The reliability of mortality data in Johannesburg

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Abstract **Information on deaths in Johannesburg is collected on a voluntary basis by the Johannesburg City Health Department from the Department of Home Affairs regional offices as well as state mortuaries in the area. The reliability of these routinely collected data was assessed.**

Records of deaths of Asians, coloureds and whites from 1 July 1989 to 31 December 1989 were included in the study. Burial orders obtained from the different cemeteries and crematoria in the area were compared with the routinely collected mortality data.

Two thousand eight hundred and thirty-seven deaths were included in the study. One hundred and ninety (6%) deaths in the department's records could not be found among the corresponding burial orders while 1 019 (36%) burial order records were not found among the department's routinely collected mortality data.

Underreporting of deaths was greatest among the aged (43%) and infants (39%). When this underreporting was taken into account, the corrected infant mortality rate was 19,1/1 000 live births as opposed to 14,1.

Recommendations are made for the improvement of the quality of routinely collected mortality data.

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> The Authorities are very keen on amassing statistics. They collect them, add them, raise them to the *n*th power, take the cube root and prepare wonderful diagrams. But what you must never forget is that every one of those figures comes in the first instance from the village watchman, who just puts down what he damn pleases.'
>
> Sir Josiah Stamp (1880-1941)[1]

Johannesburg, the largest city in South Africa, lies on the crest of the Witwatersrand. With the discovery of gold in 1886 Johannesburg developed rapidly and by 1895 it had a population of approximately 102 000. At the beginning of this century, it covered 4,81 km^2 with a population of approximately 166 000.[2,3] In 1970, the Johannesburg municipal boundaries were extended to include Lenasia, Kliptown, Eldorado Park and parts of Northcliff. By 1989 the area was 509,09 km^2[4] and the population had increased to 922 264 with 66 209 Asians, 172 948 blacks, 150 674 coloureds and 532 433 whites.[5]

Over the past 20 years the crude death rate (CDR) for all groups combined dropped from 8,6 to 5,1/1 000 population (Fig. 1). In 1988/89 the CDR was 2,8/1 000 population for Asians, 4,7 for whites, 5,7 for coloureds and 6,8 for blacks*.[5]

The proportional mortality rate (PMR), which gives an indication of the relative impact of specific causes of death, is the percentage of people in a given group who die as the result of a particular cause. Diseases are classified according to the *International Classification of Diseases* (ICD) chapters.[7,8] In the year July 1988 - June 1989 non-natural causes such as accidents, poisoning and violence were the major cause of death for blacks

* Soweto statistics are not included in this study. Until 1986 the health services in Soweto were provided by the Johannesburg City Health Department on an agency basis.

TABLE I.
PMRs (%) of the major causes of death for 1988/89 by population group

	All	Asian	Black	Coloured	White
Accidents/poisoning/violence (ICD E800-E999)	24,5 (23,3; 25,7)*	25,3 (19,3; 31,8)	41,0 (38,2; 43,8)	29,9 (26,9; 33,0)	14,8 (13,5; 16,3)
Diseases of the circulatory system (ICD 390-459)	24,4 (23,2;25,6)	42,5 (35,3; 49,5)	11,8 (10,0; 13,7)	16,9 (14,5; 19,5)	31,6 (29,8; 33,4)
Signs, symptoms and ill-defined conditions (ICD 780-799)	13,7 (12,7; 14,7)	5,4 (2,7; 9,4)	19,0 (16,8; 21,2)	19,2 (16,7; 22,0)	10,0 (8,9; 11,2)
Neoplasms (ICD 140-239)	12,9 (12,0; 13,9)	6,5 (3,5; 10,7)	5,6 (4,4; 7,0)	10,1 (8,2; 12,2)	17,8 (16,3; 19,3)
Diseases of the respiratory system (ICD 460-519)	11,0 (10,1; 11,9)	5,4 (2,7; 9,4)	7,1 (5,7; 8,7)	8,3 (6,6; 10,3)	14,2 (12,8; 15,5)
Other	13,5	14,9	15,5	15,6	11,6

*95% confidence interval.

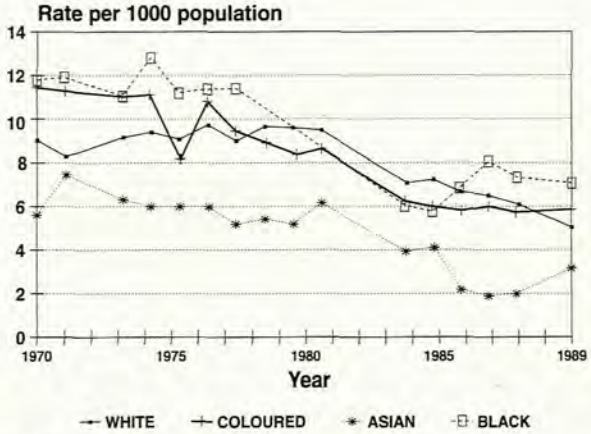

FIG. 1.
Crude death rate by population group for Johannesburg, 1970 - 1989.

(PMR 41,0%) and coloureds (PMR 29,9%), while diseases of the circulatory system were the commonest cause of death in whites (PMR 31,6%) and Asians (PMR 42,5%) (Table I).

In the absence of statistics on morbidity, mortality data are important in assessing disease patterns for a given community and have public health implications. Mortality data are thus important and need to be assessed for accuracy and reliability.[6] The accuracy of mortality statistics is dependent on the method, efficiency and classification of the recording of such data.

Typically, deaths are recorded in one of the following ways. According to the Births, Marriages and Deaths Registration Act No. 81 of 1963, amended by Act No. 41 of 1986, the regional representative of the Director-General (Home Affairs) acts as a registrar of births and deaths in a specific area. The Director-General may also appoint any representative or any member of an undertaker's business to act as an assistant registrar, provided that the specific conditions are followed. No burial may legally take place without a burial order issued either by the registrar or an assistant registrar.

In the case of a death from natural causes, a death certificate may be issued by a doctor, or else a police officer may issue a notice of death. South Africa is one of the few countries that permit police officers to certify deaths. Van der Merwe *et al.*[5] found that in Port Elizabeth, 50% of the reported deaths of blacks during a 6-week study period (13 April 1990 - 18 May 1990) were certified by the police.

In the case of a death due to unnatural causes, an autopsy is performed at a government mortuary and a certificate is issued by the district surgeon. The certificate is used to register the death at a registrar's office and information on the cause of death is also recorded.

The Johannesburg City Health Department collects information on deaths that occurred in the municipal area of Johannesburg of persons who, according to the regional offices of the Department of Home Affairs, had an address in the area. A clerk transcribes information of all records of deceased persons who had a Johannesburg address from the death register. Although not compelled to do so, the Health Department regularly checks government mortuaries to ensure that all deaths are recorded (Fig. 2).

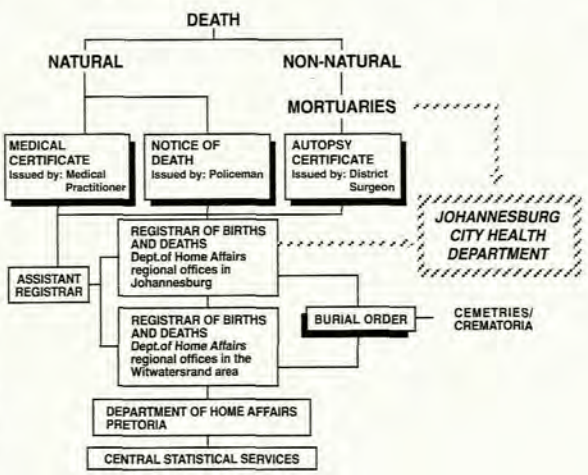

FIG. 2.
Flow diagram demonstrating the routine collection of information on mortality in Johannesburg.

The cause of death recorded at the different regional offices and mortuaries is often incomplete or incorrect. In some cases the underlying cause of death is not transcribed on the death register.

Information obtained from some undertakers revealed that a large number of organisations use funeral services outside the municipal area and that deaths of some Johannesburg residents are consequently not registered at the appropriate regional offices. Some deaths are also notified directly to Pretoria by some large firms of undertakers who are entitled to act as assistant registrars of death.

The responsibility for the collection of most mortality data among blacks falls under the jurisdiction of Soweto Health Department. The poor quality of black mortality statistics in general has also been well documented in South Africa.[8-12] It was therefore decided to include only deaths among Asians, whites and coloureds. This paper aims to assess the reliability of these mortality data and identify the potential sources and types of misclassification and reporting errors.

Methods

Because no burial should take place without a burial order it was decided that these records could be used for comparison with the routinely collected mortality data of the Health Department.

According to Section 14 of Act No. 81 of 1963, persons in charge of a burial place must keep a burial register in which the full name, sex, last known address, population group, date of death, date of burial, cause of death and date and place where the burial order was issued are recorded.[7] The records of all burials within the municipal area of Johannesburg are kept by the Parks and Recreation Department of the Johannesburg City Council which controls cemeteries, including the Brixton and Avalon crematoria. The records used in this study were obtained from this department.

Data were collected on all deaths occurring from 1 July to 31 December 1988. Records of deaths with an address within the Johannesburg municipal boundaries were included in the study.

The name, age, sex, area/suburb, population group and cause of death were manually checked and verified. This was done by the nosologist in the department.[13] The major groupings of the ICD were used to code the cause of death.[9,14]

Percentages and 95% confidence intervals of categorical data were calculated.[15] Differences between the information routinely collected and information on the deaths identified from the burial orders were tested by means of the chi-square and Student's *t*-test.[16]

The proportion of death records missing in each population group (i.e. deaths identified from burial orders which could not be found among the Department's records) was calculated individually for each cause of death. One was added to each of the proportions and the number of deaths in each of these categories was then multiplied by the correction factor to obtain new estimates of the mortality rates.

In this paper the term 'missing' refers to deaths identified from burial orders which could not be found in the records kept by the Health Department.

Results

The records of 2 837 deaths were found in the burial registers. One thousand and nineteen (36%, 95% CI 34,1 - 37,7%) of these records were missing from the data of the Health Department, while 190 (6,7%, 95% CI 5,8 - 7,6%) of the deaths in the data of the Health Department were not found in the burial records.

Age

In Fig. 3 the age distribution of deaths is given. Forty-five records of infant death (39%) were missing, while most missing records (247, 43%) involved persons aged 65 - 74 years (Table II).

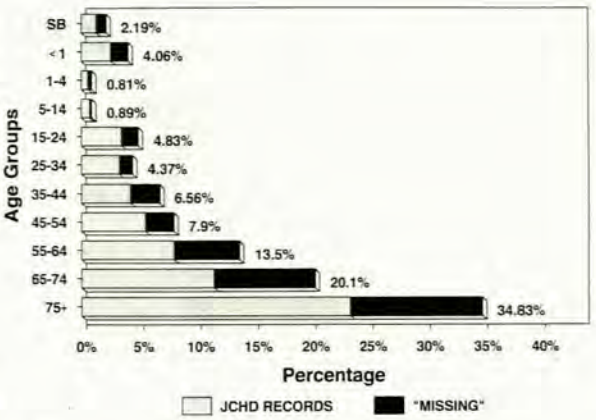

FIG. 3.
Age distribution of deaths according to those recorded and those missed.

TABLE II.
'Missing' deaths for different age groups (%)

	Found in records of Health Department		Missing	
	%	No.	%	No.
Stillbirth	64,5 (52,5 - 76,5%)*	40	35,5 (23,5 - 47,5%)	22
Infant	60,9 (52,0 - 69,8%)	70	39,1 (30,2 - 48,0%)	45
Child deaths: 1-4 yrs	73,9	17	26,1	6
Children: 5-14 yrs	88,0	22	12,0	3
Young adults: 15-24 yrs	70,8 (63,2 - 78,4%)	97	29,2 (21,6 - 36,8%)	40
Adults				
25 - 34 yrs	74,2 (66,5 - 81,9%)	92	25,8 (18,1 - 33,5%)	32
35 - 44 yrs	62,4 (55,4 - 69,4%)	116	37,6 (30,6 - 44,6%)	70
45 - 54 yrs	70,0 (63,0 - 76,0%)	156	30,0 (24,0 - 36,0%)	68
55 - 64 yrs	59,0 (54,1 - 63,9%)	226	41,0 (36,1 - 45,9%)	157
65 - 74 yrs	56,7 (52,6 - 60,8%)	323	43,3 (39,2 - 47,4%)	247
75 + yrs	66,7 (63,8 - 69,6%)	982	33,3 (30,4 - 36,2%)	576

* 95% confidence interval.

Sex

One thousand five hundred and fifty-three (55%) of all deaths were men and 1 282 (45%) women while the sex of 2 persons was unknown. There was no significant difference (P = 0,728) between the percentage of missing data for men (35,1%, N = 546, 95% CI 32,7 - 37,5%) and women (36,6%, N = 469, 95% CI 34,0 - 39,2) respectively.

Population group

Two thousand and seventy-one (73%) persons who died were white, 560 (19,7%) were coloured and 206 (7,3%) were Asian. Significantly more records of deaths were missing in Asians (50,4%, N = 104, 95% CI 48,5 - 52,2%, P < 0,001) than among whites (37%, N = 766, 95% CI 34,9 - 39,1%) and coloureds (27%, N = 149, 95% CI 22,9 - 30,3%).

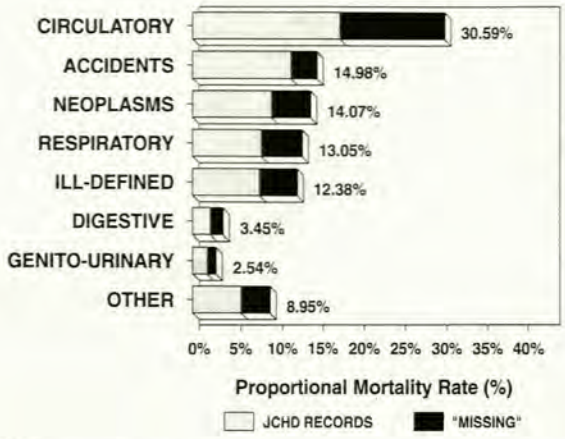

FIG. 4.
PMR for the seven major causes of death for those included and those missed.

Cause of death

Forty-one per cent of the records of deaths due to causes in the chapter on circulation of the *International Classification of Diseases* (ICD 390 - 459) were missing. Fewer records of deaths due to non-natural causes (21,7%, N = 92/425) were missing (Fig. 4). When the cause of death on each of the records was compared, it was the same in 93% of cases. If, however, the cause of death was compared on the basis of individual ICD codes as opposed to major groupings, it was only the same in 79% of the cases.

Registration of death

Two thousand six hundred and ninety-nine (95%) of all deaths were registered in Johannesburg either by a registrar or an assistant registrar. Eight hundred and eighty-one (87%) of the 1 019 deaths not recorded by the Health Department were registered in Johannesburg.

Correction of mortality figures for 1988/1989

In 1988/89 there were 3 561 deaths among Asians, coloureds and whites in Johannesburg. The percentage of missing records of deaths (36%) was used to estimate underreporting of mortality in 1988/89. The estimated CDR after correction for Asians is 4,8/1 000 population as opposed to 2,8, for whites, 6,5/1 000 population as opposed to 4,7 and for coloureds, 6,9/1 000 population as opposed to 5,7. The corrected PMRs are shown in Table III.

Infant mortality rates

The infant mortality rate (IMR) for the Asian, coloured and white population groups when corrected for underreporting increased from 10,4/1 000 live births to 14,5/1 000 live births. In Asians the IMR increased from 13,2 to 21,7, in whites from 6,0 to 8,7 and in coloureds from15,7 to 20,1.

Discussion

The major limitation of this study concerns the data used for comparison. Ideally, the records of the Health Department should have been compared with records from the Central Statistical Services (CSS). However the CSS data are not easily accessible and there is a long delay in receiving them, often up to 3 - 4 years.

It is also possible that the burial data are incomplete or inadequate. Burial data only include deaths of persons with Johannesburg addresses and exclude those not buried within the area. Errors may be made when the information is transcribed from the death register onto the burial orders. In some cases only the first cause, and not the contributory cause or causes of death written on the death certificate, is transcribed in the death register. It is difficult to distinguish between the main cause of death and the contributory causes of death on the current South African death certificate[10] and this may well account for the appearance of only the direct cause of death on the burial order.

This study has shown a large discrepancy between the number of deaths recorded at the cemeteries and deaths recorded routinely by the Health Department. Only 64% of burials are recorded by the Health Department. Ninety-three per cent of those recorded by the Health Department corresponded with the burial records. A small percentage of persons who die in a specific area are not buried within the area, and may account for the 7% of deaths not recorded.

The percentage of records of deaths not recorded increased after the first year of life. The funeral costs of a deceased person with a legitimate Johannesburg address are substantially less than for a non-Johannes-

TABLE III.
Actual and estimated PMR for 1988/89 by population group

		Asian		Coloured		White	
		%	No.	%	No.	%	No.
Diseases of the circulatory system (ICD 390 - 459)	Actual	42,5	79	16,9	144	31,6	797
	Estimated	43,5	138	19,1	199	32,5	1 132
Accidents/poisoning/violence (ICD E800 - E999)	Actual	25,3	47	29,9	255	14,8	374
	Estimated	18,9	317	26,9	280	13,0	452
Signs, symptoms and ill-defined conditions (ICD 780 - 799)	Actual	5,4	10	19,2	164	10,0	252
	Estimated	6,6	21	20,6	214	10,9	352
Neoplasms (ICD 140 - 239)	Actual	6,5	12	10,1	86	17,8	448
	Estimated	5,7	6	9,6	100	17,1	595
Diseases of the respiratory system ICD 460 - 519	Actual	5,4	10	8,3	71	14,2	357
	Estimated	7,3	23	7,6	79	14,8	516
Other	Actual	15,1	28	15,6	133	11,6	294
	Estimated	18,0	57	16,2	168	12,6	438

burg resident who is buried in Johannesburg. This may account for the high proportion of records (43%) of persons 65 - 74 years old that were not recorded.

The IMR for Asians, coloureds and whites increased from 11,2/1 000 live births to 15,6/1 000 live births. The most dramatic difference was noted in the IMR for the Asian group; 17,0 as opposed to 28,6/1 000 live births. This percentage of missing infant deaths may well be higher among blacks because of the poor quality of black mortality statistics.[8,10,11] This study may indicate a conservative estimate of the black IMR in Johannesburg. The corrected black IMR is 29,6/1 000 live births as opposed to 21,3. The results show that the black IMR in Johannesburg may be grossly underestimated. If one corrects for all population groups the estimate of the IMR for all groups will increase from 14,1/1 000 live births to 19,5.

Fifty per cent of the records of Asian deaths were missing. This may be due to the fact that funeral directors may act as assistant registrars[7] and may notify the offices of the Department of Home Affairs in Pretoria directly. Eighty-three per cent of Asian deaths not recorded were found among the burial orders from the Brixton cemetery where most cremations take place. The missing records of Asian deaths need further investigation.

Significantly fewer deaths from non-natural causes were not recorded ($P < 0,01$). Autopsies after deaths due to non-natural causes are performed by the district surgeon at mortuaries. The nosologist visits these mortuaries and collects the information on these deaths.

The coding of the cause of death for the Health Department and the burial orders was done by one person. This eliminated the possibility of biases and inter-observer variation. There was good agreement between the cause of death on both datasets.

Conclusion

This study has shown that the mortality statistics collected routinely by the Health Department underestimate the true mortality rate. Because of the poor recording and/or absence of details of cause of death, the PMRs and the prevalence of specific diseases calculated from the Department's routine mortality data for the Johannesburg community should be interpreted with caution.

Public health practitioners who need to use the available mortality data should, preferably, use this information to study trends over time and causes of death classified according to the ICD chapters.

Although the burial orders may not be a valid data source to determine the reliability of the cause of death, this study has shown that if the ICD chapters are used to describe the cause of death there is good agreement between the cause of death rcorded by the Health Department and that recorded on the burial order.

The accuracy of data varies with age and population group. Inferences about morbidity from the available mortality statistics should be made with caution, especially in older age groups. Care should also be taken when inferences are made about the different population groups, because of the high percentage of Asian deaths not recorded.

A large number of deaths in South Africa are certified by police officers.[8] The inclusion of cause of death by non-medically trained persons introduces yet another source of error. In many cases cause of death is described as ill-defined.[8]

Recommendations

Better and more efficient ways of data collection must be explored. Furthermore, all methods of mortality data collection on a local as well as a national level should be re-evaluated.

This survey has shown in the short term that the best means of collecting mortality data in Johannesburg would be to use the records from the different crematoria, cemeteries and government mortuaries in the area. The support and assistance of undertakers in the area should be sought and the importance of mortality statistics stressed.

Data from the CSS should be made available to the health services timeously to facilitate appropriate interventions and changes in policy. Differences between the areas that a magisterial district comprises and that of a local authority should be eliminated.

The decentralisation of mortality data collection from national to local level and methods to prevent duplication should be explored. Existing resources could be used more effectively and a rapid turnover of reliable mortality statistics on a local level may have a greater health impact.

An alternative solution is the modification of legislation to enable the relevant local authority to receive a copy of the death certificate. This would ensure more accurate mortality data which would facilitate the provision of appropriate health services for the community.

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