Year	MIS cases	DOH cases	Difference	% Difference
1990	2743	2044	699	25
1991	1740	1751	-11	-1
1992	586	299	287	49
1993	6264	3833	2431	39
1994	5207	4544	663	13
1995	4279	1276	3003	70
1996	10627	4267	6360	60
1997	11690	9317	2373	20
1998	14517	14575	-58	0
1999	26742	27238	-496	-2
2000	42396	41786	610	1
2001	7811	9443	-1632	-21

APPENDIX 9 DISCREPANCIES IN REPORTING OF MALARIA CASES BETWEEN THE MIS CASES AND THE DOH CASES FOR MPUMALANGA PROVINCE, 1990-2001

Year	MIS cases	DOH cases	Difference	% Difference
1990	1756	1478	278	16
1991	1562	888	674	43
1992	1660	1812	-152	-9
1993	4299	1452	2847	66
1994	3149	2573	576	18
1995	2820	740	2080	74
1996	9940	2130	7810	79
1997	5912	5273	639	11
1998	6214	6332	-118	-2
1999	11363	11741	-378	-3
2000	15184	12390	2794	18
2001	11596	8943	2653	23

APPENDIX 10 DISCREPANCIES IN REPORTING OF MALARIA CASES BETWEEN THE MIS CASES AND THE DOH CASES FOR LIMPOPO PROVINCE, 1990-2001

Year	MIS cases	DOH cases	Difference	% Difference
1990	1713	1850	-137	-8
1991	785	926	-141	-18
1992	368	211	157	43
1993	2262	1298	964	43
1994	1898	1804	94	5
1995	1152	702	450	39
1996	5165	2009	3156	61
1997	4659	4104	555	12
1998	4579	4573	6	0
1999	10917	11342	-425	-4
2000	9902	7758	2144	22
2001	7223	6951	272	4

APPENDIX 11 OPERATIONAL PLANS OF THE MALARIA CONTROL PROGRAMME IN JOZINI HEALTH DISTRICT

DEPARTMENT OF HEALTH – KWAZULU-NATAL
ENVIRONMENTAL HEALTH DIRECTORATE
MALARIA CONTROL PROGRAMME
KEY RESULT AREAS FOR 2002/03

VISION

- To achieve optimal health for all persons in KZN

MISSION

- To develop and maintain a sustainable, efficient and cost effective malaria control programme, which promotes community participation so that the potential threat of malaria, is minimized.

OJECTIVES

A. To ensure maintenance of malaria mortality rate at 0.05 per thousand population at risk.
B. To ensure that the incidence of malaria remains at or below 10 cases/1000 population at risk
C. To ensure and maintain zero transmission in areas presently free of the disease
D. To ensure that operational research is responsive to the problems of the disease

OBJECTIVE A

TO REDUCE MALARIA MORTALITY FROM 0,07 TO 0.05 PER THOUSAND POPULATION AT RISK.

ACTIVITIES	INDICATOR	TARGET DATES
1. Facilitate training of nurses on proper case management through early diagnosis and prompt treatment according to guidelines.	Number of nurses trained	30 November 2002.
2. Facilitate the provision of malaria treatment guidelines to all clinics in the malarious areas.	Number of health facilities with guidelines.	30 July 2002.
3. Facilitate training of CHWs and the development of a manual for CHWs to clinically recognize signs of malaria creation.	Number of CHWs trained Training manual.	31 December 2002.
4. Facilitate the awareness creation amongst Umkhanyakude communities on recognition of symptoms and importance of compliance with treatment.	No. of H/Education actions Cross section sectional survey.	31 July 2002 & angoing.
5. Facilitate free supply of bednets to pregnant mothers in malaria high risk areas.	Number of bed net supplied.	30 June 2002.

OBJECTIVE B

TO REDUCE THE INCIDENCE OF MALARIA TO BELOW 10 CASES/THOUSAND POPUTATION AT RISK.

ACTIVITIES	INDICATOR	TARGET DATES
1. Facilitate the in door residual spraying to at least 90% of all structures in identified areas with an effective insecticide.	Number of structures sprayed.	31 Dec 2002.
2. Facilitate training of newly recruited and existing spraymen.	Number of spraymen trained	31 August 2002.
3. Facilitate the distribution survey and population dynamics of the vector mosquito in the operational areas.	1st half yearly report.	31 December 2002.
4. Facilitate capacity building all EHPs within MCP.	Number E.HP's trained.	31 October and ongoing.
5. Facilitate the impregnation of bednets.	Number of bednets impregnated.	28 February 2002
6. Facilitate the IEC to reduce man vector contact.	Number of H/Ed actions	30 April & ongoing.

OBJECTIOVE C

TO MAINTAIN ZERO TRANSMISSION IN AREAS PRESENTLY FREE FROM THE DISEASE

ACTIVITIES	INDICATOR	TARGET DATES
1. Facilitate quarlity randomized Entomological surveys in Emp/Richard's Bay health district.	Entomological reports.	31 December 2002.
2. Facilitate all the classification of all malaria cases to determine whether they are local or imported (source of infection)	Number Cases classified.	30 April & ongoing.
Facilitate the delivery of the information through articles in printed media for informed decision making.	Number of articles published.	30 April & ongoing.
3. Facilitate the fault at the development of an epidemic preparedness plan to suit existing strata.	Epidemic prepared Epidemic preparedness plan.	30 November 2002.

OBJECTIVE D

FACILITATE THE OPERATIONAL RESEARCH (SOTHAT IT IS) RESPONSIVE TO THE PROBLEMS OF THE DISEASE.

ACTIVITIES	INDICATOR	TARGET DATES
1. Facilitate the drug efficacy studies COARTEM.	Report.	30 June 2002.
2. Facilitate the assessment of the efficacy of insecticides used in the spraying programme.	Report.	28 February 2003 and ongoing.
3. Facilitate KAPB studies to determine gaps in the knowledge of malaria.	KAPB/study report	30 September 2002.
4. Facilitate faces parasite prevalence Studies to determine the paraseateamia presence in the communities.	Prevalence maps.	30 January 2003.
5. Facilitate assessment of possible insecticide resistance in vector populations.	Reports.	31 January 2003 and ongoing.