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**Epidemiological Estimates of Infectious diseases in KwaZulu-Natal**

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## **Editorial**

I am very pleased to write the editorial of the second issue of the Epidemiology Bulletin on the estimates of the major infectious diseases for Kwazulu-Natal. The burden of the infectious diseases is considerable and the impact of HIV/AIDS and TB is likely to affect the health system even more in the near future. Therefore, difficult decisions are required on how to use scarce resources cost effectively. The Epidemiology Bulletin aims at providing sound statistics for the planning process and the Italian Cooperation is glad to have supported the first two issues through the contributions of Dr Mariani and Dr. Vella.

The Italian Cooperation has always considered the strengthening of the capacity in the data collection and analysis as the cornerstone of our collaboration with the DOH. We share with the Department of Health the awareness that the final goal is to use information to identify health problems and priority interventions, so that resources are used according to sound planning. For this reason we are providing support to the Epidemiology Unit and the Health Informatics Directorate. Epidemiology is critical for the analysis of health problems and the identification of the right strategies and we congratulate Dr. Thilo Govender for her efficiency, enthusiasm, competency and leadership in covering this important area.

As a final observation, let me stress the importance of creating adequate links with the relevant research institutions operating in KwaZulu-Natal. The share of information among these institutions is essential to improve the epidemiological estimates. The Italian Cooperation is keen in joining the efforts of the Department of Health in expanding the information base by providing the technical and material support within its own capability.

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**Glossary of epidemiological terms**

<i>Accuracy</i>	An estimate is accurate when it represents the true value.
<i>Age specific rates</i>	The rates for specific age groups are derived by dividing the number expected in each age group (numerator) in a certain population and year, by the average mid year population in the same age group (denominator).
<i>Bias</i>	Flaws in the data yielding conclusions that depart from the truth.
<i>BOD</i>	The Burden of Disease (BOD) is the estimation of the contribution of each disease to the burden of ill health. It can be measured through morbidity and mortality or other comprehensive measures like the DALYs.
<i>Case Fatality Rate</i>	Percent of cases affected by a disease who die from that disease in a period of time.
<i>Causes of death</i>	One or more causes of death can be recorded on a death certificate. The direct/immediate cause of death is the disease, injury and complication that directly lead to death. The contributing cause is whatever is reported between the direct and the underlying cause. The underlying cause is recorded last as the cause that started the chain of events leading to death. When more than one cause is reported, the underlying cause is considered the primary cause of death.
<i>Clinical epidemiology</i>	While epidemiology is focused on the general population, clinical epidemiology is focused on the patient. The clinical epidemiologist uses epidemiological techniques to take decisions on the basis of the probabilities that an individual has a disease. For example, the probability of having a disease given certain symptoms and risk factors is used to arrive at a diagnosis. Decision on how to treat a patient is related to the probability that specific therapeutic actions will produce a positive outcome.
<i>Cohort/longitudinal study</i>	Collection of information on the same population followed up over a period of time.

<i>Cost-effectiveness</i>	The cost of an intervention divided by the benefits obtained, such as the cost per death avoided or the cost per DALY gained.
<i>DALYs</i>	The Disability Adjusted Life Years measure the number of years of life lost because of disability and premature mortality.
<i>DisMod</i>	Disease Model to ensure consistency between disease incidence, prevalence, recovery and mortality rates.
<i>Efficacy</i>	The benefits expected from an intervention in trial conditions such as 85% cure rate from applying the TB Direct Observed Therapy (DOT) in experimental/pilot conditions.
<i>Effectiveness</i>	The benefits expected from an intervention in operational conditions such as 70% cure rate of TB when applying DOT in the health services.
<i>Efficiency</i>	The benefits obtained from a certain use of human and material resources. For example, if DOT in a given district has produced a TB cure rate of 70% in 2000 and 50% in 2001, and the human and material resources assigned to DOT have not changed, efficiency has declined.
<i>Endemic</i>	Persistent presence of a disease within a population
<i>Epidemic</i>	Occurrence of events in excess of what is normally expected in a population. The number of cases required to declare an epidemic depends on the number expected to be present in a population and in a period of time (i.e. season).
<i>Epidemic curve</i>	A graph of the number of cases by time.
<i>Epidemiology</i>	The objective of epidemiology is to draw inference on the distribution of health related events and causes in the population to suggest how to prevent and control diseases. Because inference depends on the data sources, the analysis need to be based on data coming from data sources that are representative of the population. These include surveillance systems, longitudinal and cross-sectional surveys, and other data sources. Assumptions and modelling may be required to take into consideration the variation in the estimates and to judge if they are robust.

<i>Epidemiological estimates</i>	Frequency of events in the population incorporating a certain degree of error.
<i>Epidemiological transition</i>	The gradual shift in importance from infectious to chronic degenerative diseases that took place during the last 100 years in industrialized countries.
<i>Evidence Based Medicine</i>	The tracing and validation of relevant research information to identify and quantify the efficacy of diagnostic, preventive and curative interventions.
<i>Hyperendemic</i>	Constant high incidence and/or high prevalence.
<i>Hypothesis</i>	A supposition to be accepted or refuted through testing.
<i>HIS</i>	The Health Information System (HIS) provides data that is collected at various levels of the health system, mainly to improve the management of services.
<i>Incidence rate</i>	Number of new events (i.e. episodes of a disease) occurring in a susceptible population in a period of time (numerator) divided by the number of persons at risk of developing the event (denominator) in the same population during the same period of time. For example, the number of new episodes of diarrhoea developing in a year among children under 5 years of age divided by the population of children under 5 years of age.
<i>Inference</i>	The process of drawing conclusions and generalizations from the results coming from the analysis of the data.
<i>ICD10</i>	10 <sup>th</sup> International Classification of Diseases.
<i>Life expectancy</i>	Average number of years a person of a certain age is expected to live given current death rates.
<i>Modelling</i>	Simplified representation of reality, where real data and assumptions are used to assess the variation in epidemiological estimates. This provides an idea about the degree of uncertainty/error and the robustness of the estimates.
<i>Outbreak</i>	Localized epidemic in a small area such as a village, a neighbourhood or an institution.
<i>Pandemic</i>	An epidemic crossing several countries.

<i>Prevalence</i>	Number of new and old cases in a defined population in a period of time (i.e. one year). For example, the prevalence of hypertension in KZN in the year 2002 is composed of hypertensive cases <sup>1</sup> arising before the end of 2001 but extending into 2002 plus the new cases developing in 2002.
PYLL	The Potential Years of Life Lost (PYLL) is a measure of the years of life lost because of premature mortality. It is estimated by setting a potential limit of life such as 70 years. The PYLL due to a death is equivalent to the potential limit of life (i.e. 70) minus the age at death. For example, in a population where the potential limit of life is 70, each death occurring at 50 contributes to 20 PYLL (70-50). It is a measure of the loss of life due to premature mortality because it is assumed that people dying from a certain disease at a certain age would have lived according to the potential limit of life.
<i>Rates</i>	Number of events divided by the average population during a period of time. Incidence, prevalence and mortality rates are usually expressed per 100,000 population for diseases with a low frequency of events.
<i>Recovery/cure rate</i>	The proportion of cases recovered/cured from a disease.
<i>Reliability</i>	Stability of a measurement in giving the same result when it is repeated under the same conditions. Lack of reliability may depend on the instrument and/or the observer.
<i>Representative of the population</i>	Unbiased statistics of measurable characteristics of a population.
<i>Seroprevalence</i>	The measurement of the prevalence of serum antibodies against antigens (i.e. against HIV antigens) in the population.
<i>Surveillance</i>	Continuous data collection and analysis to measure trends to set up control measures whenever the episodes exceed what is considered normal. Because the main objective is to compare changes overtime, surveillance should provide comparable data that are rapidly analysed for action rather than accurate data to derive incidence or prevalence rates. Surveillance is frequently based on sentinel sites where

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<sup>1</sup> Measured according to cut off points such as minimum and maximum blood pressure  $\geq 90$  and 140 mm Hg.

data are collected on specific indicators such as the annual HIV seroprevalence surveys conducted in antenatal care clinics. Certain programmes such as the TB control Programme have a surveillance system. Health professionals, who have the specific task of dealing with TB cases, collect information related to the TB cases on specific forms. The information is then aggregated into indicators that are used by the TB control programme to monitor the impact of their activities.

This is not to be confused with notification for the same disease (i.e. TB). In the case of notification, there are no specific health professionals assigned to specific programmes. Any health professional diagnosing a suspect case of TB or any other notifiable disease should report it to the relevant authorities. Although formally part of surveillance, notification is less reliable than the surveillance systems set up to monitor specific diseases (i.e. TB). For example, in FY00/01 about 33,000 TB cases were reported by the TB surveillance system of the TB control programme compared with less than 17,000 TB cases reported through the notification system. The lower coverage of case by the notification system is due to the fact that this system depends on the compliance by health personnel in notifying the suspect cases. Because the list of notifiable conditions is long and many of these diseases are frequently not considered worth the efforts of reporting them, most health professionals are unlikely to notify these diseases.

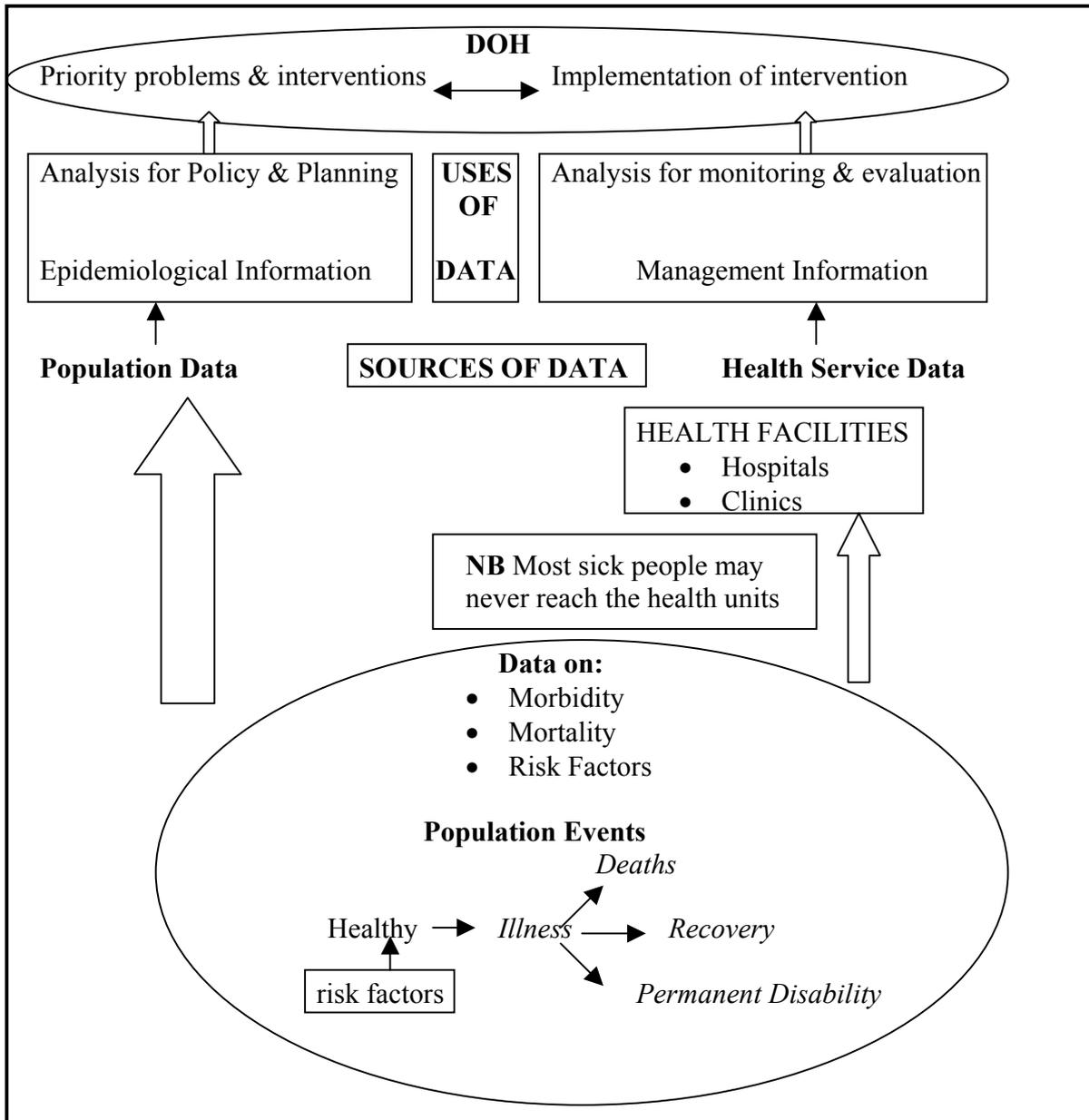
<i>Survey</i>	An investigation in which information is collected from a representative sample of the population.
<i>STI</i>	Sexually Transmitted Infections.
<i>TB</i>	Tuberculosis.
<i>Under-reporting</i>	Failure to report all cases.
<i>Vital statistics</i>	Records related to births, marriages, divorces, separations and deaths.
<i>WHO</i>	World Health Organization.

## Epidemiological Estimates of Infectious diseases in Kwazulu-Natal

### Introduction

When presenting any statistics, it is necessary to keep in mind whether it is needed for planning or management. Planning is the use of epidemiological estimates to identify problems, rank them in order of priority, identify cost-effective strategies and set up plans on how to implement them. Management is the use of indicators to monitor that priority interventions/services are implemented according to plan. Figure 1 provides a representation of the rationale behind the data sources to achieve different objectives.

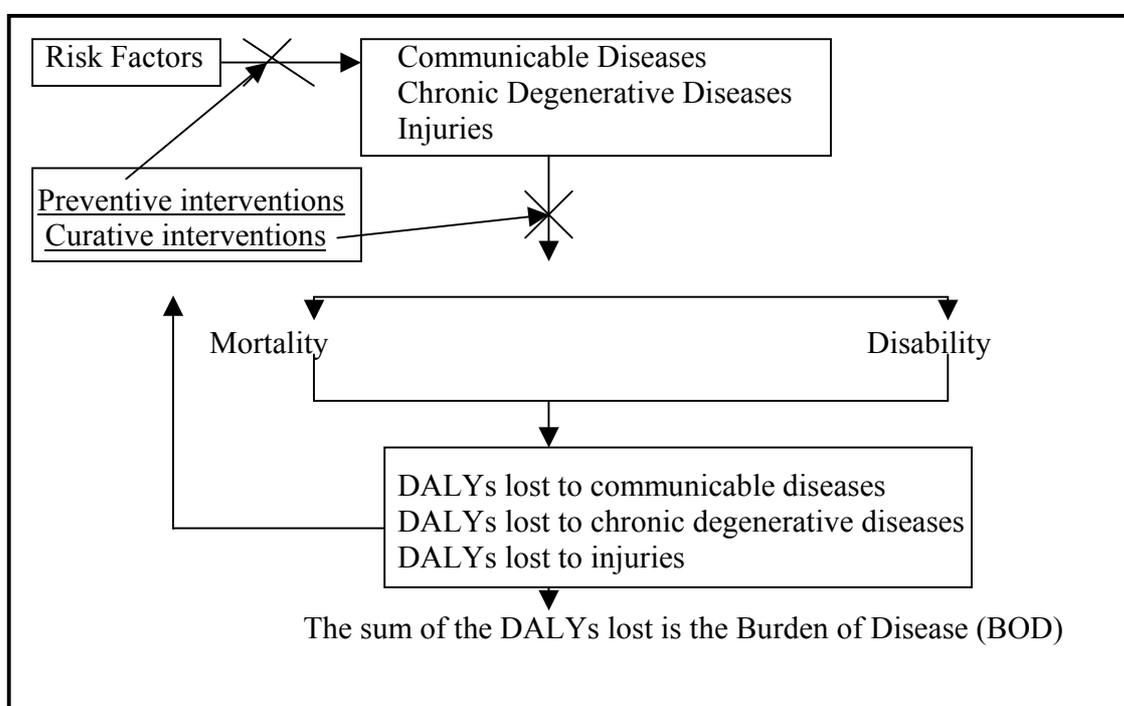
**Figure 1 Data needs for planning & management**



### *Burden of Disease*

A Burden of Disease Analysis uses data from different sources to quantify the major health problems facing a population in a defined geographic area. This is achieved by in-depth analyses of the measures of disease frequency and causes of death in that population. These health events are then standardised using the Disability Adjusted Life Years (DALYs) as the unit of measure to allow comparison and ranking across the disease spectrum (Figure 2).

**Figure 2 DALYs and BOD**



The Disability Adjusted Life Years (DALYs) take into account the years lost because of premature mortality and the years lost because of disability. Each year lived with a disability is equivalent to less than a year lived in full health, with higher levels of disability being associated with a higher portion of a healthy year lost. More details on the DALYs are reported in the expanded version of this issue available on the web site of the DOH. The DALYs are used to rank health problems and to estimate the contribution of risk factors to the BOD.

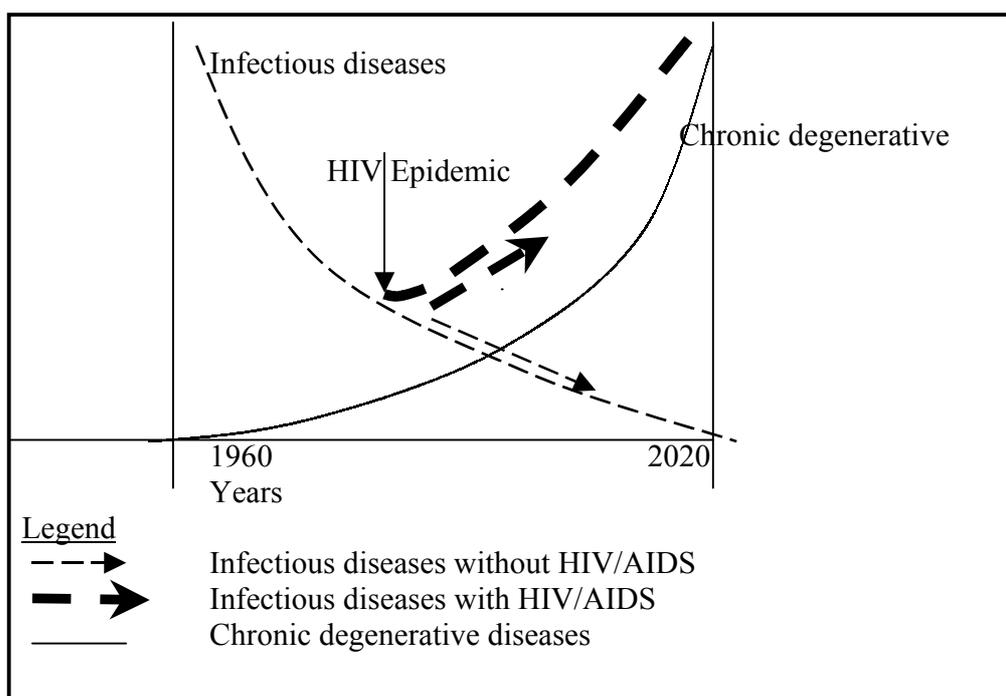
### *Use of the BOD for planning*

The DALY is a comprehensive measure of ill health. Trying to aggregate morbidity and mortality into a common measure of BOD helps to compare the effects of different diseases on ill health. For example, mortality is the most common measure of ill health but it does not provide by itself a comprehensive picture of the burden of ill health. This is due to the fact that there are diseases that are characterized by a high disability and a low mortality. The DALY allows to represent the burden of both mortality and disability and to produce a more comprehensive ranking of health problems.

While HIV/AIDS remains the major problem, the importance of other infectious diseases, chronic degenerative diseases and injuries should not be underestimated. It is therefore necessary to rank so many health problems in order of priority before deciding appropriate cost-effective strategies according to available resources.

This is especially true when both communicable and non-communicable diseases characterize the epidemiological profile. In most developed countries, chronic degenerative diseases have replaced infectious diseases. This phenomenon, known as epidemiological transition, is part of the development process of any country and would have evolved over the next few decades in South Africa too. However, the emergence of HIV/AIDS is likely to complicate the transition with a combined burden of infectious and chronic degenerative diseases as depicted in Figure 3.

**Figure 3**      **Epidemiological Transition**



This and subsequent issues of the Epidemiology Bulletin will focus on the BOD for KwaZulu Natal in the following manner:

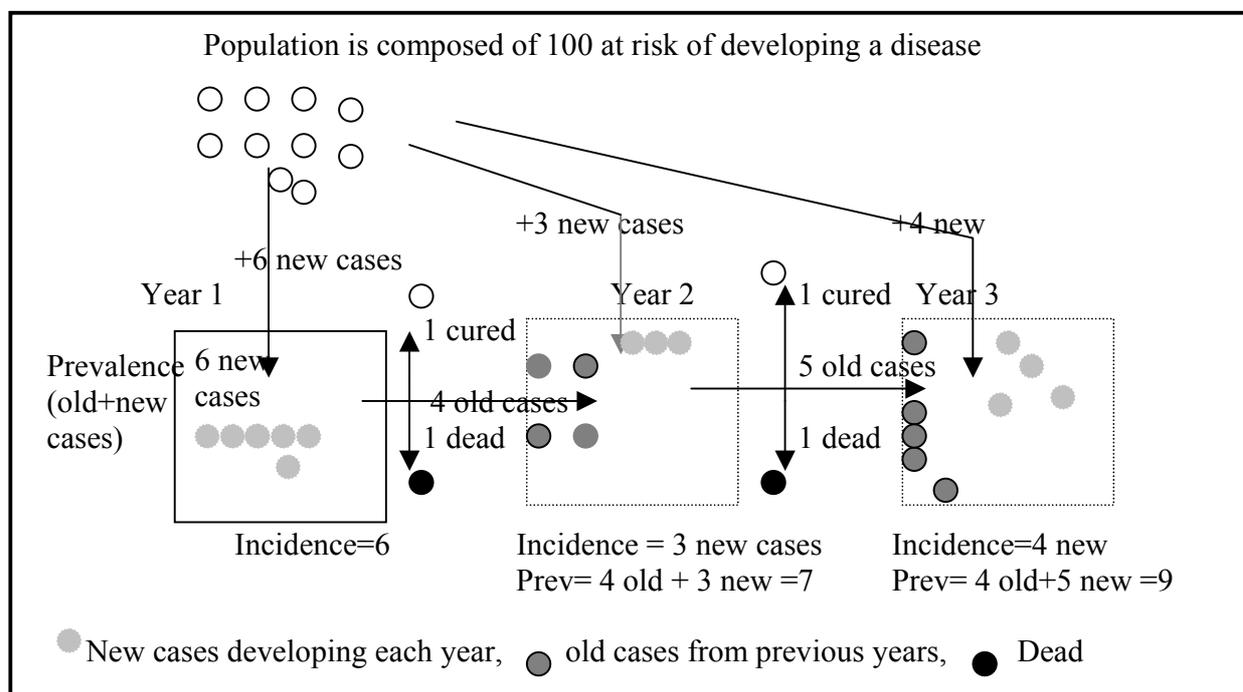
Bulletin No.2:	Infectious Diseases
Bulletin No 3:	Nutritional and Maternal & Child Health conditions
Bulletin No 4:	Chronic Degenerative Diseases
Bulletin No 5:	Injuries

*Measures of the BOD in the population*

The main epidemiological estimates are depicted in Figure 4, where a box represents each year. Incidence is obtained by dividing the new cases by the total susceptible population, while prevalence is obtained by dividing old and new cases by the total population. In the hypothetical population depicted in Figure 4, among 100 individuals, six new cases develop in year one producing an incidence and a prevalence of about 6%. Of the six cases that developed in the first year, one recovers, one dies and four remain sick and enter the second year as “old cases”. During the second year, three new cases develop and incidence is about 3%<sup>2</sup>, which together with the four old cases who did not recover in the previous year make a prevalence (new + old cases) of about 7%. By the end of the second year, one case recovers, one case dies and five old cases enter the third year. In year three, four new cases develop and the incidence is about 4% while the prevalence will be 9% (4+9/100). The mortality rate is obtained by dividing the cases dying by the general population, which in this case is around 1% per year.

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<sup>2</sup> For simplicity sake we assume that each year there are 100 susceptible cases even if in reality the susceptible entering each year are 100 minus the cases who already developed the disease in the previous year.

**Figure 4 Relationship between incidence, prevalence and mortality**

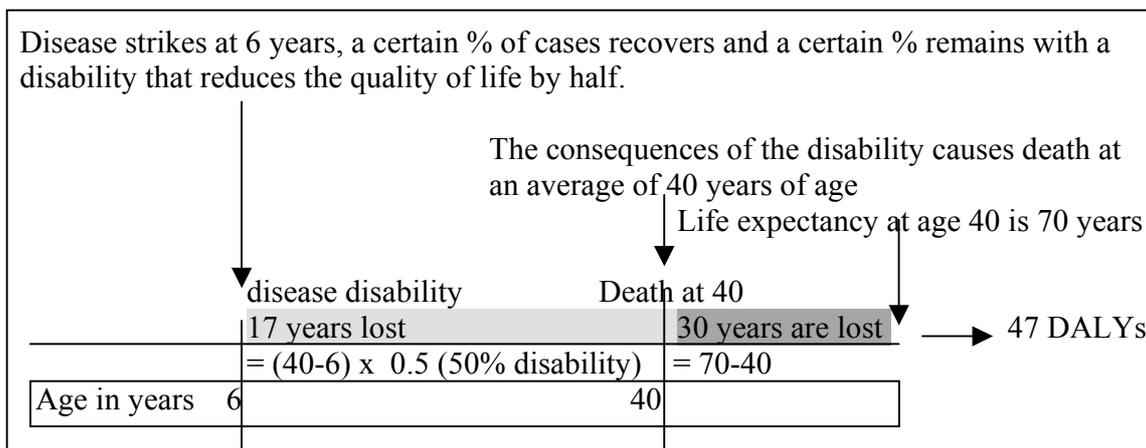
These rates need to be disaggregated by age and gender to rank health problems and to select priority interventions. For example, it is not enough to report that the incidence of TB for KZN was 420 per 100,000 in 2001 because it needs to be disaggregated into age groups and gender. The disaggregation by age is required because one death occurring at a young age is associated with a higher loss of potential years of life than a death occurring at an old age. Such number of years lost is the result of the potential number of years each case would have lived if he/she had not died from the disease.

There are several measures to quantify the loss of years of life. The simplest one is the Potential Years of Life Lost (PYLL) that is estimated by setting a potential limit of life such as 70 years. The PYLL due to a death is equivalent to the potential limit of life (i.e. 70) minus the age at death. For example, in a population where the potential limit of life is 70, each death occurring at 50 contributes to 20 PYLL (70-50). It is a measure of the loss of life due to premature mortality because it is assumed that people dying from a certain disease at a certain age would have lived according to the potential limit of life.

The DALY is a more comprehensive measure compared to the PYLL. The limit of life is not set arbitrary but it is selected according to the life expectancy existing in each age group. The DALYs quantify the loss of life by adding up the number of years lost because of disability and the years lost because of premature mortality. Figure 5, shows a theoretical example where a disease has an average age at onset of 6, produce a disability of 50% that last till the age of 40 when the average patient affected by this disease dies. Each case contributes to a loss of 17 DALYs due to disability, because the

average case lives 34 years with a disability that reduces the quality of life by 50%. The loss due to premature mortality is 30 years because the life expectancy at the age at death is 70 (70-40).

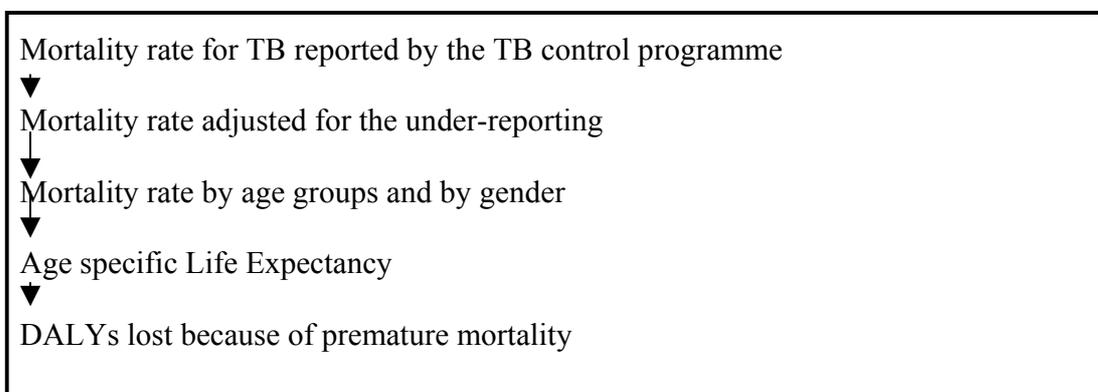
**Figure 5 Theoretical example of loss of DALYs per case of disease**



**Methodology**

The years of life lost is based on the incidence and mortality by age, which must be based on a critical review of the available data as shown in Figure 6. After getting the available estimates of incidence and mortality from several data sources (i.e. TB Control Programme), the rates must be adjusted for under-reporting to get the population estimates. After the rates are disaggregated by age groups and gender, the DALYs lost are estimated according to the life expectancy and the disability weights. The life expectancy is usually available through life tables, while disability weights can be adopted from studies such as the Global Burden of Disease carried out by Murray and Lopez.

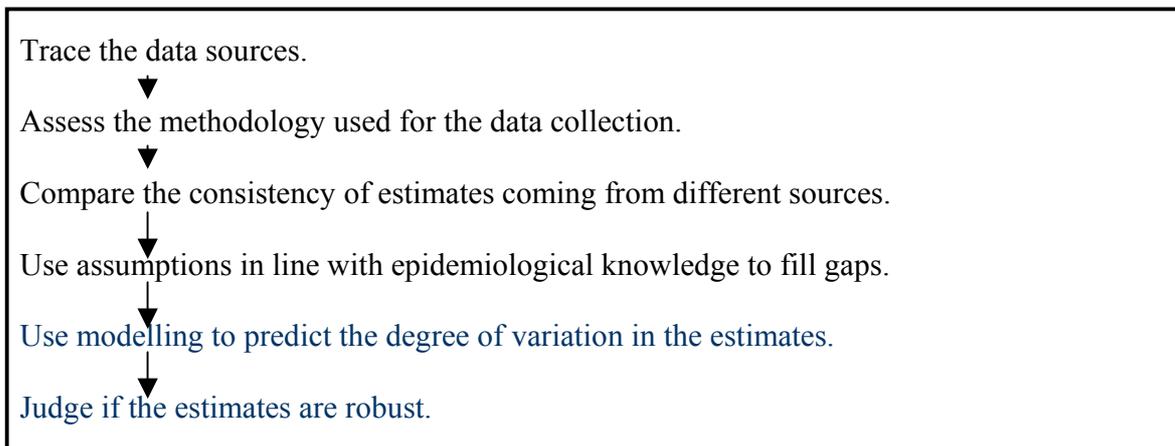
**Figure 6 Critical review of the available data**



Murray and Lopez have attempted to aggregate all available epidemiological estimates by geographic region to estimate the global BOD. This was done by reviewing the incidence and mortality by age and gender for each disease. Because of insufficient data the Global BOD had to rely on expert opinion, assumptions and modelling.

To estimate the BOD for KZN, the available data sources have been identified, critically assessed and aggregated into an Epidemiological Profile. This profile is a summary of the estimates available in scientific articles and reports and has been organized according to the 10<sup>th</sup> International Classification of Diseases. The profile is available on the DOH web site at <http://www.kznhealth.gov.za/epidata.htm>. These data sources were assessed for their validity in providing estimates that were representative of the population of KZN, as represented in Figure 4.

**Figure 7 Methodological steps for estimating the BOD**



#### *Assumptions and modelling*

Assumptions and a certain degree of modelling were used to arrive at disaggregated estimates by age and gender. Assumptions and modelling were necessary to check that estimates were consistent, to take into account a certain degree of error and to judge the robustness of the estimates. Assumptions were derived from the literature including Murray and Lopez, Jamison et al., the advance release of the recorded deaths from Statistics SA and the 2002 Nelson Mandela/HSRC Study of HIV/AIDS. One of the programmes used to model the consistency of the estimates was DisMod, which was developed by the Global Burden of Disease Study to check the consistency between incidence, prevalence, recovery and mortality of diseases.

### *Limitations*

There are several problems when using available information to estimate the frequency of diseases. Scientific articles, such as those used in the Epidemiological Profile, do not have a standard way of providing incidence, prevalence and mortality rates by age and gender, they do not provide representative estimates for the whole KZN and the estimates are not related to the same year. Mortality by cause is derived from death certificates and therefore is affected by under-reporting and assignment of the wrong cause of death. The estimates coming from the Health Information System are affected by access to the health services, and by the poor quality and irregularity of reporting. Therefore, the data sources were critically assessed to take into account the possibility of under or over estimation and to check that information was consistent with the epidemiological knowledge about diseases.

### *Recommendations to improve disease estimates*

The DOH could contact several research centres, which are doing epidemiological research to obtain more information on diseases. Even the most advanced epidemiological techniques have limitations in providing estimates and they require hard data to fill the gaps. Therefore, institutions, researchers and managers having relevant information could provide it to the Epidemiology Unit of the DOH. Institutions/programmes that have data include Statistics SA, the Stroke Data Bank in Durban, the Malaria and TB control programs, and the MRC in Hlabisa. All these institutions could provide estimates on specific diseases disaggregated by age and gender.

As far as the Health Information System is concerned, a sentinel system could provide statistics on inpatients and outpatients. At the moment getting reliable information on inpatients and outpatients from all health units is problematic because there are insufficient human resources. Allocating more resources to a few representative units to organize a sentinel system would be more feasible and would improve the reliability of the information. Limiting most data collection in a few representative units would help to produce more reliable and updated information on the trends of specific diseases.

The estimates produced in this Bulletin can be improved and updated if those having relevant information share it with the Epidemiology Unit of the DOH. The Epidemiology Unit would assess the quality of the data sources and would use the most reliable estimates to expand the epidemiological database on incidence, prevalence and mortality by cause. This will allow to have an updated high quality information source that could be accessible through the web site of the DOH to planners, researchers, managers and other users.

The BOD will allow to rank health problems and select priority interventions which will than be monitored through the collection of management indicators. Managers need information that is representative of what is going on in the health services to check that the services are organized according to plan. The management indicators include statistics on the priority interventions/services that have been identified by the planners

and have to be implemented by the managers. These indicators are related to the inputs, outputs and outcomes, including infrastructure, personnel, inpatients and outpatients, coverage of target groups and so on. It is the role of the Health Information Bulletin produced by the Health Informatics Directorate of the DOH to provide this information.

## **Results**

The results of the analysis carried out in this issue of the Bulletin are presented for the most relevant communicable diseases. Although this list is not exhaustive, it is a first attempt to take stock of what is known. The Results provide the estimates by age and gender for the following diseases:

- Tuberculosis;
- Sexually transmitted diseases;
- HIV/AIDS;
- Diarrhoea; and
- Malaria.

Each disease is presented in the following manner:

- (a) The introduction describes what is known about the disease;
- (b) The assumptions and modelling (where applicable) describe the methods used to arrive at more comparable estimates disaggregated by age and gender; and
- (c) The estimates provide incidence, prevalence and mortality by age and gender.

## Tuberculosis

### Introduction

While the first issue of the Bulletin has focused mainly on official rates coming from the HIS, this issue provides an example on how using existing information through sound assumptions and a certain degree of modeling can provide the most likely population estimates. According to the DOH, the TB incidence per 100,000 population has increased from 110 in 1995/96 to 420 in 2000/01 and the case fatality rate per 100 cases has increased in the same period from 4.5% to 8%. This has been paralleled by an increase in HIV prevalence and more than half of TB patients are estimated to be HIV positive (Connolly C et al 1998). All the above is very informative but it has the limitation of being an under-estimate of the population rates and of not being disaggregated by age and gender.

### Assumptions

There is strong evidence that the population overall incidence of the new cases of TB developing annually in KZN is not less than 700 per 100,000 population. This is suggested by the followings:

- In 1998, there were 1,393 ward admissions for adult TB in Hlabisa health district (Floyd K. et al), equivalent to about 700 per 100,000.
- The reporting completeness of the national TB control programme has varied between 37% and 72% across the years. The total number of TB cases in KZN adjusted for under-reporting was estimated at around 65,700 in the year 2000; equivalent to a crude incidence of 720 per 100,000 (2000 South Africa Health Review).

According to the above assumptions, the minimum incidence of 700 per 100,000 has been used in this analysis and the total expected cases were disaggregating by age and gender. To distribute the expected cases across age and gender, the following assumptions were used:

- The total expected cases was partitioned according to a male/female ratio of 1.5. This was based on the M/F ratio of TB deaths reported on death certificates in the advance release of recorded causes of death published by Statistics SA for the period 1997-2001 and the M/F ratio of the prevalence reported by the 1998 Demographic & Health Survey (DHS).
- The total expected cases were distributed across age groups according to the proportion reported by the national TB control programme.
- The recovery rate was 40% and the Case Fatality rate was 8% as reported by the DOH for 2000/01.

## Estimates

The most likely rates for TB for KZN are in tables 1-3. DisMod was used to check how varying the assumptions affected the estimates and the consistency between incidence and prevalence. Table 1 shows that among males incidence, prevalence and mortality per 100,000 population is respectively 862, 1694 and 135. Table 2 shows that women have an incidence, prevalence and mortality per 100,000 population slightly above 500, 1000 and 80. Table 3 shows that the overall (all ages and genders) incidence, prevalence and mortality per 100,000 are respectively, 691, 1358 and 109.

**Table 1. TB in KZN among Males in 2002\*,**

	<b>Incidence</b>	<b>Prevalence</b>	<b>Mortality</b>
<b>Males</b>	Rate /100000	Rate /100000	Rates /100000
0-4	42	54	4
5-14	42	86	7
15-44	1378	2643	211
45-59	1392	2919	234
60+	733	1714	138
All ages	862	1694	135

\*case fatality rate = 8%, remission = 40%

**Table 2. TB in KZN among Females in 2002**

	<b>Incidence</b>	<b>Prevalence</b>	<b>Mortality</b>
<b>Females</b>	Rate /100000	Rate /100000	Rate /100000
0-4	28	36	3
5-14	28	57	5
15-44	852	1633	130
45-59	771	1616	129
60+	330	789	64
All ages	532	1047	84

\*case fatality rate = 8%, remission = 40%

**Table 3. TB in KZN (Total) in 2002\***

	<b>Incidence</b>	<b>Prevalence</b>	<b>Mortality</b>
<b>M+F</b>	Rate /100000	Rate /100000	Rate /100000
0-4	35	45	4
5-14	35	72	6
15-44	1106	2120	169
45-59	1050	2202	176
60+	491	1160	93
All ages	691	1358	109

\*Case fatality rate = 8%, remission = 40%

## Sexually Transmitted Infections

### Introduction

The incidence of sexually transmitted infections (STIs) in KZN has been estimated in 1996 at around 9% among the 15-49 years old. A study carried out in Hlabisa in 1996 (Wilkinson et al 1998), which utilized a surveillance system based on general practitioners and clinics, estimated that at least 9% of men and women 15-49 years of age acquired an STI each year.

*The prevalence* of STIs in KZN in the late 1990s was estimated at around 25% among females. In a study carried out in Hlabisa in 1996 (Wilkinson D et al 1999), 25% of women were found infected with STIs and half of these cases were not symptomatic. Several data collection systems were involved in this study including surveillance and community surveys, and the definition of STIs was rigorous.

*As far as causal agents* are concerned the most frequent causes include chlamydia, syphilis and gonorrhoea. The prevalence of causal agents derived from surveys carried out in the late 1990s (Williams BG et al 2001; Wilkinson D et al 1999) is reported in the table below. These studies used a sound methodology to represent pregnant and non-pregnant women as well as men from the general population and to define cases.

**Table 4 Prevalence of STIs by cause (15-49 years of age) \***

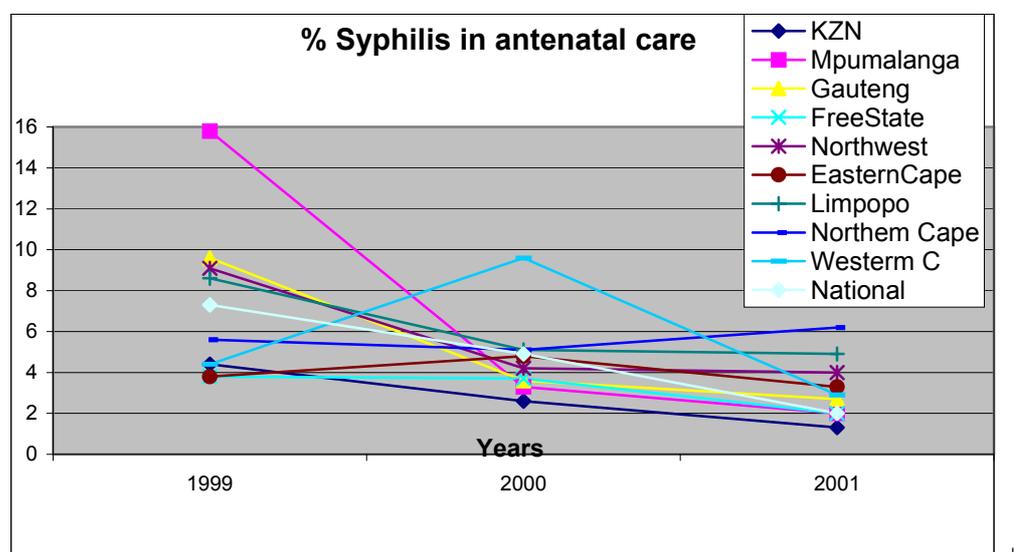
	<b>Men</b>	<b>Women</b>
Syphilis	6.1%-9.3%	8%-9.7%
Gonorrhoea	2.3%-3.4%	4%-7.8%
Chlamydia	5.2%-5.6%	6.4%-12.9%

\* From community surveys carried out between 1995-1998 in KZN

Nationwide trends suggest that the prevalence of STIs has been declining in the last few years. The 1998 DHS reported a national prevalence of 11.9% for painful urination and/or genital sore among adult males 15 years and older. A national "HIV/AIDS population survey" was carried out in 2002 and reported a national prevalence of 3.9% for the same symptoms and the same population group. These changes are equivalent to an annual decline of 17% for symptoms related to STIs.

Such trends are also confirmed by the decline in the seroprevalence of syphilis measured among women attending antenatal clinics. According to the national seroprevalence surveys based on antenatal clinics, seroprevalence of syphilis in South Africa declined from 11.2% to 2.8% between 1997 and 2001. This is equivalent to an annual decline of 19% nationwide, which is in line with the 17% decline in symptoms related to STIs mentioned above. The figures for each single province, available for the years 1999, 2000 and 2001, show that the decline was widespread (Figure 8). The seroprevalence for syphilis among women attending antenatal care in KZN declined from 4.4% to 3% between 1999 and 2001.

**Figure 8 Trends in syphilis seroprevalence among women attending antenatal clinics**



(Data from Summary Report of National HIV and Syphilis seroprevalence Survey in South Africa 2001. DOH May 2002)

The decline in the prevalence of STIs may be due to a lower degree of transmission and/or to wider treatment with the syndromic approach. The findings from the 2002 “population HIV survey” suggest a higher prevalence in the use of condoms and other behavioral changes compared with the 1998 DHS. These changes may be one of the reasons for the decline of syphilis and other STIs.

### Assumptions

The above information suggest that:

- The most important causes of STIs are syphilis, gonorrhoea and chlamydia;
- In the late 1990s the incidence and prevalence for STIs in KZN was respectively 9% and 25% among 15-49 years old;
- The above estimates are likely to have declined at an annual rate of 17%-19% in the last few years.
- Men are infected at a later age and are more symptomatic than women, with the most common symptoms being urethritis. Among women, the chronic complications include urethral stricture and epididymitis. Women are less symptomatic and the sequelae include: pelvic inflammatory disease (PID), cervicitis, salpingitis, ectopic pregnancies and infertility.

## Estimates

According to the above assumptions, the most likely incidence and the prevalence of STIs in KZN in 2002 in the population 15 years and over is estimated respectively at 1% and 2.5%.

Complication rates are more difficult to estimate. The complications and sequelae of STIs are more important than the acute infection per se, which is usually limited to urethritis lasting a few days. Data on STI complications can only be extrapolated from the literature that has been summarized in Table 5.

Other complications caused by STIs affect the newborns and the old age. Gonococcal and chlamydial infections cause both ophthalmia neonatorum and neonatal respiratory infections. The incidence depends on whether neonatal prophylaxis is implemented at birth. Other serious consequences of STIs include tertiary syphilis and cancer of the cervix associated with human papilloma virus.

**Table 5 Prevalence of STI complications (15-44 years old) in Sub-Saharan Africa**

Gender	Type of Complication	Jamison et al*	GBOD** Chlamydia	GBOD** Neisseria G
Men	Urethral strictures		0.09%	0.36%
	Epididymitis		0.3%	0.5%
Women	Pelvic Inflammatory Infections (PID) and chronic pelvic pain	1-3%	3%	1.4%
	Tubal abscess, bilateral tubal occlusion, ectopic pregnancies	0.3-1.5%	0.12%	0.08%
	Cervicitis		2.2%	3.6%
	Infertility		0.2%	0.1%

\* Incidence for urban areas in Sub-Saharan Africa

\*\* Sub-Saharan Africa

## HIV/AIDS

### Introduction

While the first issue of the *Epidemiology Bulletin* has already dealt with the seroprevalence based on the antenatal care surveillance system, this issue deals with the rates expected in the general population. In 2002 a population HIV survey (Nelson Mandela/HSRC Study of HIV/AIDS) was the first nationwide HIV testing on a representative sample from the population. Therefore, its estimates must be acknowledged and compared with the estimates derived from the HIV surveillance based on women attending antenatal clinics.

As discussed in the introduction it is important to take into account the objective of using statistics. The main objective of the serosurveillance system based on antenatal care units is to measure trends. Because this surveillance system is based on the same units and data are collected with the same methodology, these annual surveys are able to monitor the trends of HIV seroprevalence on women attending antenatal care. As a secondary objective, the data may be used as a proxy of the prevalence in the general population of the same target age group, but several issues need to be taken into account. The validity of such extrapolation depends on the assumption that those attending the clinics selected by the surveillance system are representative of the women attending antenatal clinics.

On the other hand, the HIV population survey had the primary objective to take a representative sample and to draw conclusions on the population. The validity of the sample in representing the population depends on the sampling and on the response rate of those who were interviewed. While the sampling was not a problem, only 60% in KZN and 62% in the whole national sample agreed to be tested for HIV. This may have introduced a bias if those refusing to be tested were at different risk for HIV compared with those who accepted. However, even if this were the case, the same bias affected both the sample in KZN and the sample at the national level. Therefore, this potential bias is unlikely to affect differently KZN and the national sample and the data can still be used to compare the HIV prevalence found in KZN with the prevalence found in the national sample.

The main difference found by the 2002 "HIV population survey" compared with the seroprevalence measured in women attending antenatal clinics was a lower HIV prevalence in KZN than expected. The data from the antenatal care sentinel sites have always suggested that KZN had the highest seroprevalence compared with the other provinces. According to the 2001 antenatal care survey, KZN had an HIV seroprevalence of 33.5% among women 15-49 years old attending antenatal care clinics; which was 9% higher than the national prevalence (24.8%). However, the 2002 "HIV population survey" found that KZN ranked fourth after Free State, Gauteng and Mpumalanga in HIV prevalence. The HIV prevalence measured by the 2002 "HIV population survey" among men and women aged 15-49 was almost the same in KZN and in the national sample (16%).

Several factors may explain the differences between the 2002 “HIV population survey” and the seroprevalence derived from the antenatal clinics. On one side the 2002 “HIV population survey” may have underestimated the HIV prevalence and on the other side the surveillance based on antenatal care clinics may have over-estimated the prevalence of HIV. The rigorous methodology, the high standards of implementation and the validity checks make the results of the 2002 “HIV population survey” reliable. The fact that about 40% of the sample did not accept to be tested may have introduced a bias. If this were the case, the possibility of an under estimation depends on the possibility that those who refused to be tested were at higher risk for HIV.

On the other hand, the seroprevalence measured each year in satellite antenatal clinics is not without bias either and it may overestimate the prevalence in the general population. This may be caused by a higher risk for HIV in pregnant women attending the antenatal clinics enrolled in the surveillance system compared with the general population of women attending antenatal services. For example, if the antenatal clinics selected for the surveillance system are nearer to the major transport routes and if the population in these areas are more at risk for HIV, the seroprevalence obtained from these clinics could be higher than the prevalence in the general population. The above considerations are important because of the implications involved in extrapolating antenatal care data to the general population.

### **Assumptions**

The above findings suggest that the truth may lie somewhere in the middle between the HIV prevalence measured by the “HIV population survey” and that measured by the serosurveillance system. The ASSA 2000 was used to estimate the high case scenario because it is a model that is validated against the seroprevalence based on antenatal clinics. As discussed before, if the rates from the antenatal care units are likely to overestimating the rates in the general population, this overestimate affect the predictions of the model as well. Therefore, the predictions of the ASSA2000 model are provided as the high case scenario against the low case scenario of the “HIV population survey” carried out in 2002. More details on the ASSA2000 are in the expanded version of this issue available on the web site of the DOH.

### **Estimates**

The high and low case scenarios for 2002 are in table 5. The ASSA2000 model estimates a higher HIV prevalence for KZN than the prevalence estimated by the 2002 “HIV population survey”. The reason behind such difference is related to calibration of the ASSA2000 model on the antenatal care prevalence survey, which may lead to an overestimate of the prevalence of the general population. Another possibility is the lower prevalence of condom use and other protective behavior assumed by the ASSA2000 compared with the findings of the 2002 “HIV population survey”. If we

accept that the estimates of the 2002 “HIV population survey” are on the low side it is likely that the ASSA ones are on the high side. The high case scenario is 32% HIV prevalence in the 15-49 age group (genders combined) and 18% in the whole population. The low case scenario measured by the 2002 “HIV population survey” is 16% and 12% respectively among the 15-49 years old and the whole population.

**Table 6 HIV seroprevalence rates in the population of KZN in 2002**

	Low case scenario (2002 survey)	High Case Scenario (ASSA prediction for 2002)
15-49 (M & F)	16%	32%
All ages (M & F)	12%	18%

## Diarrhoea

### Introduction

Diarrhoea is a symptom caused by viruses and bacteria and its population rate is difficult to estimate because of several methodological problems. Case definition and severity of symptoms vary a lot, seasonality makes comparability across studies difficult and causal agents can only be diagnosed through lab tests.

Several epidemics related to “diarrhoea” have affected KZN in the 1990s. A rise in Shighella cases was reported in the mid 1990s, while cholera started getting the attention in the year 2000. These pathogens are likely to be endemic, with periodical epidemics.

It is not known how many cases reported as cholera in the year 2000 were really cholera. A very small proportion of suspect cholera cases were tested through lab techniques at the beginning of the epidemic and it is not possible to know how many suspect cases were due to cholera, shighella or other causal agents. Once a cholera epidemic is declared, suspect cases are usually not tested which makes sense on the management point of view. However, according to WHO more than 90% of episodes of cholera are “more than 90% of episodes are of mild or moderate severity and are difficult to distinguish clinically from other types of acute diarrhoea”. Therefore, on the epidemiological point of view any suspect case should be defined as “diarrhoea of unknown origin” unless confirmed through lab tests.

### Assumptions

Taking into account the above points and using several data sources it is possible to attempt a rough estimate on the average numbers of annual episodes of diarrhoea, keeping in mind that most episodes are mild and not seeking care. The 1998 DHS estimated the prevalence of diarrhoea among children less than 5 years of age. The survey was conducted between January and September 1998, covering both the rainy and the dry season. The prevalence estimated by the 1998 DHS can be considered representative for the situation existing in “not epidemic” years.

According to WHO<sup>3</sup> it is possible to estimate the incidence from the prevalence according to the followings:

$$2\text{-week } I = 2\text{-weeks } P * 14/(14+d)$$

Where I and P are respectively the incidence and the prevalence in the previous 2 weeks, and d is the average duration in days, which is usually between 3 and 7 days for acute diarrhoea.

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<sup>3</sup> Diarrhoea morbidity, mortality and treatment practices. Household Survey Manual. CDD/SER/86.2. WHO 1986

## **Estimates**

According to the 1998 DHS the prevalence among children under 5 years of age in KZN was 17.8%, which gives an annual incidence of 3-3.8 episodes per child <5 years. This is not far from the annual 2.3-5 episodes per child under 5 years of age estimated for developing countries by the Global BOD study.

Estimating the incidence in the older age groups is more difficult but it can be attempted by using several sources. Jamison D et al. have estimated that the incidence among children 5-14 years old and among adults is respectively 5 and 14 times lower than among children under 5 years old. This would lead to an incidence of about 0.8 and 0.2 episodes per person per year respectively for those 5-14 years of age and for adults. This is in line with the Global BOD study, which estimated a diarrhoea incidence for developing countries between 0.4 and 1.2 episodes per year between 5 and 14 years of age and 0.2-0.3 episodes among adults.

The DOH could improve these rough estimates by organizing a diarrhoea surveillance system. This could be based on a few health units providing information on inpatients and outpatients suffering from diarrhoea. Although this would be an underestimate of the real number of episodes of diarrhoea in the population, nonetheless it could provide useful information on trends. If a representative sample of cases would be regularly investigated through lab tests it would be possible to have an idea on the profile of the causal agents including cholera, shigella and other causes.

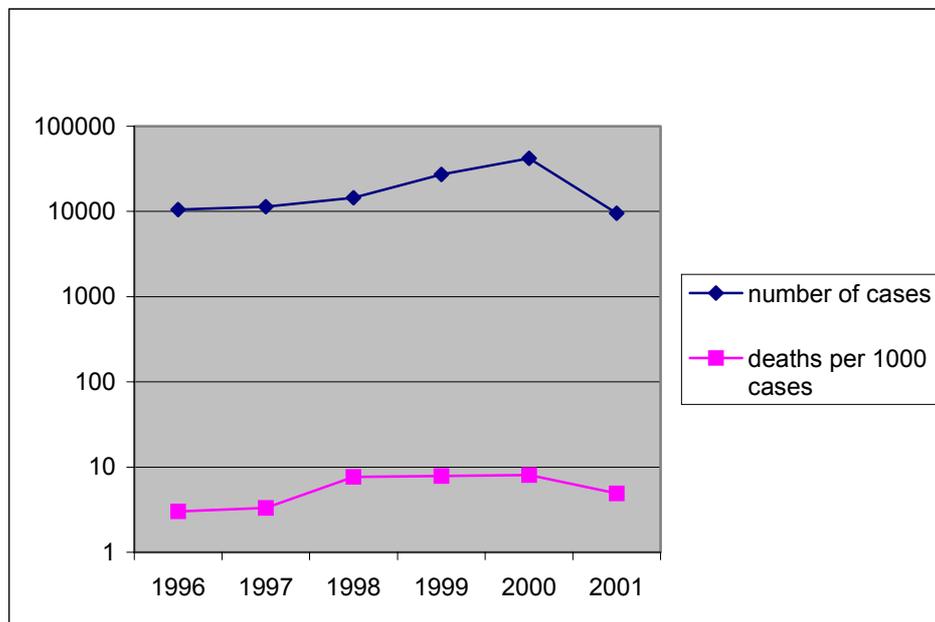
## Malaria

### Introduction

Malaria is diagnosed through the presence of symptoms and the tracing of the plasmodium in the blood. The three species of plasmodium found in South Africa are falciparum, ovale and malariae and are transmitted by the anopheles. DDT, which was replaced by pyrethroid in the 1990s, was reintroduced in 2000 because of the resistance of anopheles to pyrethroids. Bed nets treated with insecticides have been introduced in high-risk areas and have been found associated with a decline in malaria incidence.

Malaria in KZN is now limited to the districts bordering Mozambique and Swaziland but it was much more widespread a few decades ago. Till the 1940s malaria was spread further south than at present, with Durban experiencing a slight risk for epidemics. According to the South Africa Health Review 2000, the seriousness of malaria was such that between November 1931 and June 1932 almost all districts reported cases of malaria. After the late 1940s malaria was brought under control and for decades very few cases continued to be reported. In the mid 1980s malaria started to increase again and several epidemics were recorded, with the last epidemic reaching its peak in 2000 and declining in 2001 (Figure 6).

**Figure 9 Malaria Epidemic in KZN**



The malaria epidemics are the results of several factors, which disturb a precarious equilibrium. These include higher rainfall and flood, especially in the areas near the border with Mozambique, higher influx of people from Mozambique and Swaziland, less

effective control measures, resistance of the parasite to drugs and resistance of the vector to the insecticides. *Anopheles funestus* has re-emerged and has become resistant to pyrethroid, while *plasmodium falciparum* has become resistant to chloroquine and sulphadoxine pyrimethamine (SP). Drug combination of SP and chloroquine and the introduction of new drugs (i.e. artemisinin) have been advocated to combat the resistance.

As the cases are reported through the surveillance system, there may be underreporting in some years and over-reporting in other years. The proportion of cases confirmed through blood smear is not available and it may vary across years. It is likely that the data collected in 2001 may have been more reliable because of the strengthened malaria control strategies mounted in the year 2000.

### **Assumptions**

Because malaria epidemics are likely to continue, incidence and mortality are likely to vary from year to year. The number of cases reported in 2000 and 2001 can be considered as the high and low case scenario. In 2000 there were more than 42,000 cases and 340 deaths while in 2001 there were 9,500 cases and 47 deaths, with January and June being the most affected months. If we take Zululand and Umkhanyakude as the districts at risk, the incidence rate per 100,000 population was over 3,000 and 700 respectively in 2000 and 2001, while mortality in the same years was respectively 26 and 4 per 100,000. There was no significant variation across age groups, which is probably related to the fact that the acquired immunity is lower than in other areas of sub-Saharan Africa where malaria is more widespread and repeated parasite inoculation ensure the persistence of immunity.

The above rates for the endemic districts are within the estimates predicted by Snows RW et al. for the endemic areas of Southern Africa according to climatic models. These models are based on the “epidemiological associations between climate and the likelihood of stable malaria *falciparum* transmission”. These models provide estimates of stable transmission and are representative of areas like the endemic districts of KZN. For the area of Southern Africa where the climatic conditions are favorable for the parasite transmission the incidence per 100,000 population predicted by the model was 1100 with a 95% confidence interval (CI) of 440-2940 episodes and the mortality per 100,000 was 11 deaths with a 95% CI of 2-20.

### **Estimates**

The rates experienced by the endemic districts in 2000-2001 are within the confidence intervals predicted by the model. The confidence intervals predicted by the climatic model could be used to represent the uncertainty characterizing the malaria situation in KZN. Therefore we can accept that the incidence per 100,000 population is likely to be within 440-2900 and the mortality per 100,000 is likely to be within 2-20.

Besides the number of episodes and deaths, the BOD due to malaria includes long-term disability. The rate of cerebral malaria and its consequences for SubSaharan Africa reported by Snow RW et al. are shown in table 6. The neurological sequelae include hemiplegia, hemiparesis, speech and behavioural disorders, hearing impairments, cerebral palsy and epilepsy. Another consequence of malaria is the HIV transmission through blood transfusion because of severe anaemia caused by malaria. Quantifying the HIV transmitted through this route is difficult because it requires to estimate the rate of severe anaemia and transfusion rates among malaria cases, and transmission rates of HIV through transfusion. A sentinel site system could collect information on the incidence of cerebral malaria and its complications.

**Table 7 Malaria complications, Annual Rates per 100,000, Sub-Saharan Africa**

<b>Age</b>	<b>Cerebral malaria</b>	<b>Permanent neurological sequelae</b>	<b>Severe malaria anaemia (haemoglobin&lt;5g/dl)</b>
<15	26-260	0.4-4	399-1161
>=15	13-61	0.2-1	11-72

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