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A DATA BASE FOR USE IN THE EPIDEMIOLOGICAL SURVEILLANCE OF POTENTIAL CHANGES IN DRINKING WATER QUALITY IN SOUTH AFRICA

Final report to
THE WATER RESEARCH COMMISSION

by the Department of Community Health
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This project is an extension of an earlier project entitled *Epidemiological studies pertaining to the possible reclamation and reuse of purified sewage effluent in the Cape Peninsula.* The methodology and procedures were fully developed and as a consequence a steering committee was not appointed. However whenever assistance or information were needed the neceassary people and institutions were consulted. We wish to thank the following for their assistance:

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TERMINOLOGY

Much of the information incorporated into the data bases described in this report derive from official data. This data is often stratified into the racial categories of Asian, Black, Coloured or White. Such terminology is used in this report when analyzing this official data. It should be considered only as representing a stratification of the population in terms of the Population Registration Act and does not imply the legitimacy of such terminology.

EXECUTIVE SUMMARY

The current project "Epidemiological surveillance of potential changes in drinking water quality in South Africa" is a continuation of and extension of a previous project "Epidemiological studies pertaining to the possible reclamation and reuse of treated sewage effluent in the Cape Peninsula".

In the former study certain medical indicators were identified as being of particular relevance in monitoring potential changes in the health status of communities subjected to changing water supplies. Collation and analysis of data collected specifically for a particular situation is expensive and time consuming. The study presented here examined, inter alia, the possibility of using routinely collected public health data.

The health indicators chosen for detailed analysis were mortality, morbidity from general practice, and birth defects. Where possible an uniform data set has been assembled and made available on a computer tape as a supplement to this report. A copy of this data is also lodged with the Computer Centre for Water Research at the University of Natal, Pietermaritzburg.

An abstract of every death registered in South Africa from 1967 onwards was obtained on computer tape from Central Statistical Services. Those from 1978 onwards have been collated into an uniform data set containing cause of death, age, sex, population group, place of death and residence of deceased. Detailed spatial analyses of mortality rates have been done and a mortality atlas produced which is available on computer tape. Another public health measure of mortality, the potential years of life lost, was also calculated on a spatial basis as were life tables of the various population groups. Mortality data for Windhoek, (Namibia) collected for other WRC sponsored research for the period 1976 to 1988 is also included in the data base.

Various sources of routinely available morbidity (disease) data were investigated. These included hospital morbidity, statutorily notifiable diseases and cancer registries.

A source of data from a routine sampling of general practitioners was identified as the most appropiate for surveillance purposes and regional contact rates established.

A national birth defect system has been established in conjunction with the Department of National Health and Population Development. It establishes the incidence of clinically observable birth defects during the first seven days of life. Preliminary rates are available. Birth defect surveillance is important as the foetus is sensitive to environmental insults. In addition, such defects would present within a short period following the insult as opposed to, for example, cancer mortality where there could be a long and often unknown latent period before the onset of clinically observable effects.

A review of the sources of data for potable water quality as opposed to that in impoundments has been carried out and the reporting format discussed.

The data base is intended to be used as a tool in answering specific health related problems. A bibliography of papers resulting from use of the data base is presented. Two such problems were an investigation into trihalomethane levels in South African waters

and their possible influence on carcinoma rates; the other an investigation into the effect of hardness of water on coronary heart disease in South Africa.

Appendices list the detailed structure and the codes used in the computer files which comprise the data base.

CONTENTS

INTRODUCTION

This report describes a data base for the use in epidemiological studies pertaining to possible change in drinking water quality in South Africa. It is an extension of earlier work on epidemiological studies pertaining to the possible reclamation and reuse of treated sewage effluent as a source of potable water in the Cape Peninsula (Bourne *et al.*, 1987).

Useful epidemiological indicators, identified in the earlier study were mortality, morbidity from general practice, and birth defects. This report discusses their general applicability to epidemiological studies throughout South Africa and describes the sources of such data and their availability. In certain cases baseline data is available in a computer readable supplement to this report. Access to these supplemental files is available through the Computer Centre for Water Research at the University of Natal, Pietermaritzburg.

It is hoped to update this data base at regular intervals. Enquiries should be made to the authors. Enquiries about the data base can also be made from computer terminals by EMAIL.

For users in South Africa using computers on the South African Universities UNINET system the EMAIL address is **ZDB@UCTVAX.**

For international users access can be obtained through the FIDONET network. The EMAIL address **ZDB.UCTVAX@F4.N494.Z5.FIDONET.ORG** should be used.

Reference

Bourne D E, Sayed A R, Watermeyer G S, Klopper J M L (1987)
Epidemiological studies pertaining to the possible reclamation and reuse of purified sewage effluent in the Cape Peninsula. Report WRC 74/ 1/87. Water Research Commission. Pretoria. ISBN 0 908356 56 0.

1 EPIDEMIOLOGICAL METHODS

1.1 Criteria for causality in epidemiology

Epidemiology is defined *as the study and determinants of health related states or events in specified problems, and the application of this study to control health problems*. In the past fifty years or so, the definition has broadened from concern with communicable disease epidemics to take in all phenomena related to health in populations (Last, 1988).

Epidemiological studies result in observational data that may establish a statistically significant association between variables or attributes. This association may be artifactual, indirect, or direct. The possibility of an artifactual (or spurious) result can be eliminated if the design and conduct of the studies are adequate, and if studies conducted in different geographical areas and among different population groups produce the same or similar statistical associations. Once an artifactual association has been ruled out, it is then necessary to determine whether the association is an indirect or direct (causal) one.

Bradford-Hill (1965) laid down criteria for causality in epidemiological studies. These criteria were modified by the US Surgeon General (1982) to include the:

- consistency of the association
- strength of the association
- specificity of the association
- temporal relationship of the association
- coherence of the association

Consistency of the association

This criterion implies that diverse methods of approach in the study of an association will provide similar conclusions. Consistency requires that the association be repeatedly observed by multiple investigators, in different locations and situations, at different times, with different methods of study. Such replication assures that the association is not likely to be an artifact due to bias in study methodology or subject selection, and that it is not indirect due to confounding variables such as diet, occupation or genetics.

Strength of the association

The relative risk ratio, that is the ratio of the risk of disease or death among the exposed to the risk among the unexposed, measures the strength of an association.

Specificity of the association

This concept cannot be entirely dissociated from the concept in the strength of the association. It implies the precision with which one component of an associated pair can be util-

ized to predict the occurrence of the other, i.e., how frequently the presence of one variable will predict, in the same individual, the presence of another.

Temporal relationship of the association

In an evaluation of the significance of an association, exposure to an agent presumed to be causal must precede, temporally, the onset of a disease which it is purported to produce. The criterion of temporal relationship requires that exposure to the suspect etiologic factor precede the disease. Temporality is more difficult to establish for diseases with long latency periods, such as cancer.

Coherence of the association

The final criterion for the appraisal of causal significance of an association is its coherence with known facts in the natural history and biology of the disease.

Coherence requires that descriptive epidemiologic results on disease occurrence correlate with measures of exposure to the suspected agent. Perhaps the most important consideration here is the observation of a dose response relationship between agent and disease, that is, the progressively increasing occurrence of disease in increasingly exposed groups.

1.2 Design of epidemiological studies

Epidemiological studies cannot by themselves prove that a particular agent causes a particular health effect; they may, however, demonstrate quantitatively the strength of an association between the presence of the agent and the occurrence of the hypothesized effect.

Appropriate statistical analyses may in turn determine the probability that an association as strong as that observed might have occurred by chance . Whether the correct agent has been identified or whether the apparent association has arisen artifactually, because of correlations with exposure to other agent or factors that were not studied, is a question requiring further epidemiological studies and, where possible, also toxicological work.

Most investigations in the field of environmental epidemiology are necessarily of an observational nature, that is, they are observations based on existing situations. Associations can be demonstrated most clearly if it is possible to compare groups exposed to several levels of the agent in question, but in the last resort, hypotheses about the exact form of exposure/effect relationships can be tested effectively in experimental situations, where the research worker has some control over exposures.

While the working hypotheses must be as simple as possible, it has to be recognized that causes of ill health are commonly multi-factorial, and that the environment, though it comprises many individual components, acts as an entity, having effects liable to be greater than the total of those of the components.

The main types of study designs in environmental epidemiology, which could utilize the information in the current data base, and some of the salient features of each are presented in Tables 1.1 and 1.2

Table 1.1

Major features of various study design in environmental epidemiology (after World Health Organization, 1983)

Study	Descriptive	Cross-sectional	Prospective	Retrospective cohort
Population	Various sub populations	Community or special groups; exposed vs non-exposed groups	Community or special groups; exposure vs non-exposed groups	Special groups such as occupational groups, patients and injured persons
Exposure	Records of past measurements	Current	Defined at outset of study, can change course of study	Occurred in past - need records of past measurements
Health effect	Mortality & morbidity stastistics, case registries etc	Current	To be determined during course of study	Occurred in past - need records of past diagnosis and measurements
Confounders	Difficult to sort out	Usually easy to measure	Usually easy to measure	Often difficult to measure because of retrospective nature e.g. past smoking habits
Problems	Hard to establish cause-result exposure and effect relationships	Hard to establish cause-relationship, current exposure may be irrelavent to current disease	Expensive and time consuming; exposure categories an change; high drop out rate	Changes in exposure/effect over time of study, need to rely on records that may not be accurate enough
Advantages	Cheap, useful to formulate hypothesis	Can be done quickly, can use large populations, can estimate extent of problem	Can estimate incidence and relative risk, can study many diseases, can infer cause-result relationship	Less expensive and quicker than cohort prospective study giving similar response if sufficient past records are available

Table 1.2

Major features of various study design in environmental epidemiology (after World Health Organization, 1983)

Study	Time series	Case control	Experimental (intervention)	Monitoring and surveillance
Population	Large community with several million people, susceptible groups such as asthmatics	Usually small groups diseased (cases) vs non-diseased (controls)	Community or special groups	Community or special groups
Exposure	Current, e.g daily changes in exposure	Ocurred in past and determined by records or interview	Controlled/known	Current
Health effect	Current e.g daily variations in mortality	Known at start of study	To be measured during course of study	Current
Confounders	Often difficult to sort out, e.g effects of influenza	Possible to generalize due to small study group, some incorporated biases	Can be measured, can be controlled by randomization of subjects	Difficult to sort out
Problems	Many confounding factors, often dificult to measure	Relatively cheap and quick, useful for studying rare diseases	Expensive ethical consideration study, subjects compliance required; dropouts	Difficult to relate exposure data with effects
Advantages	Useful for studies on acute effects		Well accepted results, strong evidence for causality	Cheap when using existing monitoring and surveillance data

References

Bradford-Hill A (1965)
The environment and disease: association or causation ? Proc. Royal Soc. Med. **58**, 295-300.

Last J M (1988)
A dictionary of epidemiology. 2nd Edn. Oxford University Press, New York,

U.S. Surgeon General (1982)
The health consequences of smoking. U.S. Government Printing Office, Washington DC.

World Health Organization (1983)
Guidelines on studies in environmental epidemiology. Environmental health criteria 27. World Health Organization, Geneva.

2 MORTALITY

2.1 Sources of data

By statute, all deaths occurring within the Republic of South Africa are required to be registered with the authorities. For a review of this process and the accuracy of death notification and registration in South Africa see Kielkowski (1989).

The most readily available source of data on mortality in South Africa is the series of reports on deaths issued by the Central Statistical Services. For a complete bibliography of these reports see Bourne (1991).

Since 1968 the Central Statistical Services has produced a computer tape containing an abstract of each death registered in South Africa. For Blacks this information was collected only for 34 selected urban magisterial districts until 1977. From 1978 onwards the whole country was covered, although the quality of reporting varied (Botha and Bradshaw, 1985).

As certain homelands became independent, deaths registered in these areas were excluded from South African official statistics; Transkei in 1977, Bophuthatswana in 1978, Venda in 1980 and Ciskei in 1982. There is no current detailed information on deaths from these areas.

The Central Statistical Services has not retained a copy of all the computer tapes they have on mortality produced statistics. Nonetheless a complete set of tapes is retained by the Department of Community Hêalth, University of Cape Town and by the Medical Research Council. Details of the format of these tapes appears in Appendices 8.1 and 8.2.

Data on deaths occurring in Namibia were excluded after 1977. Data is however, available for the Windhoek area in connection with a WRC project on the potable reuse of tertiary effluent (Isaäcson, Sayed and Hattingh, 1987). An extension of this project has recorded deaths in the Windhoek area until 1988. Details of these Windhoek data files which constitute an unique source of mortality for Namibia appear in Appendix 8.3.

2.2 Mapping of mortality rates

2.2.1 Introduction

While official reports on mortality of the Central Statistical Services do tabulate the number of deaths in each of the country's magisterial districts, these are not given by cause of death nor are any death rates given for the various areas.

As a result of this lack of detailed spatial information, a series of map and tabulations on a regional basis has been carried out for this data base.

These maps are a first endeavor to present available official mortality data in a form which will enable areas of high or low mortality to be identified and which could act as a catalyst to assist the formulation of hypotheses to explain these differences.

2.2.2 Mortality data source for the maps

The source of mortality data for the production of these maps is the Central Statistical Services (formerly the Department of Statistics) computer tapes which contain extracts of all registered deaths (340 000) for Whites, Coloureds and Asians for the five year period 1978-1982 around the 1980 census.

These tapes were used for producing the official reports on mortality for this period (Central Statistical Services, 1978a to 1982a). The data on these tapes is essentially complete. Data for Blacks are presented in another series of reports (Central Statistical Services 1978b to 1982b). Grave doubts however, have been expressed as to the accuracy of and completeness of coverage of mortality among the Black population (Bourne and Dick, 1979; Botha and Bradshaw, 1985; McGlashan 1985). Reluctantly data for Blacks, who constitute the majority of the population of the country, have been excluded from the analyses except for those on potential years of life lost (Section 2.3).

2.2.3 Population data sources

Censuses were held in South Africa on 6 May 1980 and 5 March 1985. A series of reports on both census have been published by the Government Printer. The 1980 census is covered in the report series numbered 02-80-01 to 02-80-23 and the 1985 census in the report series 02-83-01 to 02-85-16.

Critical analyses of these censuses particularly with regard to under enumeration have been produced by Mostert *et al.* (1987) and Van Tonder *et al.* (1987). An adjustment of the census for undercount by district has been produced by Van Zyl (1988). A regular series of intercensual population estimates is now being produced by the Bureau for Market Research of UNISA (Steenkamp, 1978)

The source of data for the population is the final report of the 1980 population census, supplied on computer tape by the Central Statistical Services. Although there are indications of an undercount in this census, the population figures have not been adjusted, as estimates of the adjustment vary.

2.2.4 Methods of analysis for regional death rates

The computer tapes contained, for each death, data on the age, sex, population group (as defined by the Population Registration Act), place of death, place of residence, and cause of death coded by the Central Statistical Services.

The spatial coding of the data was according to the de jure place of death (ie. the place of residence). The quantum of spatial coding was the magisterial district. The data was coded according to the Central Statistical Services standard code list for places (Central Statistical Services 1977, 1978c, 1980c, 1981c, 1982c). Over this period (1978-1982) not only did some magisterial districts have their codes changed, and some new ones were created, but the boundaries of South Africa itself changed. For this reason we have excluded certain magisterial districts which did not exist in an unchanged form over the period 1978 to 1982. We have also excluded all deaths coded to the independent national states of Transkei, Bophuthatswana, Venda and Ciskei, as well as the self-governing national states of Lebowa, Gazankulu, Kwandebele, Kangwane, Kwazulu and Qwa qwa. A list of the 263

magisterial districts used appears in Appendix 8.5

Spatial miscoding of data has also taken place, particularly between the magisterial districts of Cape Town and Wynberg as well as Bethal and Highveld Ridge (excluded). For this reason as well as for the exclusions mentioned above, caution should be exercised in interpreting results for individual magisterial districts in isolation.

The causes of death were coded according to the International Classification of Diseases, 9th Revision (ICD-9) (World Health Organization, 1977). The underlying cause of death is the single cause utilized for analysis. Although deaths were coded according to the full 3 digit classification of ICD-9, the basic tabulation list (BTL) of 56 causes as modified by the Central Statistical Services, was used for tabulation and mapping (1979d, Appendix 8.6). The following data was calculated for each sex and population group:

- the number of deaths for the whole 5 year period (1978-1982) in each of the following age categories (in years): <1, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, >74.

- the death rate in the above age categories per 1 000 of the population. The unadjusted 1980 census figures were used for the denominator.

- the standardized mortality ratio (SMR) - normalized to 1 - with its 95% and 99% confidence limits (Bailar 1981) as well as an indication as to whether the SMR differed significantly from 1.

The standard population and death rates for calculating the SMR is the one for that particular sex and population group for the 263 magisterial districts used in the atlas. The exact number of deaths which occurred in these 263 magisterial districts is given immediately after the listing of these districts. The mapping of mortality data presents certain problems (McGlashan, 1972). On the one hand, if a normal spatially exact map is used, areas of large geographical extent but of sparse population are over represented visually with the converse occurring to areas of great population density. Mapping according to a demographic base map, where the area represented on the map is related to the population, can overcome this. The former approach was utilized in the first edition of the National Atlas of Disease Mortality in the United Kingdom (Howe, 1963), the latter in the second edition (Howe, 1970).

In these maps several factors acted against using either of these techniques. The vast differences in population density precluded a pure spatial representation. On the other hand the concentration of population in the Pretoria-Witwatersrand area would greatly distract the spatial relation of a demographic map. Furthermore, as six different sex and population group categories are used, six different demographic maps would be needed.

Consequently a compromise was utilized giving equal weight to each of the 263 magisterial districts used, regardless of population or size. This technique was also convenient for computer analysis in that maps could be prepared on a line printer. The magisterial districts are represented by a single symbol at the approximate position of the centroid of that district. Separate symbols are used to indicate whether the SMR for that district is above or below 1 (the national norm) and whether this difference is statistically significant. The printed map is somewhat distorted because of the coarseness of the vertical and horizontal spacings

available on the line printer. Since a list of map co-ordinates of the various districts is given, this does not hinder the interpretation of the map.

The key to these symbols is:

#	SMR > 1 and significant at 99% level (mnemonic: a double plus sign)
+	SMR > 1 and significant at 95% level (mnemonic: a plus sign)
A	SMR > 1 but not significant (mnemonic: an upward pointing sign)
V	SMR < 1 but not significant (mnemonic: a downward pointing sign)
-	SMR < 1 and significant at 95% level (mnemonic: a minus sign)
=	SMR < 1 and significant at 99% level (mnemonic: a double minus sign)

It is not our intention that an attempt be made to endeavor to explain trends in the data presented in the atlas files of this report, but to provide a tool to enable further work to be done. A useful source of supplementary material also mapped by magisterial district is the Population Census Atlas of South Africa (Zietsman and Van der Merwe, 1986).

The mortality atlas is available on the files indicated in Appendices 8.7 and 8.8.

2.3 Potential years of life lost

The potential years of life lost (PYLL) is a measure of mortality, not involving population numbers. It is defined for an individual as the difference between the age of death and 65 years. For individuals dying over the age of 65 the potential years of life lost is zero. Other measures of potential years of life lost, as well as the utility of the index are discussed in the report of the U.S. Centers for Disease Control (1986).

In view of the difficulties involved in calculating rates for regional South African populations, particularly for Blacks and also for intercensual years, PYLL provides a convenient method of mortality analysis for South African conditions.

Potential years of life lost are tabulated for each population group, for all geographic statistical regions, and for each of the rubrics or the Basic Tabulation List (BTL) of causes of death of ICD-9. Details of the computer files available are given in Appendix 8.9.

2.4 The life table

2.4.1 The current life table

Life tables are one form of combining mortality rates of a population at different ages into a single statistical model. One of their main advantages over other methods of measuring mortality is that they do not require the adoption of a standard population for acceptable comparisons of levels of mortality in different populations. The current life table, which is the one tabulated in this report is an artificial construct in that it takes the current age specific mortality rates and applies them to a group of, say 100 000 persons just born. They

do not reflect the actual changing mortality rates through an individuals life. Life tables are usually constructed around census years, the mortality data for three or five years, centered on the census year, being pooled to give stability to the rates. The latest South African life tables are for 1979-1981 and 1984-86 (Central Statistical Services 1985d, 1987d). These tables are for whites, coloureds and Asians. Official life tables for Blacks are not produced.

Because of the differential mortality rates for males and females separate life tables, are calculated for each sex.

2.4.2 The life table functions

The functions which make up the life table express the various aspects of the mortality conditions prevailing in a population. The commonly used functions in a simple decrement life table and the relationships between them can be defined in the following way for an abridged life table, that is a life table that does not list the functions by single years of age.

l_x The number of persons surviving to exact age x out of the original number at age zero

l_o termed the radix of the life table (usually 1 000 or 100 000)

${}_np_x$ The probability that a person alive at exact age x will survive for a further n years (equal to l_x+n/l_x)

${}_nq_x$ The probability that a person alive at exact age x will die before reaching age x + n (equal to $1-{}_np_x$)

${}_nd_x$ The number of deaths occurring between ages x and x + n (equal to l_x-l_x+n).

${}_na_x$ The average number of years lived in the interval between ages x and x + n by those who die in the interval. If this information is not available it will often be assumed that deaths are spread evenly over the interval. In such a case the values of nax will be taken as 0.5n. This is normally reasonable except for very young and old ages

${}_nL_x$ The total number of person years lived in the interval between ages x and x + n. It is also the number of people in this age group which would be found in a stationary population experiencing the mortality implied by the life table and with the number of births equal to l_0 (equal to ${}_nl_x - {}_nd_{xn}a_x$)

T_x The total number of person years lived beyond age x. Also the size of the stationary population at ages x and above (equal to the sum of the ${}_nL_x$ values for all values above x)

e_o The life expectancy at age x., i.e., the average additional number of years lived beyond age x by those who reach x (equal to T_x/L_x). The most often quoted value of this function is e_o, the life expectancy at birth

${}_nm_x$ The central death rate in the life table (equal to ${}_nd_x/{}_nl_x$).

Bloom B, Bourne D, Sayed A R, Klopper J M L (1988)
Morbidity patterns from general practice in Cape Town, A pilot study. South African Medical Journal **73**, 166-168.

Central Statistical Services (1989)
Census of hospitals and establishments for inpatients, 1987. Report 93-01-01 (1987). Government Printer, Pretoria.

Centers for Disease Control (1984)
Estimated number of physician contacts by prinicpal diagnosis. Morbidity and mortality weekly report **33**, 1.

Department of Health (1989)
Declaration of medical conditions to be notifiable. Government Notice R 2708. Government Gazette No 12216, 15 December 1989.

Doll R, and Peto R (1981)
The causes of cancer, Oxford University Press, Oxford.

Higginson J, and Muir C (1979)
Environmental carcinogenesis: misconception and limitations to cancer control. J. Natl. Cancer Inst. **63**, 1291-1298.

Last J (1988)
A dictionary of epidemiology. 2nd Edition. Oxford University Press, New York.

Parkin D M, Wagner G, Muir C (1985)
The role of the registry in cancer control. IARC Scientific Publication 66, International Agency for Research on Cancer, Lyon.

South African Institute for Medical Research (1989)
1986 Cancer registry of South Africa. SAIMR, Johannesburg.

Table 3.7

National morbidity data (1985) according to the 17 chapters of ICD-8

Chapter	Description	Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
10	Diseases of the genito-urinary system	5 752	4 600	1 152	0,25
11	Complications of pregnancy, childbirth and the puerperium	845	547	298	0,55
12	Diseases of the skin and subcutaneous tissue	3 539	2 669	870	0,33
13	Diseases of the musco-skeletal system and connective tissue	4 044	2 611	1 411	0,56
14	Congenital anomalies	104	77	27	0,35
15	Certain conditions originating in the perinatal period	33	19	14	0,74
16	Symptons, signs and ill defined conditions	5 210	3 851	1 359	0,35
17	Accidents, poisoning and violence (external causes)	3 853	3 092	761	0,25
Y	Codes		2 406	2 090	0,87

Ratio is a measure of chronicity

Table 3.6

National morbidity data (1985) according to the 17 chapters of ICD-8

Chapter	Description	3 226 Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
1	Infectious and parasitic diseases	6 005	5 087	918	0,18
2	Neoplasms	465	244	221	0,91
3	Endocrine, nutritional and metabolic diseases and immunity disorders	1 735	537	1 198	2,23
4	Diseases of blood and blood-forming organs	548	307	241	0,79
5	Mental disorders	2 837	1 318	1 519	1,15
6	Diseases of the nervous system and sense organs	3 863	2 940	923	0,31
7	Diseases of the ciculatory system	5 482	1 430	4 052	2,83
8	Diseases of the respiratory system	13 964	11 928	2 036	0,17
9	Diseases of the digestive system		2 320	906	0,39

Ratio is a measure of chronicity

Table 3.5

National morbidity data (1985) according to the C list of 70 causes of ICD-8

Cause groups		Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
Nature of injury					
CN66	Fractures	525	336	189	0,56
CN67	Intracranial and internal injuries	83	67	16	0,24
CN68	Burn	158	101	57	0,56
CN69	Adverse effects of chemical substances	137	29	0,27	
CN70	All other injuries	2 950	2 480	470	0,19
Supplementary classification					
	Prenatal care (Y60)	1 499	404	1 095	2.71
	Residual Y codes	2 997	2 002	995	0,50
		64 574	45 840	19 924	

Table 3.4

National morbidity data (1985) according to the C list of 70 causes of ICD-8

Cause groups		Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
C52	Nephritis	25	11	14	1,27
C53	Calculus of urinary system	46	23	23	1,00
C54	Hyperplasia of prostate	8	3	5	1,67
C55	Other diseases of genito-urinary system	5 653	4 543	1 110	0,24
C56	Abortion	57	45	12	0,27
C57	Other complications of pregnancy, childbirth and the puerperium	595	385	210	0,55
C58	Delivery without mention of complication	193	117	76	0,65
C59	Infections of skin and subcutaneous tissue	1 218	998	220	0,22
C60	Other diseases of skin and subcutaneous tissue	2 321	1 671	650	0,39
C61	Arthritis and spondylitis	1 403	605	798	1,32
C62	Other diseases of musculoskeletal system and connective tissue	2 641	2 006	635	0,32
C63	Congenital anomalies	104	77	27	0,35
C64	Certain causes of perinatal morbidity	33	19	14	0,74
C65	Other specified and ill-defined diseases	5 383	3 988	1 395	0,35

Table 3.3

National morbidity data (1985) according to the C list of 70 causes of ICD-8

Cause groups		Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
C35	Ischaemic heart disease	540	109	431	3,95
C36	Cerebrovascular disease	154	45	109	2,42
C37	Venous thrombosis and embolism	151	58	93	1,60
C38	Other diseases of circulatory system	1 094	490	604	1,23
C39	Acute respiratory infections	5 503	5 087	416	0,08
C40	Influenza	2 708	2 548	160	0,06
C41	Pneumonia	391	258	133	0,52
C42	Bronchitis, emphysema and asthma	3 244	2 374	870	0,37
C43	Hypertrophy of tonsils and adenoids	123	82	41	0,50
C44	Pneumoconioses and related diseases	3	0	3	-
C45	Other diseases of respiratory system	1 992	1 579	413	0,26
C46	Diseases of teeth and supporting structures	312	297	15	0,05
C47	Peptic ulcer	411	188	223	1,19
C48	Appendicitis	129	92	37	0,40
C49	Intestinal obstruction and hernia	272	160	112	0,70
C50	Cholelithiasis and cholecystitis	50	27	23	0,85
C51	Other diseases of digestive system	2 052	1 556	496	0,32

Table 3.2

National morbidity data (1985) according to the C list of 70 causes of ICD-8

Cause groups		Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
C18	Helminthiases	179	167	12	0,70
C19	All other infective and parasitic diseases	2 303	1 917	386	0,20
C20	Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissue	207	45	162	3,60
C21	Benign neoplasms and of unspecified nature	258	1 991	59	0,30
C22	Thyrotoxicosis with or without goitre	17	7	10	1,43
C23	Diabetes mellitus	588	82	506	6,17
C24	Avitaminoses and other nutritional defiency	130	84	46	0,55
C25	Other endocrine and metabolic diseases	988	364	624	1,71
C26	Anaemias	386	175	211	1,21
C27	Psychoses and non-psychotic mental disorders	2 826	1 313	1 513	1,15
C28	Inflammatory diseases of eye	826	742	84	0,11
C29	Cataract	9	6	3	0,50
C30	Otitus media and mastoiditis	1 245	1 045	200	0,19
C31	Other diseases of nervous system and sense organs	1 783	1 147	636	0,55
C32	Active rheumatic fever	29	10	19	1,90
C33	Chronic rheumatic heart disease	32	11	21	1,91
C34	Hypertensive disease	3 482	707	2 775	3,93

Table 3.1

National morbidity data (1985) according to the C list of 70 causes of ICD-8

Cause groups		Visits			Ratio
		All	First	Subsequent	
		(a)	(b)	(c)	(c)/(b)
C1	Typhoid, paratyphoid fever, other salmonella infections	2	1	1	1,00
C2	Bacillary dysentery and amoebiasis	7	6	1	0,16
C3	Enteritis and other diarrhoeal diseases	2 208	2 001	207	0,10
C4	Tuberculosis of respiratory system	49	23	26	1,13
C5	Other tuberculosis including late effects	2	2	0	0,00
C6	Brucellosis	9	3	6	2,00
C7	Diphteria	0	0	0	-
C8	Whooping cough	35	33	2	0,06
C9	Streptococcal sore throat and scarlet fever	114	102	12	0,12
C10	Smallpox	0	0	0	-
C11	Measles	84	73	11	0,15
C12	Viral encephalitis	6	2	4	2,00
C13	Infectious hepatitus	24	10	14	1,40
C14	Typhus and other rickettsioses	5	4	1	0,25
C15	Malaria	7	6	1	0,16
C16	Syphilis and its sequelae	206	151	55	0,36
C17	Gonococcal infections	560	463	97	0,20

whom no script is written. These records are to be made at the time of seeing each patient.

Details to be recorded are:

- Age of patient
- Sex of patient
- Place of visit
- First or subsequent visits
- New or continued therapy
- Regional distribution, and town size group
- Speciality group
- Multiple prescription and drug prescribed*
- Dosage*
- Type of prescription (private, medical aid, others)*
- Diagnosis
- Desired effects*

* information not used in this data base.

3.5.5 National morbidity data

National data from the NDTI system for 1985 is presented in Tables 3.1 to 3.7. The data was coded according to the 8th revision of the ICD-8.

In these tables,the total number of visits gives an indication of the workload of the doctor. The number of first visits for a particular condition gives an indication of the incidence of that condition. The ratio of subsequent to first visits for a condition gives an indication of the chronicity of the condition.

Regional morbidity rates are given in Appendices 8.14 and 8.15.

References

Berkson J (1946)
Limitations of the application of the fourfold table analysis to hospital data. Biometrics Bulletin **2**, 47-53.

- Cape Province and
- Natal

The doctor universe is stratified according to ten specialties:

- General practice - metropolitan
- General practice - non metropolitan
- Physician (medicine - internist)
- Surgery
- Obstetrics and gynaecology
- Paediatrics
- Otolaryngology
- Opthalmology
- Psychiatry and neurology
- Others (dermatology, urology, proctology, venerology)

3.5.3 The National Disease and Therapeutic Index (NDTI) sampling plan

NDTI-SA uses a stratified random sample with sub-sampling from units of equal size.

The 55 region - speciality cells supply the stratification as indicated in section 3.5.2. A sample of medical practitioners, consisting of 8% of the universe, is drawn at random and independently for each one of these strata.

Each sampled practitioner is asked to supply information on a sub-sample consisting of a seven day period of his practice. These reporting periods are scheduled in such a manner as to provide information for every day of the year. This means that the sample data includes an equal number of Saturdays, Sundays and holidays, including a representative number of practitioner vacation days.

The sample drawn by this procedure consists of 375 medical practitioners in private practice throughout the Republic of South Africa.

Each sampled doctor is asked to report information on private patient visits only for a seven year period.

3.5.4. Data recorded by the National Disease and Therapeutic Index (NDTI)

Doctors who agree to co-operate in the survey are provided with a supply of casebooks are asked to record details for seven consecutive days of all patients seen, including those for

Note that the rate of notification of diseases may not necessarily reflect the true incidence of the disease.

3.4 Cancer registries

Descriptive epidemiology indicates that perhaps eighty per cent of cancer cases are environmentally determined (Higginson and Muir, 1979, Doll and Peto, 1981). Cancer registries are a useful means of obtaining data on which to base epidemiological evidence as to the possible causes of various cancers (Parkin *et al.*, 1985). A cancer registry has been founded in South Africa at the South African Institute for Medical Research. Its first report for the year 1986 (S A Institute for Medical Research, 1989) contained information on 36 000 diagnoses. The registry is pathology based with information coming both from the public and private sectors. Such a registry has the advantage of a high degree of accuracy of data as it does not depend on a clinical diagnosis and death certificates both of which are suspect sources of information. Only indisputably malignant tumors are included. Doubtful, borderline and in-situ cancers and benign tumors were omitted. Age specific and age standardized rates by sex and race are given in the reports of the registry.

3.5 Morbidity from general practice

3.5.1 Introduction

The records of general practice provide a fruitful source of information about that sector of the population that utilizes their services.

A pilot study on the utilization of a panel of sentinel general practitioners was carried out in the earlier contract (Bloom *et al.*, 1988).

Countries such as the UK and the US utilize a rotating panel of a small number of sentinel GP's to supply national morbidity statistics (Centers for Disease Control 1984). In South Africa a panel of rotating GP's and specialists has been utilized by a South African company Intercontinental Medical Statistics-International South Africa (IMS) to produce a series of reports, primarily for the pharm aceutical industry called the National Disease and Therapeutic Index-South Africa (NDTI). The computer tapes of the data collected (with proprietary drug information removed) have been made available to this project.

3.5.2 The National Disease and Therapeutic Index (NDTI) universe

The NDTI universe is defined to include all medical doctors in active private practice within the Republic of South Africa excluded are pathologists, anaesthesiologists and radiologists.

The universe is stratified according to region and specialty. The country is divided into five regions :

- Witwatersrand
- Rest of Transvaal
- Orange Free State

3 MORBIDITY

3.1 Sources of morbidity data

Morbidity can be considered as any departure, subjective or objective from a state of physiological or psychological well being.

Morbidity can be measured in terms of:

- persons who are ill
- the illness that these persons experienced and
- the duration of these illnesses (Last, 1988).

Sources of morbidity data for populations are not readily available, except for certain mainly epidemic diseases, (see section 3.2) there is no legal requirement to report diseases.

While hospital morbidity records are a convenient source of data, care must be taken in interpreting such data since false conclusions can be arrived at since combination of disease and exposure can be over-represented in a hospital population (Berkson, 1946).

It appears that sampled data from general practitioners is one of the best ways of obtaining morbidity data, although such statistics only cover that sector of the population that could afford to visit a general practioner (GP).

3.2 Hospital morbidity

The Central Statistical Services publishes a series of reports on their censuses of hospitals and establishments for inpatients in Report series 20-06- . The latest available is for 1987 (Central Statistical Services, 1989). These reports have very limited information on morbidity, the diseases being broken down only according to the 17 chapters of the International Classification of Diseases, and according to race and province. There are no analyses of detailed causes of morbidity by age or sex.

Computer tapes of the information used in compiling these reports are not available for detailed analysis because of confidentiality requirements of the Statistics Act.

3.3 Notifiable diseases

In terms of the Health Act 1977 as amended, the occurrence of certain diseases are by law required to be reported to the health authorities (Department of Health, 1989). These conditions are listed in Appendix 8.3 and are regularly reported in the publication *Epidemiological comments* published monthly by the Department of National Health and Population Development. Detailed information on notifications are held on a data base at the Department of National Health and enquiries as to the availability and format of such data should be made to the Directorate Epidemiology, Department of National Health and Population Development, Private Bag X63, Pretoria.

Steenkamp H A (1988)
Regional population estimates for 1988. Research Report 156. UNISA Bureau of Market Research, Pretoria.

Van Tonder J L, Mostert W P, Hofmeyer B E (1987)
Rekonstruksie van die sensusouderdomstrukture van die Suid Afrikaanse Asier-, Blanke- en Kleurling-bevolkings: 1984 to 1985. HSRC report S-154. Human Sciences Research Council, Pretoria.

Van Zyl J A (1988)
Adjustment of the 1985 census population of the RSA by district. Research Report 149. UNISA Bureau of Market Research, Pretoria.

World Health Organization (1977)
Manual of the international statistical classification of diseases, injuries and causes of death. 9th Revision. World Health Organization, Geneva.

Zietsman H L, van der Merwe I J (1986)
Population census atlas of South Africa. Publication IS/1986. Institute for Cartographic Analysis, University of Stellenbosch, Stellenbosch.

Central Statistical Services (1985d)
South African life tables 1979-1981. Report 02-06-03. Government Printer, Pretoria.

Central Statistical Services: Population census (1980d).
Age by statistical region and district. Report 02-80-04. Government Printer, Pretoria.

Central Statistical Services (1986d)
Census of hospitals and establishments for inpatients (1983). Report 20-06- Government Printer, Pretoria.

Central Statistical Services (1987d)
South African life tables 1984-1986. Report 02-06-04. Government Printers, Pretoria.

Howe G M (1963)
National atlas of disease mortality in the United Kingdom. First Edition. Thomas Nelson and Sons, London.

Howe G M (1970)
National atlas of disease mortality in the United Kingdom. Revised and enlarged Edition. Thomas Nelson and Sons, London.

Isaäcson M, Sayed A, Hattingh W (1987)
Studies on health aspects of water reclamation during 1974 to 1983 in Windhoek, South West Africa/Namibia. Report 38/1/87, Water Research Commission, Pretoria.

Kilekowski D, Steinberg M, Barron P M (1989)
Life after death - mortality statistics and the public health. South African Medical Journal **76**, 672-675.

McGlashan N D (1972)
Medical geography - techniques and field studies. Methuen, London.

McGlashan N D (1985)
Death certification of Blacks in South Africa as a data source for geographical epidemiology. South African Journal of Science **81**, 571-578.

Mostert W P, Van Tonder J L, Hofmeyr B E (1987)
Rekonstruksie van die sensusouderdomstrukture van die Suid-Afrikaanse swart bevolking; 1936 tot 1985. HRSC Report S-153. Human Sciences Research Council, Pretoria.

Preston S H, Keyfitz N, Schoen R (1972)
Causes of death: Life tables for national populations. Seminar Press, New York.

South West Africa (1981)
Population census report 01-01. Geographical distribution. Directorate Development Co-ordination, Windhoek.

Bourne D.E (1990)
Sources for South African mortality data 1910-1987. South African Medical Journal (in Press).

Centers for Disease Control (1986)
Premature mortality in the US: public health issues in the use of years of potential life lost. Morbidity and mortality weekly report 35 (Supplement 2S), 1 S -11S.

Central Statistical Services (1978a)
Report on deaths, Whites, Coloureds and Asians. Report 07-03-17.Government Printer, Pretoria.

----------(1979a). Report 07-03-18.

----------(1980a). Report 07-03-19.

----------(1981a). Report 07-03-20.

----------(1982a). Report 07-03-21.

Central Statistical Services (1978b)
Report on deaths of Blacks: Report 07-05-01. Government Printer, Pretoria.

----------(1979b). Report 07-05-02.

----------(1980b). Report 07-05-03.

----------(1981b). Report 07-05-04.

----------(1982b). Report 07-05-05.

Central Statistical Services (1977)
Standard Code List for Statistical Regions, Magisterial Districts, Cities, Towns and Non-urban Areas: First Edition. Central Statistical Services, Pretoria.

----------(1978c). 2nd Edition.

----------(1980c). 3rd Edition.

----------(1981c). 4th Edition.

----------(1982c). 5th Edition.

Central Statistical Services (1979d)
Statistical classification of diseases, injuries and causes of death. Based on the International classification of disease, (ICD). Ninth Revision (1975). For the use and guidance of the medical profession in South Africa. Manual 07-03--15 Government Printer, Pretoria.

For the notation used to annotate the computer files supplemental to this report see Appendix 11.

2.4.3 Multiple decrement tables

The ordinary life table discussed up to this point shows the probability of survivorship of an individual subject to the one undifferentiated hazard of death. In multiple decrement tables the individual is subject to a number of mutually exclusive hazards, such as death from cancer, heart disease, or other cause. The person is followed in the table only to his exit, as in the ordinary life table, but there is now more than one way of exiting.

2.4.4 The associated single decrement table

In addition to seeking the numerical effects of the several causes, each in the presence of the other causes, we want to find what effect each would have if it were acting alone.

Details of the theory of calculating current life tables as well as multiple decrement and associated single decrement tables appear in Preston *et al.* (1972). Algorithms for computer programs which form the basis of the calculations in this report also appear in Preston.

2.4.5 South African regional life tables

For each statistical region in South Africa, for each sex and for all population groups (except Blacks) current life tables have been calculated. For these regions, where the number of deaths per cause of death has been sufficiently large to permit convergence of the computer algorithms, the associated single decrement tables and the multiple decrement tables have been calculated according to the 17 chapters and the 56 rubrics of the BTL of ICD-9. In addition to the current life-tables, the multiple decrement table give the number of persons dying above a given age from specified causes. The associated single decrement tables give the number of persons surviving to a given age if a specific cause of death were eliminated.

Maps of the distribution of the expectation of life in South Africa, by statistical region, sex and population group are available on request from the authors.

References

Bailar J C (1981)
Significance factors for the ratio of Poisson variable to its expectations. Biometrics **20**, 639-643.

Botha J L and Bradshaw D (1985)
African vital statistics - a Black Hole? South African Medical Journal, **67**, 997-981.

Bourne, D E and Dick B (1979)
Mortality in South Africa. *In* Westcott G and Wilson F. Eds. Economics of Health Care 1. Ravan Press, Johannesburg, pp 57-94.

4 SURVEILLANCE OF BIRTH DEFECTS

4.1 Introduction

A birth defects surveillance system enables the frequency of clinically observable defects in newborn populations to be monitored. Any temporal or spatial clustering will provide information in formulating hypotheses about causes of these defects by means of epidemiological investigations. Although birth defect epidemiology is a relatively new field, there are a number of population- and hospital-based birth defects surveillance systems in operation throughout the world.

Awareness that environmental factors can cause abnormalities in babies has interested those concerned with early detection of possible hazards, such as the surveillance schemes established by the California Birth Defects Monitoring Program, OPCS (Office of Population Censuses and Surveys) in England and Wales, and the CDC (Center for Disease Control) in Atlanta, Georgia.

The rationale for beginning the monitoring of birth defects in the Cape Peninsula was based on the hypothesis that changes in water quality, as a result of the possible future introduction of other sources of water for potable use, could possibly be related to carcinogenicity and mutagenicity. Since the effects of maternal exposure to teratogenic agents are not easily identified, and in view of the long and unknown latent periods usually associated with such effects, it was thought that the prevalence of birth defects might provide an early indicator of such effects (WHO, 1975). It has been reported from South Australia that significant risk increases occurred specifically for defects of the central nervous and musculoskeletal systems as a result of differences in the composition of water supplies (Dorsch, 1984).

Although infectious and parasitic diseases are the main cause of infant mortality among the developing populations, congenital anomalies are the leading cause of infant deaths among the developed populations, anticipating what can be expected for the population as a whole in future. Table 4.1 shows the ten leading causes of infant death in United States (National Centre for Health Statistics, 1989). Deaths attributed to congenital anomalies among infants are considerably under-reported since many congenital anomalies are (incorrectly) reported on the death certificate as falling into the category of *certain conditions originating in the perinatal period.* Tables 4.2 to 4.5 show the ten leading causes of infant death in South Africa (data from Central Statistical Services). It is expected that only severe malformations will be coded to this particular cause of death, so these figures are an underestimate.

Inter alia, the possible mutagenic or teratogenic effects of water supplies subjected to novel treatment processes led to the Department of Community Health (UCT) initiating a birth defects surveillance system for the Cape Peninsula. Details of this baseline study was published in the South Afriacan Medical Journal (Sayed, Bourne, Nixon *et al.*, 1989).

The birth defects surveillance system developed here was modelled on information supplied by the International Clearinghouse for Birth Defect Monitoring Systems (ICBDMS). One of the main activities of this international body involve the exchange of information on

Table 4.1

Leading causes of death amongst infants < 1 year in the United States (1987)

Cause of death (ICD-9)		Rate/100 000 live births
1	Congenital anomalies	207,0
2	Sudden infant death syndrome	173,3
3	Disorders relating to short gestation and unspecified low birthweight	88,0
4	Respiratory disease syndrome	86,2
5	Newborn affected by material complications of pregnancy	36,7
6	Accidents and adverse affects	24,9
7	Infections specific to the perinatal period	22,6
8	Newborn affected by complications of placental cord and membranes	22,0
9	Intrauterine hypoxia and birth asphyxia	20,8
10	Pneumonia and influenza	17,7

Table 4.2

Leading causes of death for Whites <1 in South Africa (1987)

Cause of death (ICD-9)		Rate/100 000 population
1	Certain conditions originating in the perinatal period	708
2	Congenital anomalies	166
3	Other diseases of the respiratory system	64
4	Signs, symptons and ill-defined conditions	38
5	Other accidents, including late effects	30
6	Other bacterial diseases	21
7	Diseases of the nervous system	19
8	Transport accidents	19
9	Intestinal infectious diseases	15
10	Diseases of pulmonary circulation and other heart disease	10

Table 4.3

Leading causes of death for Blacks <1 in South Africa (1987)

Cause of death (ICD-9)		Number of registered deaths
1	Certain conditions originating in the perinatal period	6 549
2	Intestinal infectious diseases	3 499
3	Signs, symptons and ill-defined conditions	2 170
4	Other diseases of the respiratory system	2 103
5	Viral diseases	689
6	Congenital anomalies	508
7	Nutritional deficiencies	404
8	Other bacterial diseases	312
9	Diseases of the nervous system	261
10	Tuberculosis	97

Table 4.4

Leading causes of death for Coloureds <1 in South Africa (1987)

Cause of death (ICD-9)		Rate/100 000 population
1	Certain conditions originating in the perinatal period	2 658
2	Intestinal infectious diseases	1 029
3	Other diseases of the respiratory system	691
4	Congenital anomalies	273
5	Signs, symptons and ill-defined conditions	125
6	Other bacterial diseases	118
7	Nutritional deficiencies	105
8	Diseases of the nervous system	78
9	Viral diseases	71
10	Tuberculosis	39

Table 4.5

Leading causes of death for Asians <1 in South Africa (1987)

Cause of death (ICD-9)		Rate/100 000 population
1	Certain conditions originating in the perinatal period	1 291
2	Congenital anomalies	184
3	Other diseases of the respiratory system	145
4	Intestinal infectious diseases	102
5	Other bacterial diseases	34
6	Diseases of the nervous system	34
7	Viral diseases	24
8	Other accidents, including late effects	15
9	Signs, symptons and ill-defined conditions	10
10	Endocrine and metabolic diseases, immunity disorders	5

prevalence of monitored birth defects in member countries and the promotion of epidemiological studies. Late in 1989 the International Clearinghouse for Birth Defects Monitory System became the International Centre for Birth defects. There was, prior to the introduction of the project, no routine surveillance of birth defects prevalence rates in South Africa.

4.2 Methodology

Criteria

For the purposes of this surveillance system birth defects are defined as defects which are irreversible functional disturbances of any body organ, cell, or cell constituent resulting from disorder in the genetic constitution or antenatal environment (Scringeour, Cockburn, 1979).

One difficulty that arises in attempting to determine the total prevalence of all birth defects is that some defects, although believed to be present at birth, cannot be diagnosed until later in life and require careful and complex investigations. Therefore, the group of defects studied had to be limited to those that could be diagnosed clinically at birth. Hence only defects that can be seen clinically within the first seven days of life were recorded. This pragmatic limitation is utilized by many such birth defects surveillance systems.

The conditions listed below have been recommended for international comparison by the ICBDMS. They have been selected because they can be easily diagnosed at birth and, in general, there has been uniformity in their definition, thus minimizing the effect of different diagnostic criteria.

Anencephaly

A congenital malformation characterized by total or partial absence of the cranial vault, the covering skin, and the brain.

Spina bifida

A congenital malformation characterized by herniation or exposure of the spinal cord and/or meninges through an incompletely closed spine. Not counted when present with anencephaly.

Encephalocele

A congenital malformation characterized by herniation of the brain and/or meninges through a defect in the skull. Not counted when present with spina bifida.

Hydrocephaly

A congenital abnormality characterized by dilatation of the ventricular system, not associated with a primary brain atrophy, with or without enlargement of the head, and diagnosed before birth or during the first week of life. Not counted when present with encephalocele or open spina bifida.

Microtia

A congenital malformation characterized by absent parts of the pinna, with or without atresia of the ear canal, commonly expressed in grades (I-IV) of which the extreme form (grade IV) is anotia.

Cleft palate

A congenital malformation characterized by a fissure defect of the hard and/or soft palate behind the formen incision without cleft lip.

Total cleft lip

A congenital malformation characterized by clefting of the upper lip, with or without clefting of the alveolar ridge and palate.

Esophageal atresia or stenosis

A congenital malformation characterized by occlusion or narrowing of the esophagus, with or without tracheal fistula.

Anorectal atresia or stenosis

A congenital malformation characterized by absence of anus or of communication between rectum and anus or narrowing of anal canal, with or without fistula to neighbouring organs.

Hypospadias

A congenital malformation characterized by the opening of the urethra on the ventral side of the penis, irrespective of degree of severity.

Renal agenesis/dysgenesis

A congenital malformation characterized by complete absence of kidneys bilaterally or severely dysplastic kidneys. Polycystic kidneys not counted.

Limb reduction defects

A congenital malformation characterized by total or partial absence or severe hypoplasia of skeletal structures of the limbs.

Abdominal wall defects

Contains omphalocele and gastroschisis and unspecified abdominal wall defects.

Omphalocele

A congenital malformation characterized by herniation of abdominal contents through the umbilical insertion and covered by a membrane which may or may not

remain intact.

Gastroschisis

A congenital malformation (para-umbilical hernia) characterized by visceral herniation through an abdominal wall defect lateral to an intact umbilical cord.

Diaphramatic hernia

A congenital malformation characterized by herniation into the thorax of abdominal contents through a defect of the diaphragm.

Down syndrome

A generalized malformation syndrome characterized by a well known pattern of minor and major anomalies and associated with an excess of chromosome 21 material.

Besides the above list of defects recommended by the ICBDMS, all other clinically observable defects were also included in the data base.

Data collection

The data collection procedure for the surveillance of birth defects was initially based on the following two systems.

Population-based system

The study population of births for the population-based system was confined geographically to areas which fell under the jurisdiction of the Combined Health Scheme of the former Divisional Council of the Cape (DCC). Since the inception of the surveillance system, the *early notification of birth* form used by the DCC has required the reporting of both birth defects and birth weights. Those birth notification forms that contained an indication of a birth defect or defects were referred directly by the DCC Health Department to the Genetic Services Division of the Department of National Health and Population Development (DNHPD) for possible follow-up and verification of the cases reported. This information was then supplied to the Department of Community Health (UCT), where the information was coded and entered into a database.

These data are no longer used for surveillance purposes because it was established that there was gross under-reporting of birth defects. This source of data none the less continues to be of use to the local authority and genetic services for the provision of clinical health care to the patients concerned.

Hospital-based system

The hospital-based system was restricted to delivery institutions, namely the Peninsula Maternity and Neonatal Service (PMNS), which is comprised of 5 maternity hospitals and 3 midwife obstetric units (MOUs). The area drained by these institutions is not the same as in the population-based system. On examination of each newborn, a detailed paediatric

summary sheet is filled in by members of the Department of Paediatrics and Child Health of the University of Cape Town. The information is coded and entered on the PMNS computerised database. Since all cases of congenital malformations on the PMNS summary sheet are classified according to anatomical systems rather than specific conditions, detailed descriptive information of the specific defects had to be extracted retrospectively (for the 2-year period 1984-85) from the mothers' and infants' hospital records for the purpose of taxonomy; they were then coded in the Department of Community Health.

Encoding of birth defects

The coding system used for classifying birth defects originated with the State of California Birth Defects Monitoring Program (1984). It is based on the Centers for Disease Control (Atlanta) modification of the British Paediatric Association coding systems. This six-digit code provides for the encoding of specific diagnostic details and also for comparison with other surveillance systems.

4.3 Results of initial baseline study

The reporting of birth defects in the population-based system revealed a comparatively low ascertainment rate and poor descriptive quality. For the period January to December 1984 an overall rate of 85,7/10 000 live births for all conditions was recorded out of a total of 17 484 live births. Birth defects are recorded to a certain extent on some notification of birth forms, but generally the omissions are too numerous for useful study.

For the same period the hospital-based system (PMNS) provided a higher total ascertainment rate of 190,5/10 000 live births. For the study period (January 1984 to December 1985) the hospital based birth defect rate for all conditions was 207,3/10 000 live births out of a total of 51 427 live births. Of the 1 118 infants identified as having congenital malformations in the PMNS computerised database 52 (4,6%) hospital records were not accessible.

Tables 4.6 and 4.7 show cases and birth defect rates with their 95% confidence intervals (Fleis, 1981) from the PMNS hospital-based study for specific conditions. The rates for selected defects obtained locally in a hospital-based (PMNS) surveillance system were consistent with those reported internationally (Sayed, Bourne, Nixon *et al.*, 1989).

Fig 4.1 shows a significantly higher rate of defects amongst male infants which is consistent with the literature (Rudolph, 1987). For birth defects by maternal age, a high birth defect rate has been observed amongst infants of mothers under the age of 20 or over the age of 34 years (Fig 4.1). Rudolph, (1987) reported that mother's age was a risk factor for specific birth defects. Infants of older mothers are at higher risk for Down Syndrome.

In view of the establishment of a national birth defects surveillance system by the DNHPD the Genetic Services Division of the DNHPD requested the Department of Community Health (UCT) to indicate whether the experience gained in Cape Town could be utilized to form the basis of a national Birth Defects Surveillance System (BDSS). Table 4.7 shows a comparison of initial baseline rates for selected conditions from the PMNS study and rates from Baragwanath hospital, a participant of the national BDSS programme.

Table 4.6

Birth defect rates/10 000 live births - Cape Peninsula Maternity and Neonatal Service
(PMNS, 1984-1985)

ICD-9 code	Condition	Cases*	Rate	95% CI**
740	Anencephalus	10	1,9	1.0-3,7
741	Spina bifida	30	5,8	4,0-8,4
742	Other congenital anomalies of nervous system	43	8,4	6,1-11,4
742.0	Encephaocele	2	0,4	0,1-1,6
742.3	Hydrocephalus	13	2,5	1,4-4,4
743	Congenital anomalies of eye	9	1,8	0,9-3,5
744	Congenital anomalies of ear	48	9,3	6,9-12,5
745-747	Congenital anomalies of heart #	91	17,7	14,3-21,8
748	Anomalies of respiratory system	9	1,8	0,9-3,5
749	Cleft palate and cleft lip	45	8,8	6,4-11,8
749.0	Cleft palate	19	3,7	2,3-5,9
749.1 - 749.2	Cleft lip with or without Cleft palate	26	5,1	3,4-7,5
750	Other anomalies of upper alimentary tract	13	2,5	1,4-4,4
750.3	Oesophageal atresia or stenosis	9	1,8	0,9-3,5
751	Other congenital anomalies of digestive system	18	3,5	2,1-5,7
751.2	Anorectal atresia or stenosis	9	1,8	0,9-3,5

** Includes cases with multiple effects*

*** Confidence interval*

 # Excludes heart murmer

Table 4.7

Birth defect rates/10 000 live births - Cape Peninsula Maternity and Neonatal Service (PMNS, 1984-1985)

ICD-9 code	Condition	Cases*	Rate	95% CI**
752	Anomalies of genital organs	123	23,8	19,9-28,6
752.6	Hypospadias and epispadius	36	7,0	4,9-9,8
753	Anomalies of urinary system	17	3,3	2,0-5,4
754	Certain muscoskeletal deformities	127	24,7	20,7-29,5
755	Other anomalies of limbs	220	42,8	37,4-48,9
755.2 - 755.4	Reduction deformities - upper lower and unspecified limb	9	1,8	0,9-3,5
756	Other muscoskeletal anomalies (excluding those classified to 754)	53	10,3	7,8-13,6
756.61	Diaphragmatic hernia	6	1,2	0,5-2,7
756.70	Exomphalos-omphalocele	8	1,6	0,7-3,2
757	Anomalies of the integument	79	15,4	12,2-19,2
758	Chromosomal anomalies	71	13,8	10,9-17,5
758.0	Down's syndrome	41	7,9	5,8-10,9
759	Other and unspecified anomalies	28	5,4	3,7-7,9
760.71	Fetal alcohol syndrome	40	7,8	5,6-10,7

** Includes cases with multiple effects*

*** Confidence interval*

Table 4.8

Selected birth defects rates/10 000 live births
(Baragwanath hospital and Cape peninsula Maternity and Neonatal Service (PMNS, 1984-1985)

ICD-9 code	Condition	Rates/10 000 live births		
		Baragwanath	95% CI*	PMNS
740	Anencephhalus	0,7	0,1 - 2,6	1,9
741	Spina bifuda	3,5	1,9 - 6,5	5,8
742.3	Hydrocephalus	4,8	1,8 - 8,2	2,5
749	Cleft palate	1,6	0,6 - 4,0	3,7
749.1 - 749.2	Cleft lip with or without cleft palate	1,6	0,6 - 4,0	5,1
750.3 -	Oesophageal atresia or stenosis	2,2	1,0 - 4,8	1,8
751.2	Anorectal atresia or stenosis	1,3	0,4 - 3,5	1,8
752.6	Hypospadias and epispadius	4,8	2,8 - 8,2	7,0
755.2 - 755.4	Reduction deformities - upper lower and unspecified limb	1,9	0,8 - 4,4	1,8
756.4	Exomphalos - omphalocele	2,2	1,0 - 4,8	1,5
758.0	Down's syndrome	9,7	6,6 - 14,0	7,9

Total live births/a (Baragwanath hospital) = 31 000
** Confidence interval*

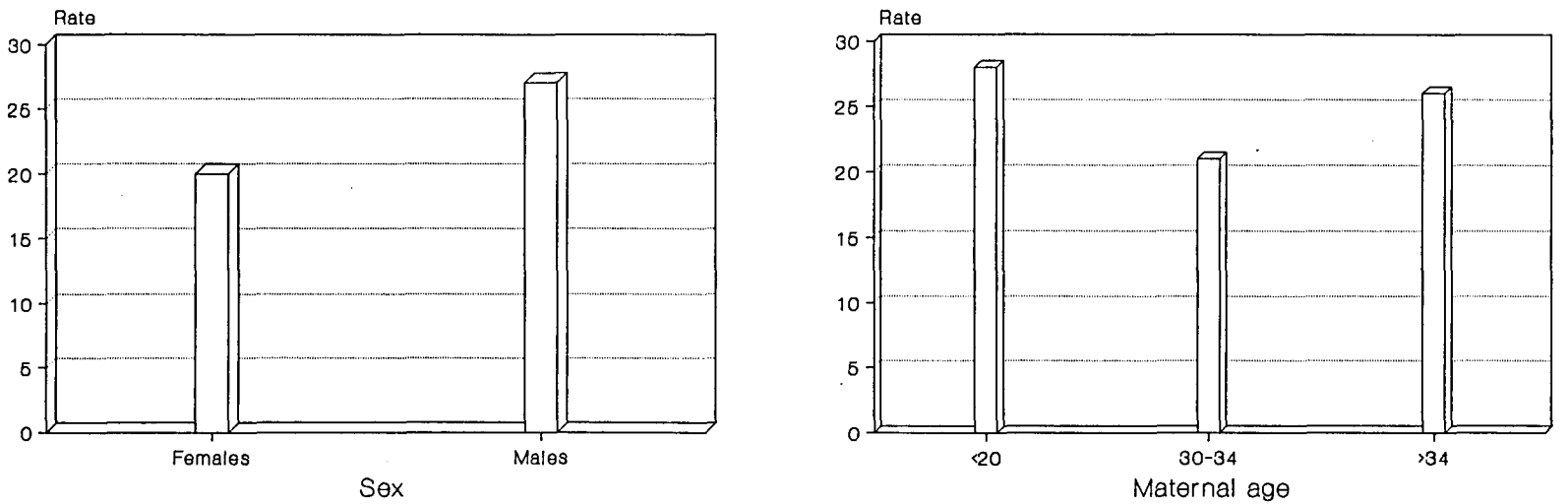

Fig 4.1 Birth defect rates/1 000 live births by sex and maternal age at the Cape Peninsula Maternity and Neonatal Service during 1984/85

As the proportion of birth defects among still births is greater than among live births, a detailed anatomical investigation of all still births would greatly enhance the assessment of the situation with respect to causes in epidemiological investigations. Because of incomplete coverage of still birth data and the lack of routine post-mortem examinations of stillborns, birth defects among still births have not been included in this study .

For statistically valid conclusions the expected number of cases for each condition is usually calculated by applying a *baseline rate* to the total number of births reported. Since birth defects are a relatively rare occurrence it will be necessary to record all such events for at least about 100 000 births, to produce acceptable baseline data (a figure recommended by the ICBDMS). Furthermore it would be necessary to examine the detailed case history of each occurrence of a defect if an increase were noted, in order to endeavor to establish a causal relationship between the defect and its possible source.

4.4 Proposed study design

The following study design would be proposed in order to determine the relationship between maternal water source and the risk of birth defects for infants born in areas exposed to recycled water and areas not exposed to recycled water.

A birth defects surveillance database such as the national BDSS would identify all cases which have been ascertained as birth defects retrospectively. Cases would be matched on an individual basis with infants without a defect (controls) by maternity institution, maternal age, parity and date of birth. In addition, it would be important to record the place of residence of the mother for the duration of her pregnancy. This study design would be suitable for a sample based case-control study especially when only selected maternity institutions provide information for the surveillance schemes. However for a population based case-control study all cases and total live births would have to be available for the total study population in the defined geographical area. Birth defect rates would be established for areas exposed to recycled water source and areas not exposed to recycled water source. The feasability of this study design would depend on the coverage of cases ascertained in a surveillance system for the areas under study. That is, all institutions including private hospitals would have to be participants of the birth defects surveillance system.

References

California birth defects monitoring program (1984)
Procedure manual, II: Classification of birth defects. Berkeley, California: California Department of Health Services.

Dotsch M, Scragg R K, McMichael J, Baghurst A, Dyer F (1984)
Congenital malformations and maternal drinking water supply in rural South Australia: a case-control study. American Journal of Epidemiology **119**: 473-486.

Fleiss J L (1981)
Statistical methods for rates and proportions. New York: John Wiley.

International Clearinghouse for Birth Defects Monitoring Systems (1985)
Annual Report 1985. Sydney: ICBDMS.

National Center for Health Statistics (1989)
Monthly Vital Statistics Report (**38**, no 5).

Rudolph A M (1987)
Pediatrics. London: Appleton and Lange.

Sayed A R, Bourne D E, Nixon J, Klopper J M L, Op't Hof J (1989)
Birth defects surveillance, a pilot system in the Cape Peninsula . S Afr Med Journal **76**: 5-7.

Scrimgeour J B, Cockburn F (1979)
Congenital abnormalities. Lancet (ii) 1349-1352.

World Health Organization International Reference Centre for Community Water Supply (1975). Health effects relating to direct and indirect re-use of waste water for human consumption. Technical Paper Series No 7. The Hague: WHO.

5 POTABLE WATER QUALITY*

5.1 Sources of data

5.1.1 Collection objective

The data discussed in this section of the report was collected for a limited purpose in order to establish a data base for a specific research project, namely to investigate the relationship between the hardness of potable water and cardiovascular disease mortality in South African urban areas (see section 6, Derry, 1987 and Derry *et al.*, 1990).

5.1.2 Sources of data

No single data bank for the chemical quality of potable water yet exists in South Africa. The data were thus obtained from a number of water authorities, including the Rand Water Board, the Orange Free State Goldfields Water Board, the Umgeni Water Board, the Lower South Coast Regional Water Services Corporation, the Lower Umfolozi Water Supply Authority, the Hydrological Research Institute of the Department of Water Affairs and the local authorities of Cape Town, George, Kimberley, East London, Oudtshoorn, Paarl, Port Elizabeth, Queenstown, Stellenbosch, Uitenhage, Worcester, Klerksdorp, Orkney, Stilfontein, Nelspruit, Pietersburg, Potchefstroom, Fochville, Witbank, Ladysmith, Vryheid and Bloemfontein.

Associated problems

A number of problems were revealed regarding the availability and usefulness of chemical-quality data for potable water in South Africa.

The main problems included:

- The lack of standardization of water sampling periods by authorities controlling the supply of treated water to South Africa's major cities and towns
- The lack of a standardized data reporting format
- Failure to report the chemical analytical method
- The absence of a national data bank for potable water

5.2 Discussion of reporting format

Whilst water boards and large municipalities usually take samples on a daily basis, smaller local authorities cannot carry out sampling with the same frequency with the result that some data sets are of dubious quality.

* This section was contributed by C W Derry

Chemical data was returned to the researcher in one of three general formats:

a) An over-simplified format, originally intended only to give city councillors or ratepayers a brief summary of the work carried out by the water engineer or chemist, by means of an abridged tabulation presented annually. Quality factors in such a tabulation were limited only to those of immediate interest to the intended reader and the summary index used for each factor was usually calculated from monthly means without an indication of seasonal variations in supply volume.

b) A more detailed, but *user friendly* format intended for an enlightened readership including water engineers and chemists who wished to be presented with the facts without wading through too much raw data.

   One of the most useful reports produced in this format was that of the Rand Water Board (RWB) which provided an analysis of 28 factors by the month published on an annual basis. Maxima, minima and detection limits for each factor were included as were color coded maps relating to areas supplied by various treatment works.

   The RWB also has an excellent backup service to elucidate or augment data as required.

   This type of data presentation may be more useful to the health researcher than raw data per se, as the data have been prepared and worked by experts who make allowances for changes in supply volume from different sources or for improbable values in raw data caused by errors generated during sampling, analysis or calculation.

c) The raw data format, which sometimes consisted of the photocopied pages of a laboratory record book into which the results of analysis had been directly entered.

Whilst it is tempting to believe that the quality of data improves with proximity to the source, the use of data in this format pre-empts the carrying out of adjustments by enlightened experts as referred to in (b) above.

Different methods of analysis and calculation for total hardness can lead to variations in the results obtained by different laboratories as is borne out by the recommendation in Standard Methods for the Examination of Water and Waste Water (American Public Health Association, 1989) that the analytical method used should be stated when such data is presented. This information was however found to be lacking in all data supplied during the course of research and this prevented the use of the data in a number of cases until further information could be obtained.

Whilst a fairly comprehensive data bank for raw water is searchable through the Hydrological Research Institute in Pretoria or through the Computerized Centre for Water Research in Pietermaritzburg, no such data bank exists for potable (treated) water.

In view of the fact that most water boards and larger local authorities have such data on record for their local areas and that structures already exist for the collation, standardization and assimilation of similar data regarding raw water, it is surprising that a national data base for potable water is not already in existence.

The existence of such a bank would greatly enhance research into the health implications of utilizing South Africa's dwindling water resources to their full advantage.

References

American Public Health Association (1989)
Standard Methods for the examination of water and waste water. 17th edition. American Public Health Asso.; American Water Works Assoc. & Water Pollution Control Federation, Washington DC.

Derry C W (1986)
The importance of appropriate chemical quality data in research on health aspects of water. Paper presented at 1st symposium on Water Quality Assessment. CSIR Pretoria, May 1986.

Derry C W (1987)
The relationship between the hardness of potable water and cardiovascular and ischaemic heart disease mortality in South African urban areas. Unpublished MSc. thesis, University of Cape Town.

Derry C W, Bourne D E, Sayed A R (1990)
The relationship between hardness of treated water and cardiovascular disease mortality in South African Urban areas. South African Medical Journal (in press).

6 BIBLIOGRAPHY OF STUDIES ORIGINATING FROM THE USE OF THE DATA BASE

6.1 Reuse of sewage effluent as a source of potable water (Windhoek, Namibia)

Isaäcson M, Sayed A R (1987)
Human consumption of reclaimed water - The Namibian experience. Proceedings Water Reuse Symposium **IV**, Denver American Waterworks Research Foundation. Denver.

Isaäcson M, Sayed A R (1988)
Health aspects of potable water reuse in Windhoek, Namibia, 1974-83. S. Afr. Med. J. **73**, 596-599.

Isaäcson M, Sayed A R, Hattingh W H J (1987)
Studies on health aspects of water reclamation during 1974 to 1983 in Windhoek, South West Africa/Namibia, WRC Report 38/1/87. Water Research Commission, Pretoria.

6.2 Proposed reuse of sewage effluent as a source of potable water

Bourne D E and Watermeyer G S (1981)
Proposed potable re-use - An epidemiological study in Cape Town. Proceedings, Water Reuse Symposium **II**, Washington DC 3, 2195-2199. American Waterworks Research Foundation, Denver.

Bourne D E, Sayed A R, Klopper J M L (1988)
The Cape Town epidemiological baseline and its ability to detect changes in health patterns following the introduction of potable reuse. Implementing Water Reuse, Proceedings Water Reuse Symposium **IV**. pp 803-820. American Water-works Association Research Foundation. Denver.

Bourne D E, Sayed A R and Watermeyer G S (1985)
Epidemiological planning for water reuse. Future of Water Reuse - Proceedings of the Water Reuse Symposium **III** San Diego 1984. Vol 3, pp 1634-1 638. American Waterworks Research Foundation, Denver.

Bourne D E, Sayed A R, Watermeyer G S, Klopper J M L (1987)
Epidemiological studies pertaining to the possible reclamation and reuse of purified sewage effluent in the Cape Peninsula. WRC Report 74/1/87. Water Research Commission, Pretoria. ISBN 0 908356 56 0.

Hattingh W H J, and Bourne D E (1989)
Research on the health implications of reclaimed sewage effluent in South Africa. S. Afr. Med. J. **76**, 7-10.

6.3 Mortality studies

Bourne, D E (1987)
A mortality atlas of South Africa, 1978-1982. S. Afr. Med. J. **72**, 158

Bourne, D E (1990)
Sources of South African mortality data 1910-1985, S.Afr.Med.J..(in press).

Bourne D E, and Rip M R (1987)
Neonatal and post-neonatal mortality among blacks living in squatter communities in metropolitan Cape Town. S. Afr. Med. J. **72**, 724.

Bourne D E, Rip M R, Sayed A R (1987)
Mortality in the first two years of life. S. Afr. Med. J. **72**, 364.

Bourne D E, Rip M R, Woods D L (1988)
The characteristics of infant mortality in South Africa, 1929-1983. II. Causes of death among White and Coloured infants. S. Afr. Med. J. **73**, 230-232.

Bourne D E, Rip M R, Woods D (1989)
The spatial distribution of neonatal and post-neonatal mortality in South Africa, 1978-1982. S. Afr. Med. J. **76**, 49-52.

Bourne D E, Roussouw J, Sayed A (1989)
Ischaemic heart disease mortality by day of week in Abstracts of the 2nd International Conference on Preventive Cardiology, Washington, DC, p A88.

Bourne D E, Sayed A R, Rip M R (1987)
Decline in ischaemic heart disease in South Africa. 1978-1984. S. Afr. Med. J. **72**, 87-88.

Derry C W, Bourne D E, Sayed A R *et al.* (1987)
Mortality (1978-1982) among Asian, Coloured and White population groups in South Africa. VI Mortality from ischaemic heart disease. S. Afr. Med. J. **72**, 698-700.

Disler P B, Epstein L, Bourne D E *et al.* (1987)
Mortality (1978-1982) among Asian, Coloured and White population groups in South Africa. II. Mortality from cerebro-vascular disease. S. Afr. Med. J. **72**, 408-410.

Epstein L, Sayed R, Bourne D E, Benatar S R. (1987)
Variations in mortality 1978-1982 in the Coloured, White and Asian populations in South Africa IV. Respiratory mortality. S. Afr. Med. J. **72**, 559-563.

Rip M R and Bourne D E (1988)
Spatial distribution of infant mortality rates in South Africa -1982. S. Afr. Med. J. **73**, 224-226.

Rip M R, Bourne D E, Woods D L (1988)
The characteristics of infant mortality in South Africa, 1929-1983. I. Components of the White and Coloured infant mortality rate. S. Afr. Med. J. **73**, 227-229.

Rip M R, Bourne D E, Woods D L (1989)
The spatial variation of mortality among children under 5 years of age in South Africa, 1978-1982 S. Afr. Med. J. **75**, 565-569.

Rip M, Epstein L, Bourne D E *et al.* (1987)
Mortality (1978-1982) among Asian, Coloured and White population groups in South Africa I. All Causes. S. Afr. Med. J. **72**, 404-407

Taylor S P, Epstein L, Bourne D E *et al.* (1987)
Mortality (1978-1982) among Asian, Coloured and White population groups in South Africa. V. Mortality from hypertensive diseases. S. Afr. Med. J. **72**, 696-698.

Whittaker S, Epstein L, Bourne D E *et al.* (1987)
Mortality (1978-1982) among Asian, Coloured and White population groups in South Africa. III. Mortality from rheumatic heart disease. S. Afr. Med. J. **72**, 411-412

6.4 Birth defect surveillance

Bourne D E, Rip M, Watermeyer G S (1983)
Occurrence of births by day of week. S. Afr. Med. J. **63**, 141.

Sayed A R, Bourne D E, Nixon J, Klopper J, Lawrence G A, Op't Hof J (1986)
A birth defect surveillance system for the greater Cape Town area. Proceedings of the 5th Conference on Priorities in Perinatal Care in South Africa, pp 41-44. Witwatersrand University, Johannesburg.

Sayed A R, Bourne D E, Nixon J, Klopper J M L, Op't Hof J (1989)
Birth defects surveillance, a pilot system in the greater Cape Town area. S. Afr. Med. J., **76**, 5-7.

6.5 Morbidity from general practice

Bloom B, Bourne D E, Sayed A R, Klopper J (1988)
Morbidity patterns from general practice in Cape Town. A pilot study. S. Afr. Med. J. **73**, 166-168. .

6.6 Liquid consumption patterns

Bourne D E, and Bourne L T (1989)
Liquid consumption patterns among individuals in Cape Town - the contribution of water bound in food. Water Sci. Tech. **21,1805-1808.**

Bourne L T, and Watermeyer G S (1985)
Water Consumption Patterns among individuals. Proceedings of the Water Reuse Symposium **III**, San Diego 1984. Vol. 1, pp 103-108. American Waterworks

Research Foundation, Denver.

Bourne L T, Bourne D E, Hattingh W H J (1989)
Boiled and Unboiled water intake among individuals in Cape Town. Water S.A., **15**, 227-230.

Bourne L T, Bourne D E, Watermeyer G S, Klopper J M L (1987)
A liquid consumption survey of individuals in greater Cape Town. WRC Report 74/2/87. Water Research Commission, Pretoria. ISBN 0 908356 57 9.

6.7 Other epidemiological studies

Bourne D E, Pick W M, Taylor S P, Mc Intyre D E, Klopper J M L (1990)
A methodology for resource allocation in health care for South Africa. Part III : A South African health resource allocation formula. S. Afr. Med. J. **77**, 456 - 459.

Derry C, Bourne D, Sayed A R (1990)
The Relationship between hardness of treated water and cardiovascular disease mortality in South African urban areas. S. Afr. Med. J. **77**, 521 - 524.

Van Steenderen R A, Pieterse M J, Bourne D E (1990)
Trihalomethane formation in potable waters with reference to related variables and health data bases. Proc. Biennial Conference of International Association on Water Pollution and Control, Kyoto, Japan (in press.)

7 GLOSSARY

Basic tabulation list (BTL)

An abridged classification of 56 causes of death and disease of the International Classification of Diseases (qv).

Case control study

(Synonyms: case comparison study, case history study, case referent study, retrospective study).

A study that starts with the identification of persons with the disease (or other outcome variable) of interest, and a suitable control (comparison, reference) group of persons without the disease. The relationship of an attribute to the disease is examined by comparing the diseased and nondiseased with regard to how frequently the attribute is present or, if quantitative, the levels of the attribute, in each of the groups.

Cohort study

(Synonyms: concurrent, follow up, incidence, longitudinal, prospective study).

The method of epidemiologic study in which subsets of a defined population can be identified who are, have been, or in the future may be exposed or not exposed, or exposed in different degrees to a factor or factors hypothesized to influence the probability of occurrence of a given disease or other outcome. The alternative terms for a cohort study, i.e. follow-up, longitudinal, and prospective study, describe an essential feature of the method, which is observation of the population for a sufficient number of person- years to generate reliable incidence of mortality rates in the populati on subsets. This generally implies study of a large population, study for a prolonged period (years), or both.

Cross sectional study

(Synonyms: disease frequency survey, prevalence study).

A study that examines the relationship between diseases (or other health related characteristics) and other variables of interest as they exist in a defined population at one particular time. The presence or absence of disease and the presence or absence of the other variables, (or if they are quantitative, their level) are determined in each member of the study population or in a representative sample at one particular time. The relationship between a variable and the disease can be examined.

- in terms of the prevalence of diseas e in different population sub groups defined according to the presence or absence (or level) of the variables and

- in terms of the presence or absence (or level) off the variables in th e diseased versus the nondiseased.

Note that disease prevalence rather than incidence is normally recorded in a cross-sectional study. The temporal sequence of cause and effect cannot necessarily be determined in a cross-sectional study.

Descriptive study

A study concerned with and designed only to describe the existing distribution of variables, without regard to causal or other hypotheses. Contrast analytic study. An example is a community health survey, used to determine the health status of the people in a community. Descriptive studies, e.g. analyses of cancer registry data, can be used to measure risks.

Epidemiology

The study of the distribution and determinants of health related states or events in specified populations. Modern medical usage is broader than the definition in the Oxford English Dictionary as *that branch of medical science which treats epidemics.*

International classification of diseases (ICD)

An agreed international classification of diseases and causes of death published by the World Health Organization. The current edition, the ninth, indicated by the abbreviation ICD-9, was published in 1975 and came into use in South Africa in 1978. There are some changes to ICD-9 as used in South Africa (see Appendix 8.6). The ICD is divided into 17 main chapters.

Intervention study

An abbreviated list of causes, the Basic Tabulation list is sometimes used.

An epidemiologic investigation designed to test a hypothesized cause-effect relationship by modifying a supposed causal factor in a population.

Monitoring

The performance and analysis of routine measurements, aimed at detecting changes in the environment or health status of populations. Not to be confused with *Surveillance*. To some monitoring also implies intervention in the light of observed measurements.

Surveillance of a disease

The continuing scrutiny of all aspects of occurrence and spread of a disease that are pertinent to effective control.

Most of these definitions follow Last (1988).

8 APPENDICES

8.1 Format of computer tapes of deaths as supplied by Central Statistical Services

8.1.1 Black Deaths before 1972

Field	
1-2	Section
3-4	Series
5	Month of death
6	Year of death
7	Sex
8	Institution
9	Population group (Volkseenheid)
10-12	Age
13-15	Cause of death (ICD-8)
16-18	Nature of injury
19	Certification
20-22	Residence town (Dorp)
23-25	" District
26-27	" Metropolitan Area
28-32	Form No

Record Length = 32 Blocksize = 1600

8.1.2 Black deaths 1973-1977

Field	
1-5	Form number
6-7	Section
8-9	Series
10	Year of death
11-12	Month of death
13	Sex
14	Institution
15	Population group (Volkseenheid)
16-19	Age
20-22	Cause of death (ICD-8)
23-25	Nature of injury
26	Certification
27-29	Residence District
	" Town (Dorp)
	" Metropolitan area

Record Length = 33 Block size = 1650

8.1.3 Whites, Coloureds and Asian deaths 1973-1977

Field	
1-5	Form number
6	Year
7-8	Month
9-11	Age
12	Sex
13	Race
14	Marital status
15-16	Place of birth
17-19	District of residence
20-21	Town of residence
22-23	Metropolitan area
24	Area of residence
25	Institution
26-28	District of death
29-30	Town of death]
31	Area of death
32-34	Cause of death (ICD-8)
35	Certification
36-38	Nature of injury
39	RSA/Namibia/Overseas
40-41	Province of residence
42-43	Province of death
44-45	Age group
46-47	Principal cause group
48-49	Sub cause group
50	Blank

8.1.4 Deaths 1978 onwards (All population groups)

Field		
1-2	Identification	Section
3-4	"	Series
5-6	"	Consignment Date Month
7-8	"	Consignment Date Year
9-13	"	Serial number
14-15	Date of birth/age	Year or age
16-17	"	Month
18-19	"	Day
20-21	"	Age (Single years)
22-23	"	Age (Grouped)
24-25	"	Age (Grouped)
26-27	"	Infant yeaths-age (Grouped)
28-29	"	Infant deaths-age (Grouped)

30-31	Date of death	Year
32-33	"	Month
34-35	"	Day
36	"	Sex
37-38	Population group	
39	Marital status	
40-42	Occupation	(Single codes)
43-44	"	(Grouped codes)
43-50	Place of residence	Magisterial district
51	"	Check digit
52-53	"	Province
54-59	"	Magisterial district (includes black states)
60	"	Check digit
61	"	Urban/rural
62-63	"	Metropolitan area
64-69	Place of death	Magisterial district
70	"	Check digit
71	"	Grouped
72	Institution	
73-75	Cause of death	Single codes
76-77		Grouped
78-79		Grouped
80-81		Grouped
82		Grouped
83	Certified	
84-86	Nature of injury	
87	Home language	

Record Length 87 Blocksize 4002

8.2 Format of uniform mortality data files in this date base

Field	
2-7	Date of Birth (YYMMDD)
9-14	Date of Death (YYMMDD)
16-18	Age in Years
20	Sex (1= M, 2= F)
22-23	Race (1= Wht, 2= Col, 3= Asn)
25-28	Place of residence *
32-35	Place of death *
39-41	Cause of death (ICD-9)

* For details of this coding see reference in Chapter 2 for Central Statistical Services (1977c, 1978c, 1980c, 1981c and 1982c)

8.3 Format of Windhoek and Cape Town mortality

8.3.1 Windhoek

Field	
1-5	Form number
7-12	Hospital number
14-15	Area (Fig 8.1)
17-18	Race
20	Sex
22-23	Age
25	Institution
27-32	Date of death *
34-36	Cause
38-39	Category

* For 1976-1982 ICD-6 was used
and for 1983-1988 ICD-9 was used

For further details see Isaäcson, Sayed and Hattingh (1987)

8.3.2 Cape Town

Field	
1	Sequence letter
2-6	Sequence number
8	Race
10	Sex
12-14	Age in years
15	Neonatal/postneonatal death
16	Y=age in years S=stillbirth U=unknown age
18	Magisterial district
19-22	ESD of 1980 census
24-26	ICD-9 (Underlying cause of death)
28-30	ICD-9 (Secondary cause of death)
32-37	Date of death DDMMYY
39-41	Local area of 1980 census
43-44	Underlying cause of death ICD-9 BTL
46-47	" " Chapter
49-53	Median head of household income for local area of death Remaining fields are blank

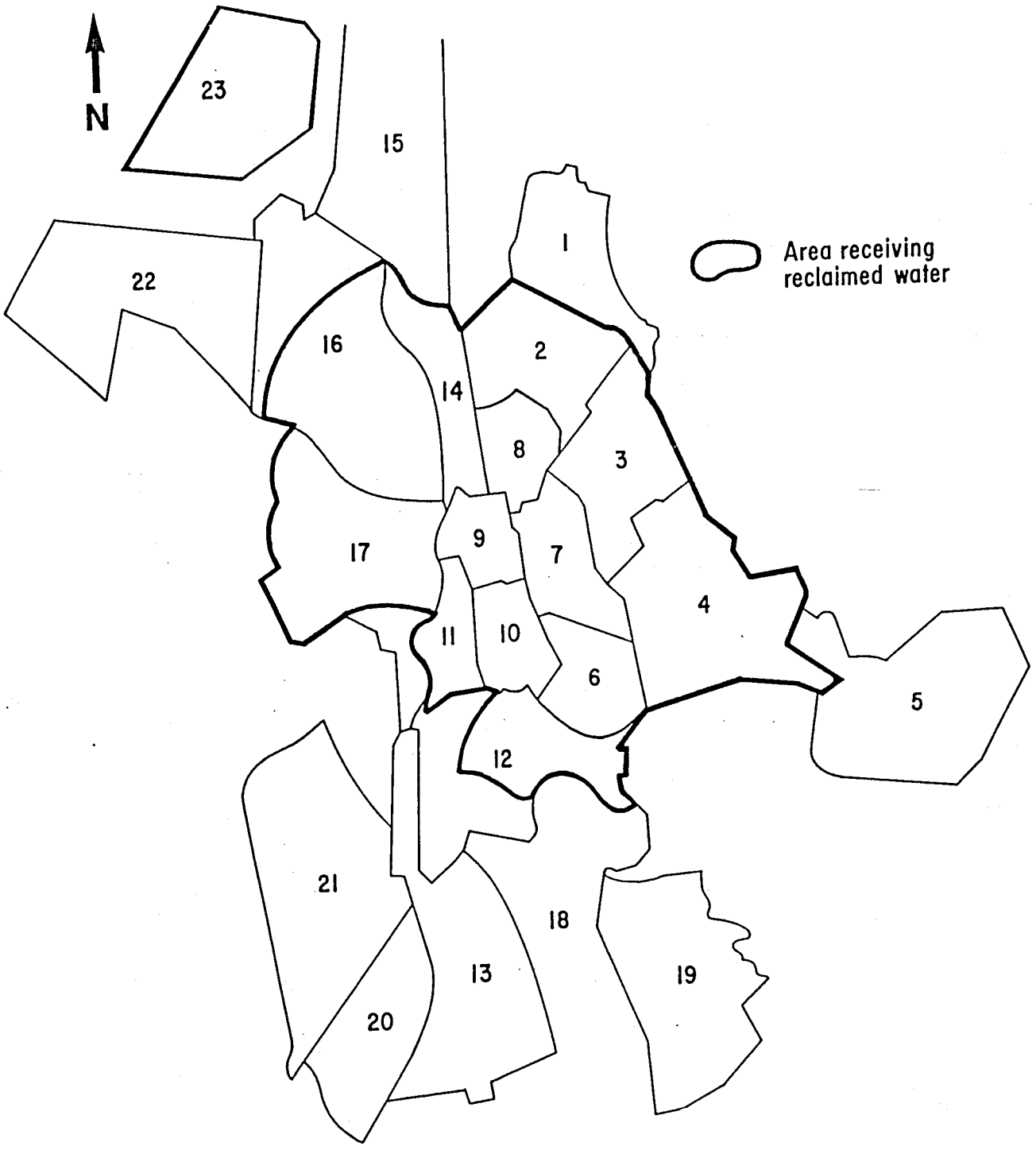

Figure 8.1 Map of Windhoek showing the area used in the data base.

8.4 Computer files mortality data sets

8.4.1 South Africa (Uniform data set)

Filename

MWCA78	Whites, Coloureds, Asians	1978
MWCA79	"	1979
MWCA80	"	1980
MWCA81	"	1981
MWCA82	"	1982
MWCA83	"	1983
MWCA84	"	1984
MWCA85	"	1985
MWCA86	"	1986
MB79	Blacks	1979
MB80	"	1980
MB81	"	1981
MB84	"	1984
MB85	"	1985
MB86	"	1986

8.4.2 Cape Town

MCT8184	Cape Town mortality	1981-1984

8.4.3 Windhoek

MWK7682	Windhoek mortality	1976-1982
MWK8388	"	1983-1988

8.5 Alphabetical list of magisterial districts used in mortality atlas

		Map coordinates	
		Row	Column
1	ABERDEEN	46	46
2	ADELAIDE	46	64
3	ALBANY	49	65
4	ALBERT	38	64
5	ALBERTON	18	79
6	ALEXANDRIA	50	61
7	ALFRED	38	93
8	ALIWAL NORTH	38	68
9	AMERSFOORT	21	94
10	BABANANGO	28	102

11	BALFOUR	20	83
12	BARBERTON	16	103
13	BARKLY EAST	38	75
14	BARKLY-WEST	26	49
15	BATHURST	50	67
16	BEAUFORT WEST	45	36
17	BEDFORD	46	62
18	BELFAST	15	95
19	BELLVILLE	51	7
20	BENONI	17	81
21	BERGVILLE	29	87
22	BETHAL	19	90
23	BETHLEHEM	27	81
24	BETHULIE	36	61
25	BLOEMFONTEIN	30	63
26	BLOEMHOF	23	58
27	BOKSBURG	18	80
28	BOSHOFF	27	57
29	BOTHAVILLE	23	67
30	BRAKPAN	18	81
31	BRANDFORT	28	65
32	BREDASDORP	54	18
33	BRITS	14	76
34	BRITSTOWN	36	42
35	BRONKHORSTSPRUIT	15	85
36	BULTFONTEIN	27	63
37	CALEDON	53	14
38	CALITZDORP	50	30
39	CALVINIA	39	15
40	CAMPERDOWN	34	97
41	CAPE TOWN	52	4
42	CARNARVON	30	31
43	CAROLINA	17	97
44	CATHCART	47	70
45	CERES	47	15
46	CHRISTIANA	24	56
47	CLANWILLIAM	45	9
48	CLOCOLAN	29	74
49	COLESBERG	37	55
50	COLIGNY	18	65
51	CRADOCK	44	59
52	CULLINAN	14	84
53	DANNHAUSER	26	93
54	DE AAR	37	47
55	DELAREYVILLE	19	58
56	DELMAS	17	84
57	DEWETSDORP	32	67
58	DUNDEE	27	96
59	DURBAN	34	101
60	EAST LONDON	48	74

61	EDENBURG	33	61
62	ELLIOT	40	76
63	ERMELO	19	96
64	ESHOWE	30	104
65	ESTCOURT	30	91
66	EXCELSIOR	30	71
67	FAURESMITH	33	54
68	FICKSBURG	29	76
69	FORT BEAUFORT	47	66
70	FOURIESBURG	28	79
71	FRANKFORT	22	82
72	FRASERBURG	42	28
73	GEORGE	51	36
74	GERMISTON	17	79
75	GLENCOE	27	94
76	GOODWOOD	52	6
77	GORDONIA	24	23
78	GRAAFF-REINET	44	51
79	GROBLERSDAL	13	90
80	HANKEY	51	53
81	HANOVER	39	50
82	HARRISMITH	26	87
83	HARTSWATER	24	53
84	HAY	30	38
85	HEIDELBERG (CAPE)	53	23
86	HEIDELBERG (TVL)	19	81
87	HEILBRON	22	78
88	HENNEMAN	25	70
89	HERBERT	30	46
90	HERMANUS	54	12
91	HLABISA	27	110
92	HOFMEYER	42	60
93	HOOPSTAD	25	61
94	HOPEFIELD	48	4
95	HOPETOWN	33	44
96	HUMANSDORP	52	49
97	IMPENDLE	33	92
98	INANDA	33	101
99	INDWE	41	72
100	INGWAVUMA	22	1131
101	IXOPO	36	94
102	JACOBSDAL	30	54
103	JAGERSFONTEIN	33	58
104	JANSENVILLE	47	52
105	JOHANNESBURG	18	78
106	JOUBERTINA	51	45
107	KEMPTON PARK	17	80
108	KENHARDT	31	19
109	KIMBERLEY	29	50
110	KING WILLIAMSTOWN	46	74

111	KIRKWOOD	49	57
112	KLERKSDORP	20	67
113	KLIPRIVIER	28	92
114	KNYSNA	52	41
115	KOFFIEFONTEIN	32	54
116	KOMGA	46	76
117	KOPPIES	22	75
118	KOSTER	16	70
119	KRANSKOP	30	100
120	KROONSTAD	24	72
121	KRUGERSDORP	16	75
122	KUILSRIVIER	52	7
123	KURUMAN	21	37
124	LADISMITH (CAPE)	50	26
125	LADYBRAND	31	73
126	LADY GREY	38	71
127	LAINGSBURG	48	24
128	LICHTENBURG	17	63
129	LINDLEY	25	77
130	LIONS RIVER	32	94
131	LOWER TUGELA	32	102
132	LOWER UMFOLOSI	29	108
133	LYDENBURG	12	97
134	MACLEAR	39	79
135	MALMESBURY	49	7
136	MARICO	13	64
137	MARQUARD	28	73
138	MESSINA	1	96
139	MIDDELBURG (TVL)	16	91
140	MIDDELBURG (CAPE)	41	55
141	MOLTENO	40	64
142	MONTAGU	51	19
143	MOOIRIVIER	31	93
144	MOSSELBAY	52	31
145	MOUNT CURRIE	36	87
146	MTONJANENI	29	104
147	MTUNZINI	30	106
148	MURRAYSBURG	43	44
149	NAMAQUALAND	33	5
150	NELSPRUIT	15	100
151	NEW HANOVER	32	98
152	NEWCASTLE	25	93
153	NGOTSHE	24	106
154	NIGEL	18	84
155	NOUPOORT	39	53
156	OBERHOLZER	18	73
157	ODENDAALSRUS	24	67
158	OUDTSHOORN	50	34
159	PAARL	51	9
160	PARYS	21	75

161	PAULPIETERSBURG	23	99
162	PEARSTON	46	55
163	PETRUSBURG	30	59
164	PHILIPPOLIS	35	56
165	PHILIPSTOWN	35	50
166	PIET RETIEF	22	101
167	PIETERMARITZBURG	33	96
168	PIETERSBURG	6	92
169	PIKETBERG	47	7
170	PILGRIMS REST	11	102
171	PINETOWN	34	99
172	POLELA	34	91
173	PORT ELIZABETH	51	59
174	PORT SHEPSTONE	38	95
175	POSTMASBURG	25	36
176	POTCHEFSTROOM	19	72
177	POTGIETERSRUS	4	82
178	PRETORIA	16	97
179	PRIESKA	34	36
180	PRINCE ALBERT	48	33
181	QUEENSTOWN	43	68
182	RANDBURG	17	78
183	RANDFONTEIN	17	74
184	REDDERSBURG	33	64
185	REITZ	24	82
186	RICHMOND (CAPE)	40	46
187	RICHMOND (NATAL)	34	94
188	RIVERSDALE	52	27
189	ROBERTSON	52	16
190	ROODEPOORT	17	77
191	ROUXVILLE	36	68
192	RUSTENBURG	15	73
193	SASOLBURG	20	78
194	SCHWEIZER-RENEKE	21	57
195	SENEKAL	27	75
196	SIMONSTOWN	53	5
197	SMITHFIELD	35	65
198	SOMERSET EAST	47	59
199	SOMERSET WEST	53	9
200	SOUTPANSBERG	3	92
201	SPRINGS	18	82
202	STANDERTON	21	88
203	STELLENBOSCH	52	9
204	STERKSTROOM	41	67
205	STEYNSBURG	40	60
206	STEYTLERVILLE	49	49
207	STOCKENSTROM	46	67
208	STRAND	53	8
209	STUTTERHEIM	45	74
210	SUTHERLAND	45	21

211	SWARTRUGGENS	14	69
212	SWELLENDAM	52	21
213	TARKASTAD	43	64
214	THABAZIMBI	10	72
215	THEUNISSEN	27	67
216	TROMPSBURG	34	60
217	TULBAGH	49	10
218	UBOMBO	24	112
219	UITENHAGE	50	55
220	UMVOTI	31	98
221	UMZINTO	36	97
222	UNDERBERG	33	88
223	UNIONDALE	50	40
224	UTRECHT	24	96
225	VANDERBIJLPARK	19	76
226	VANRHYNSDORP	40	6
227	VENTERSBURG	26	72
228	VENTERSDORP	18	69
229	VENTERSTAD	38	60
230	VEREENIGING	19	78
231	VICTORIA WEST	40	39
232	VILJOENSKROON	22	70
233	VIRGINIA	26	69
234	VOLKSRUST	22	92
235	VREDE	23	87
236	VREDEFORT	21	73
237	VREDENBURG	47	2
238	VREDENDAL	42	4
239	VRYBURG	21	51
240	VRYHEID	25	101
241	WAKKERSTROOM	22	96
242	WALVISBAAI	2	2
243	WARMBAD	11	79
244	WARRENTON	26	53
245	WATERBERG	7	78
246	WATERVAL-BOVEN	15	98
247	WEENEN	30	95
248	WELKOM	25	68
249	WELLINGTON	50	10
250	WEPENER	34	70
251	WESSELSBRON	25	65
252	WESTONARIA	18	76
253	WILLISTON	38	24
254	WILLOWMORE	48	42
255	WINBURG	28	70
256	WITBANK	16	87
257	WITRIVIER	14	106
258	WODEHOUSE	40	70
259	WOLMARANSSTAD	22	63
260	WONDERBOOM	14	81

261	WORCESTER	50	13
262	WYNBERG	52	5
263	ZASTRON	36	71

8.6 Table 8.1 The basic tabulation list of the International Classification of Disease (ICD-9)

BTL	Disease
01	Intestinal infectious diseases
02	Tuberculosis
03	Other bacterial diseases
04	Viral diseases
05	Rickettsioses and other arthropod borne diseases
06	Venereal diseases
07	Other infectious and parasitic diseases and late effects of infectious and parasitic diseases
08	Malignant neoplasm of lip, oral cavity and pharynx
09	Malignant neoplasm of digestive organs and peritoneum
10	Malignant neoplasm of respiratory and intrathoracic organs
11	Malignant neoplasm of bone, connective tissue, skin and breast
12	Malignant neoplasm of genito-urinary organs
13	Malignant neoplasm of other and unspecified sites
14	Malignant neoplasm of lymphatic and haematopoietic tissue
15	Benign neoplasm
16	Carcinoma in situ
17	Other and unspecified neoplasm
18	Endocrine and metabolic diseases, immunity disorders
19	Nutritional difficiencies
20	Diseases of blood and bloodforming organs
21	Mental disorders
22	Diseases of the nervous system
23	Disorders of the eye and adnexa
24	Diseases of the ear and mastoid process
25	Rhuematic fever and rheumatic heart disease
26	Hypertensive disease
27	Ischaemic heart disease
28	Disease of pulmonary circulation and other forms of heart disease
29	Cerebrovascular disease
30	Other disease of the circulatory system
31	Diseases of the upper respiratory system
32	Other diseases of the respiratory system
33	Diseases of oral cavity, salivary glands and jaws
34	Diseases of other parts of the digestive system
35	Diseases of urinary system
36	Diseases of male genital organs
37	Diseases of female genital organs

38 Abortion
39 Direct obstetric causes
40 Indirect obstetric causes
41 Normal delivery
42 Diseases of skin and subcutaneous tissue
43 Diseases of the musculoskeletal system and connective tissue
44 Congenital anomalies
45 Certain conditions originating in the perinatal period
46 Signs, symptoms and ill-defined conditions
E47 Transport accidents
E48 Accidental poisoning
E49 Misadventures during medical care, abnormal reactions, late complications
E50 Accidental falls
E51 Accidents caused by fire and flames
E52 Other accidents, including late effects
E53 Drugs, medicaments causing adverse effects in therapeutic use
E54 Suicide and self-inflicted injury
E55 Homicide and injury purposely inflicted by other persons
E56 Other violence

Note: In this report and in the supplemental computer files the E prefix to codes 47 - 56 has been omitted in many cases (particularly in tabulations).

8.6.1 Supplemental Codes to the ICD-9 used by the South African Central Statistical Services

The following codes are used by the Central Statistical Services (1979d) to supplement the International Classification of Diseases 9th Revision. The Central Statistical Services list of the Basic T abulation List (BTL) of ICD-9 is incorrect as the additional South African codes have been ommitted. The South African additional codes, and their correct Basic Tabulation List (BTL) codes are given below;

ICD code	BTL code	Description
166	10	Malignant neoplasm of trachea
509	10	Mesothelioma
538	34	Stomach troubles (Blacks only) (Sic!)
609	34	Cirrhosis of liver alcoholic
E839	52	Accidents in sport
E849	52	Mine accidents
E889	56	Violent death, unspecified as to whether suicide or homicide
E979	54	Suicide and self inflicted poisoning by motor vehicle exhaust gas

Note:

Malignant neoplasm of trachea excluded from code 162
Cirrhosis of liver, alcoholic excluded from code 571

8.7 Spatial analysis and mapping of mortality rates layout of tables and maps in the computer files

(Note: The files are arranged as print files and the page numbers are explicitly printed on each page) of the print file.

Pages 2-6 Map co-ordinates of the 263 magisterial districts used ordered by row and column (Appendix 8.5)

Pages 7-11 Alphabetical list of the 263 magisterial districts used together with their map co-ordinates (Appendix 8.5)

Page 11 Number of deaths used in the calculations for the specific population group and sex combination of the particular volume.
Deaths input = total number of deaths in RSA for this population group and sex.
Deaths used = number of deaths in the 263 magisterial districts.

Page 12 A specimen map with all 263 magisterial districts indicated (Fig 8.2) The column number appears across the top of the map. The units digit only (to conserve space) of the column number appears across the bottom of the map. The row number is repeated on the left and right hand sides of the map. The exact row and column co-ordinates of any magisterial district plotted can thus be accurately read off by means of a ruler.

Pages 14 and following: For each of the 56 causes of death in the Basic Tabulation List (BTL) of the ICD-9, the following information is given in tabular form (over 2 lines) for each magisterial district in which the total number of deaths in that district for the given cause, sex and population group combination is greater or equal to 5 deaths for the whole 5 year period: (Specimen in Tables 8.2 to 8.8).

Line 1 Sequence number in the alphabetical list of magisterial district;

Name of district For each of the 10 age groups, and for the total of all ages combined:

- The number of deaths occurring in those categories in the whole 5 year period;
- In the column "SMR" the Standardized Mortality Ratio (SMR) (normalized to 1);
- In the column "SIG" the statistical significance of the SMR indicated by:

  ++ Significantly high at the 99% confidence level

  + Significantly high at the 95% confidence level

MAP WITH ALL MAGISTERIAL DISTRICTS PLOTTED

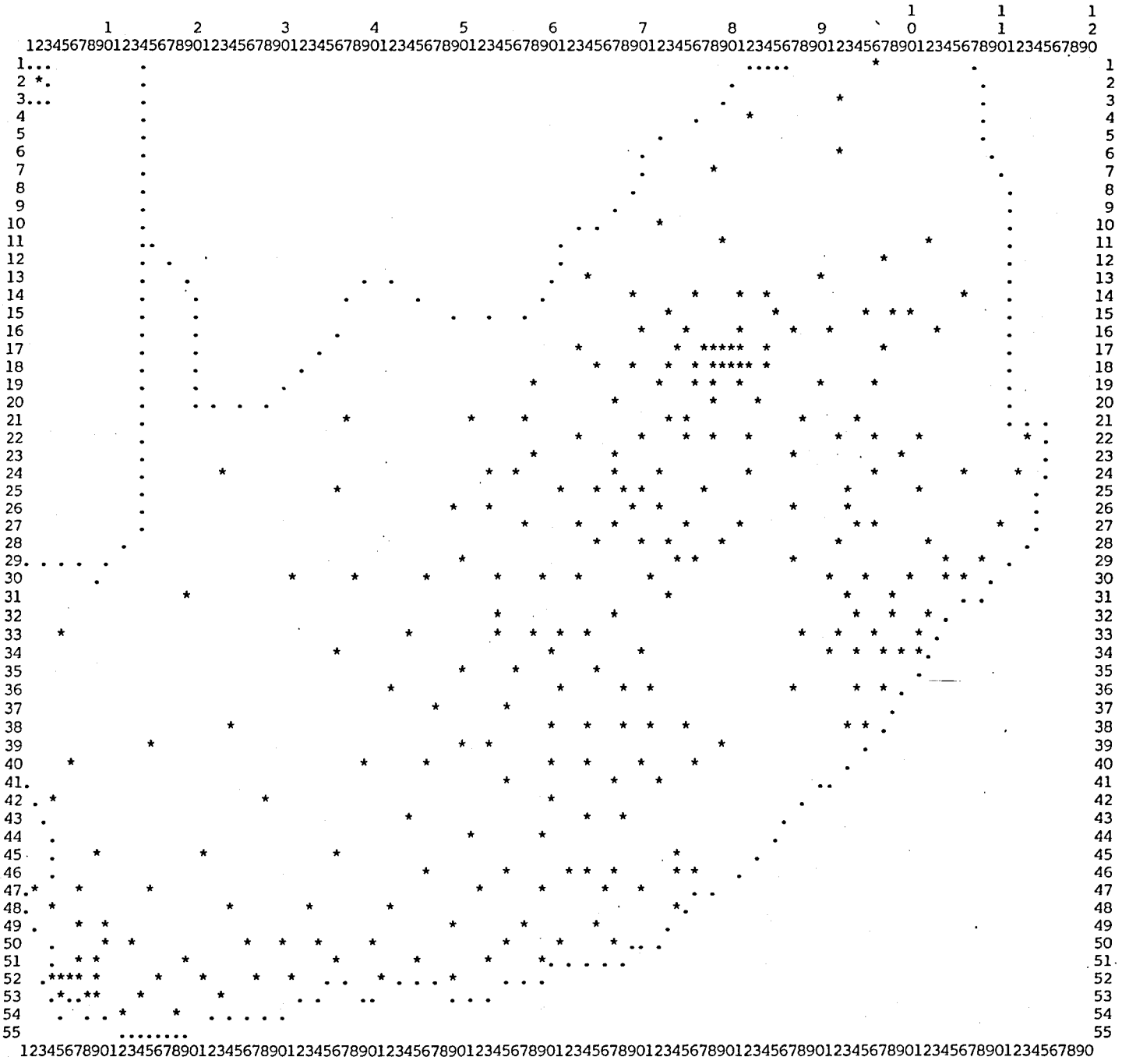

Figure 8.2 Map with all magisterial districts plotted.

Table 8.2

White male BTL all causes

Magisterial district		Age group in years										Total	SMR	SIG	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Aberdeen	Number	1	1	0	2	0	0	3	11	28	31	77	1,33	+	1,05	0,97
	Rate*	33,33	7,41	0,00	7,84	0,00	0,00	7,50	36,07	101,82	134,78	28,05			1,66	1,77
Adelaide	Number	0	0	0	2	2	4	3	5	12	17	45	1,00		0,73	0,66
	Rate	0,00	0,00	0,00	1,69	4,44	10,53	10,00	15,87	58,54	125,93	11,24			1,34	1,45
Albany	Number	7	0	2	13	12	16	36	76	97	104	363	1,25	++	1,12	1,09
	Rate	20,00	0,00	0,45	1,22	2,68	5,02	13,58	33,41	66,21	170,49	11,50			1,38	1,43
Albert	Number	1	0	0	3	4	0	4	11	31	20	74	1,03		0,81	0,75
	Rate	7,14	0,00	0,00	3,53	4,60	0,00	5,52	20,56	69,66	142,86	11,58			1,29	1,38

**Rate/1 000, SMR = Standardized mortality ratio, SIG = Signifcance, 95% = Level of significance*

Table 8.3

White male BTL all causes

Magisterial district		Age group in years										Total	SMR	SIG	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Alberton	Number	28	9	13	37	59	71	91	113	76	630	0,93			0,85	0,83
	Rate*	11,09	0,81	0,46	2,28	2,23	3,30	9,49	21,65	53,52	128,81	5,08			1,00	1,02
Alexandria	Number	2	1	0	3	1	1	4	14	25	22	73	0,85		0,67	0,62
	Rate	28,57	2,99	0,00	6,38	1,27	1,42	6,06	21,54	41,32	112,82	13,53			1,07	1,14
Alfred	Number	0	0	0	0	2	2	2	4	3	10	21	0,88		0,54	0,46
	Rate	0,00	0,00	0,00	0,00	4,55	0,00	10,53	21,05	23,08	181,82	9,23			1,35	1,51
Allwal North	Number	4	0	3	5	3	5	14	29	45	44	152	1,18	+	1,00	0,95
	Rate	42,11	0,00	1,97	6,17	2,55	5,41	16,87	34,52	55,21	118,92	19,26			1,39	1,45

** Rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.4

White male BTL all causes

Magisterial district		Age group in years										Total	SMR	SIG	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Amersfoort	Number	4	0	1	3	2	2	5	10	19	20	66	1,48	++	1,14	1,05
	Rate*	80,00	0,00	1,68	10,71	4,94	4,65	13,51	42,55	63,33	166,67	21,75			1,88	2,01
Balfour	Number	2	1	1	6	2	7	16	18	41	31	125	0,94		0,78	0,73
	Rate	6,78	0,84	0,32	3,53	0,80	3,79	12,21	18,75	49,10	134,78	8,92			1,11	1,17
Barberton	Number	5	2	3	10	10	18	23	43	53	32	199	1,07		0,93	0,89
	Rate	11,63	1,05	0,69	3,40	2,48	5,48	9,87	28,38	55,50	116,36	9,05			1,23	1,29
Barkly East	Number	0	0	0	0	0	2	3	3	12	11	31	0,90		0,61	0,53
	Rate	0,00	0,00	0,00	0,00	0,00	4,08	7,59	9,84	58,54	200,00	9,58			1,27	1,40

** Rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.5

White male BTL all causes

Magisterial district		Age group in years										Total	SMR*	SIG**	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Barkly West	Number	2	2	0	3	5	4	7	15	26	19	83	0,99		0,79	0,74
	Rate*	11,76	3,54	0,00	3,08	4,59	3,56	7,25	22,73	48,60	146,15	10,36			1,23	1,31
Bathurst	Number	2	2	1	3	0	2	7	19	53	56	145	0,70	--	0,59	0,56
	Rate	18,18	5,06	1,03	5,13	0,00	2,35	8,86	13,87	32,52	97,39	17,88			0,83	0,87
Beaufort West	Number	9	3	1	3	7	11	20	26	55	44	179	1,15		0,99	0,94
	Rate	32,14	2,65	0,35	1,50	3,07	4,89	11,30	19,40	78,01	131,34	11,96			1,34	1,40
Bedfort	Number	1	0	0	1	2	1	3	10	16	9	43	0,96		0,69	0,62
	Rate	33,33	0,00	0,00	5,13	4,88	3,08	10,53	29,85	48,48	85,71	15,87			1,29	1,40

** Rate/1 000, Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.6

White male BTL all causes

Magisterial district		Age group in years										Total	SMR*	SIG**	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Belfast	Number	6	0	1	6	4	8	9	11	49	29	123	0,83	-	0,69	0,65
	Rate*	30,77	0,00	0,35	3,30	2,61	5,35	8,57	9,52	48,28	98,31	10,02			1,00	1,05
Bellville	Number	96	24	18	95	92	126	260	487	608	525	2331	1,05	+	1,01	1,00
	Rate	18,71	1,16	0,34	2,18	1,83	3,14	9,61	26,00	59,67	146,85	8,57			1,09	1,11
Benoni	Number	47	12	12	78	56	103	173	264	328	211	1284	1,08	++	1,02	1,10
	Rate	18,29	1,10	0,40	3,32	2,38	4,16	11,38	24,25	56,75	133,54	8,63			1,14	1,16
Bergville	Number	1	0	0	0	2	3	4	3	5	7	25	0,32	--	0,21	0,18
	Rate	8,33	0,00	0,00	0,00	0,98	1,79	3,54	3,33	14,49	93,33	2,49			0,47	0,53

** Rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.7

White male BTL all causes

Magisterial district		Age group in years										Total	SMR*	SIG**	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Bethal	Number	39	10	17	50	64	71	97	96	95	61	600	2,13	++	1,97	1,92
	Rate*	36,97	2,02	1,45	6,53	6,54	9,44	24,53	45,93	79,83	265,22	11,96			2,31	2,37
Bethlehem	Number	12	2	2	19	10	10	39	62	93	103	352	1,08		0,97	0,94
	Rate	22,02	0,72	0,26	2,48	1,91	2,37	10,70	23,31	58,68	164,80	9,59			1,20	1,24
Bethulie	Number	2	0	0	1	1	0	4	10	16	18	52	0,86		0,64	0,58
	Rate	50,00	0,00	0,00	4,00	2,38	0,00	12,70	25,64	38,10	102,86	15,88			1,13	1,22
Bloemfontein	Number	78	23	23	112	98	128	224	418	545	428	2077	1,09	++	1,05	1,03
	Rate	22,10	1,45	0,53	1,70	2,77	4,91	11,14	25,79	58,26	140,33	8,68			1,14	1,16

** Rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.8

White male BTL all causes

Magisterial district		Age group in years										Total	SMR*	SIG**	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Bloemhof	Number	1	0	0	2	2	4	8	16	30	41	104	1,22		1,00	0,94
	Rate*	12,50	0,00	0,00	1,67	3,57	6,84	15,38	26,67	55,05	182,22	17,28			1,48	1,57
Boksburg	Number	41	18	14	67	64	80	139	248	293	189	1153	1,11	++	1,04	1,02
	Rate	12,08	1,17	0,42	2,70	1,95	3,25	10,43	28,80	63,97	171,82	7,10			1,17	1,19
Boshoff	Number	3	0	1	0	5	5	5	14	31	33	97	0,54	--	0,44	0,41
	Rate	17,65	0,00	0,34	0,00	4,39	4,59	5,35	12,44	24,90	66,67	8,66			0,66	0,70
Bothaville	Number	6	0	2	3	6	4	13	23	45	33	135	1,15		0,96	0,91
	Rate	31,58	0,00	0,78	2,19	2,69	2,68	9,59	25,99	63,38	160,98	11,14			1,36	1,43

** rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

Table 8.9

White male BTL all causes

Magisterial district		Age group in years										Total	SMR*	SIG**	SMR	
		<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+				95%	99%
Brakpan	Number	38	11	10	33	51	49	102	213	244	141	892	1,29	++	1,20	1,18
	Rate*	28,79	1,51	0,56	2,44	3,98	4,21	13,09	35,71	69,02	126,46	10,78			1,37	1,40
Brandfort	Number	0	1	1	4	2	3	10	15	42	31	109	0,87		0,72	0,67
	Rate	0,00	2,08	0,66	5,44	2,38	3,31	15,04	18,87	46,41	92,54	14,97			1,05	1,11

**Rate/1 000, SMR = Standardized mortality ratio, SIG = Significance, 95% = Level of significance*

- Significantly high at the 95% confidence level

-- Significantly high at the 99% confidence level

In the column "SMR 95%" The 95% lower limit to the SMR (in line 1) and under it in line 2 the 95% upper limit to the SMR;

In the column "SMR 99%" The 99% lower limit to the SMR (in line 1) and under it in line 2 the 99% upper limit to the SMR.

Line 2 Under the 10 age groups and total of all ages combined, the mortality rate **per annum** per 1 000 population.

The MAP which follows the tabulations (Specimen in Fig 8.3) consists of the following symbols plotted at the row and column co-ordinates of each of the 263 magisterial districts:

\# SMR > 1 and significant at 99% level (mnemonic: a double plus sign)

\+ SMR > 1 and significant at 95% level (mnemonic: a plus sign)

A SMR > 1 but not significant (mnemonic: an upward pointing sign)

V SMR < 1 but not significant (mnemonic: a downward pointing sign)

\- SMR < 1 and significant at 95% level (mnemonic: a minus sign)

= SMR <1 and significant at 99% level (mnemonic: a double minus sign)

8.8 Computer files: Mortality-spatial analysis and mapping of mortality rates

MAWM80	White males	1978-1982
MAWF80	White females	"
MACM80	Coloured males	"
MACF80	Coloured females	"
MAAM80	Asian males	"
MAAF80	Asian females	"

8.9 Potential years of life lost layout of tables in computer files

Potential years of life files are in the form of print files with annotation. The regional analysis is by statistical region. The causes analysed are the chapters and BTL of the ICD.

8.10 Computer files: Mortality-potential years of life lost

PYLL80 Potential years of life lost (all population groups) 1980

PYLL85 Potential years of life lost (all population groups) 1985

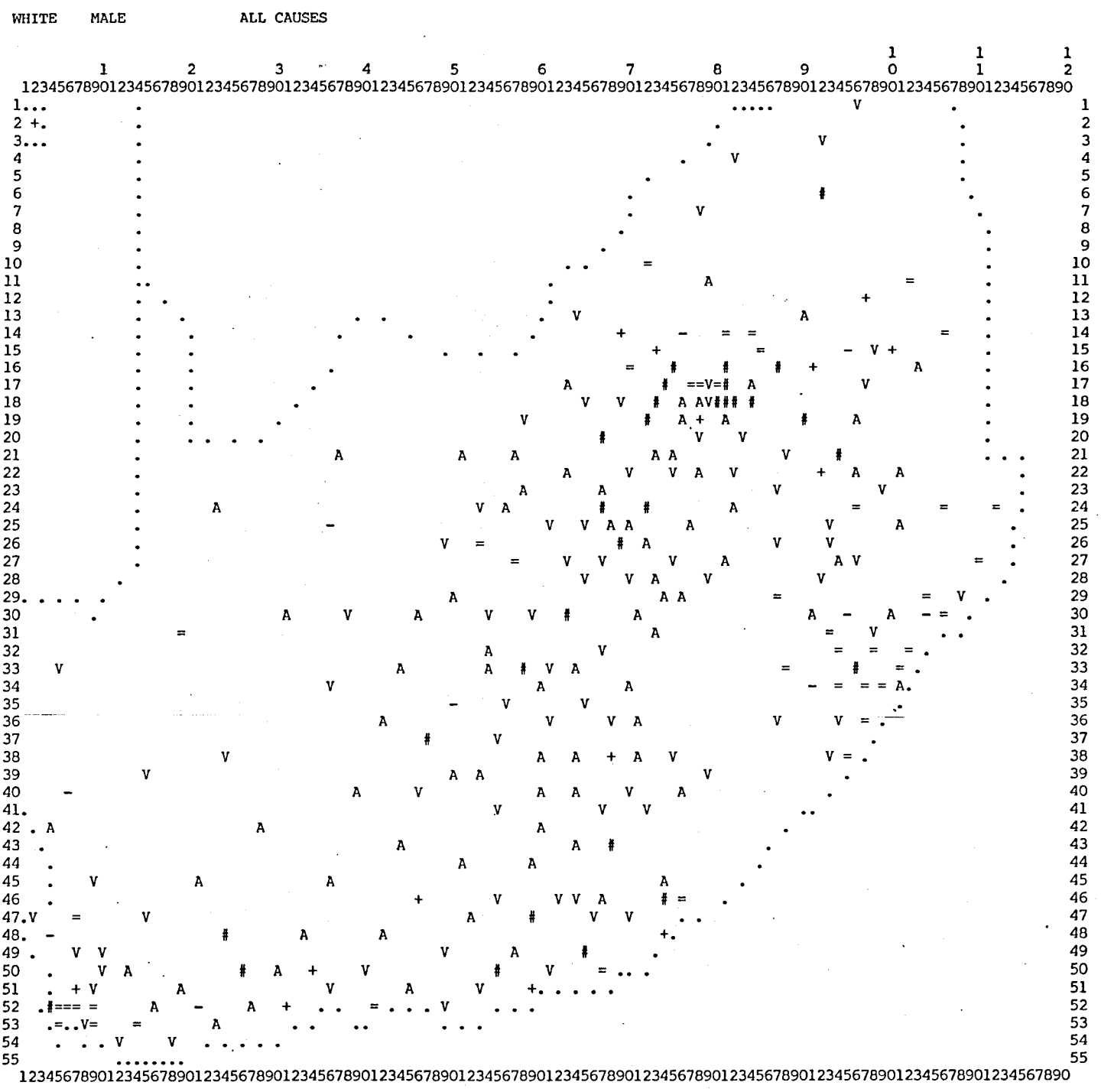

Figure 8.3 Specimen mortality map.

8.11 Life tables: Regional analysis layout of tables

The life table files are in teh form of print files. They are annotated and contain complete, associated single decrement, and multiple decrement tables by statistical region and cause of death. The ages are in five year groupings except for ages 0 and 1 - 4. The causes are by ICD - 9 chapter and BTL where there are sufficient numbers of deaths for the table calculation to converge. Standard life table notation is used. As the print file is in uppercase characters only, a repeated letter indicates upper case, a single letter lower case ie. LL = L_x and L = l_x.

8.12 Computer files life tables: Regional analysis

File

LTWM80	Regional life tables	White males	1980
LTWF80	" " "	White females	1980
LTCM80	" " "	Coloured males	1980
LTCF80	" " "	Coloured females	1980
LTAM80	" " "	Asian males	1980
LTAF80	" " "	Asian females	1980

8.13 List of notifiable medical conditions in terms of the Health Act

Acute rheumatic fever or rheumatic fever
Anthrax
Brucellosis
Cholera
Diptheria
Encephalitis
Food poisoning (outbreaks of more than four persons)
Haemorrhagic fevers of Africa (Congo, Dengue, Ebola, Lassa, Marburg, Rift Valley)
Lead poisoning
Legionellosis
Leprosy
Malaria
Measles
Meningococcal infections
Paratyphoid fever
Plague
Poisoning from any agricultural or stock remedy registered in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (ActNo 36 of 1947)
Poliomyelitis
Rabies (specify whether human case or human contact)
Rheumatic heart disease (first diagnosis only)
Smallpox and any smallpox-like disease, excluding chicken pox)
Tetanus
Trachoma
Tuberculosis

(i) pulmonary and other forms, except cases diagnosed solely on the basis of

clinical signs and symptoms

(ii) a strongly positive reaction after a tuberculin test in children under five years of age

Typhoid fever
Typhus fever (epidemic lice typhus fever, endemic ratflea typhus fever)
Viral hepatitis A, B, non-A, non-B and undifferentiated
Yellow fever

8.14 Regional morbidity for general practice : Layout of tables in computer files

The files listed in Appendix 8.15 are print files of tables similar to Table 3.1. but without explicitly giving the full description of the condition, although a code number as in Table 3.1. for each condition is given.

8.15 Computer files : Regional morbidity from general practice

GPJHB	GP morbidity for	Johannesburg	1985
GPPTA	" "	Pretoria	"
GPCTN	" "	Cape Town	"
GPDBN	" "	Durban	"
GPPEL	" "	Port Elizabeth	"
GPBLM	" "	Bloemfontein	"
GPELN	" "	East London	"
GPKIM	" "	Kimberley	"
GPGFD	" "	OFS Goldfields	"
GPMET	" "	metropolitan areas	"
GP10P	" "	centre size > 10 000	"
GP59	" "	centre size 5000-9000	"
GPLT5	" "	centre size < 5000	"

8.16 Liquid consumption and dietary intake in Cape Town

Liquid consumption and food intake patterns were ascertained in a survey of 2838 persons in Cape Town by means of a 24 hour recall of all food and drink items consumed. Water consumption was categorized by source: domestic tap water, water added in commercial processing, and water naturally bound in food.

During 1990 an additional survey of approximately 1500 black persons, who were not covered in the earlier surveys, will be carried out in conjunction with the Medical Research Council.

A data base of liquid and food consumption, of the combined surveys which will be representative of the population of Cape Town will be available in due course. It will also form part of the International FOODBASE system of the US National Cancer Institute.

Details of publications describing these surveys appear in Chapter 6. In the interim, enquiries about the availability of this data base should be directed to the authors of this report.

Table 4.8

Selected birth defects rates/10 000 live births
(Baragwanath hospital and Cape Peninsula and Neonatal Service (PMNS)

ICD-9 code	Condition	Rates/10 000 live births		
		Baragwanath	95% CI*	PMNS
740	Anencephalus	0,7	0,1 - 2,6	1,9
741	Spina bifuda	3,5	1,9 - 6,5	5,8
742.3	Hydrocephalus	4,8	1,8 - 8,2	2,5
749	Cleft palate	1,6	0,6 - 4,0	3,7
749.1 - 749.2	Cleft lip with or without cleft palate	1,6	0,6 - 4,0	5,1
750.3	Oesophageal atresia or stenosis	2,2	1,0 - 4,8	1,8

Total live births/a (Baragwanath hospital = 31 000),
** Confidence interval*

Table 4.8 (continued)

Selected birth defects rates/10 000 live births
(Baragwanath hospital and Cape Peninsula and Neonatal Service, PMNS)

ICD-9 code	Condition	Rates/10 000 live births		
		Baragwanath	95% CI*	PMNS
751.2	Anorectal atresia or stenosis	1,3	0,4 - 3,5	1,8
752.6	Hypospadias and epispadius	4,8	2,8 - 8,2	7,0
755.2 - 755.4	Reduction deformities - upper, lower and unspecified limb	1,9	0,8 - 4,4	1,8
756.4	Exomphalos - omphalocele	2,2	1,0 - 4,8	1,5
758.0	Down's syndrome	9,7	6,6 - 14,0	7,9

Total live births/a (Baragwanath hospital = 31 000)
** Confidence interval*