

Profile of mortality of patients admitted to Weskoppies Psychiatric Hospital in South Africa over a 5-year period (2001-2005)

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Abstract

Objective: Mortality in the psychiatric population, both from natural and unnatural causes, is higher than in the general population and this is despite an improvement in the delivery of care and treatment of mental illness in recent years. The study was conducted to determine a profile of mortality and standardized mortality rates within our psychiatric hospital. **Method:** A retrospective clinical case audit was conducted of deaths that occurred at Weskoppies Hospital between 1st January 2001 and 31st December 2005. Direct standardised mortality rates were calculated (gender specific adjusted for age according to the South African population). **Results:** A total of 164 deaths were observed during this period. The gender-specific all cause mortality rates, standardised to the South African population, were 0.0177 (95% CI 0.0141, 0.0213) and 0.0163 (95% CI 0.0121, 0.0206) for males and females respectively. The all cause mortality rates for the South African male and female population were 0.0188 and 0.0170 respectively (not significantly different as it falls within the 95% confidence interval of the standardised rates). The predominant natural cause of mortality was infection. Ten of the deaths were due to unnatural causes, of these 7 were suicides. The mortality ratio for unnatural causes was 0.47. **Conclusion:** Mortality studies are important tools for determining quality of health care provisions to patients. Studies of this nature assist in making recommendations for optimal clinical practice and aid in developing preventative measures.

Key words: Psychiatric; In-patient; Mortality; Mortality ratio

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Introduction

Mortality amongst psychiatric patients is higher than in the general population, as has been observed and reported in a number of studies.¹⁻⁶ According to the literature, mortality risk among psychiatric patients is two to six times higher than the general population.

Many factors have been attributed for the increased mortality in these patients, most notably long-term in-patient-based care. However, some studies have found that high mortality rates of in-patients were shown to be comparable to rates of psychiatric patients receiving out-patient care.⁷

A steady decline in the rate of premature deaths in psychiatric patients has been observed during the latter part of the last decade. This could probably be as a result of improved medical and mental health care and shorter periods of hospitalisation. De-institutionalisation of psychiatric patients to community based care has also contributed to this decrease. These rates are, however, still significantly higher than those in the general population.^{3,4,5,8}

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The high mortality rates of psychiatric in-patients have been found to be as a result of natural causes (see Appendix), with infective and cardiovascular diseases being most common. Malignancies and other respiratory causes have, however, also contributed to an increased mortality. This increased mortality rate amongst psychiatric patients could reflect a general neglect of health, unrecognised co-morbid medical illnesses, self-damaging behaviour including smoking, poor diet, sedentary lifestyle with limited physical activity, predisposition to cardiovascular risk factors as well as iatrogenic causes.^{2,5,7,9,10} Unnatural causes (see Appendix) leading to increased mortality include suicides. Research conducted in a number of countries has indicated mortality rates as a result of suicide to be between 2% to 11% of all deaths. Some studies have even found mortality due to suicide to be as high as 20-70 % of the total deaths in the younger age groups.^{4,5,6,8,10,11}

Mortality studies of psychiatric patients have been conducted in developed countries; there is however a paucity of these studies from developing countries.¹²⁻¹⁵ To the knowledge of the authors, no studies regarding this topic have been conducted in the Republic of South Africa. Analysis of psychiatric mortality studies are of theoretical and practical significance.

These studies are important tools in identifying:

- treatment deficiencies,
- determining health care provisions to psychiatric patients,
- quality of psychiatric service delivery,
- and monitoring efficacy of service delivery.

These studies also aid in making recommendations for optimal clinical practice.

The current study investigated the causes of death of in-patients at a psychiatric hospital over a five year period to establish a profile of the leading causes of deaths at the hospital as compared to studies conducted elsewhere. Further, the mortality ratio using the general population of South Africa as comparator was also determined. The knowledge of risk and contributory factors resulting in mortality would assist in making recommendations for lowering mortality rates in the psychiatric population.

Methods

Site

The research was conducted by the Department of Psychiatry at the University of Pretoria based at Weskoppies Hospital. This hospital has a total bed capacity of 974 and is the largest psychiatric hospital in the Gauteng Province in South Africa. Further, it also serves patients from North West, Limpopo and Mpumalanga Provinces.

Ethics

Prior ethical approval was obtained from the University of Pretoria Faculty of Health Sciences Research Ethics Committee (Ethics Approval Number 164/2005). Authorisation was also obtained from the Weskoppies Hospital Administration and Gauteng Department of Health to access patients' clinical files and the hospital mortality reports.

Data

In order to compile comprehensive patient information, death notification reports as well as hospital mortality reports were checked against the Hospital Board Meeting notes. It is compulsory for all hospital deaths to be reported at Hospital Board Meetings. Furthermore, autopsy reports in cases where post-mortems were conducted were also reviewed. These were obtained from the Departments of Forensic Medicine and Anatomical Pathology at the University of Pretoria.

A data capture sheet was designed that included the following information:

- Patients' demographic details (gender, race)
- Age at time of death
- Admission status (voluntary, assisted, involuntary, emergency, observation or state patients)
- Duration of hospital admission (noted in months)
- Psychiatric diagnosis
- Co-morbid medical conditions
- Substance use history
- Cause of death (grouped broadly into circulatory, gastrointestinal, endocrine/metabolic, infective, neoplasm, respiratory and other causes)

Design

The study design was that of a retrospective clinical case audit. Data was collected using the above mentioned resources for all in-patients that died, at Weskoppies Hospital, between 1st January 2001 and 31st December 2005. Patients that died while on leave-of-absence (LOA) or during periods of abscond were excluded from the study.

Analysis

The data obtained was analysed at the Division of Clinical Epidemiology at the University of Pretoria. Results were tabulated using descriptive means and frequencies. Rates were directly standardised to the South African Population age and gender distribution obtained from Statistics South Africa (www.statssa.gov.za). Gender specific mortality rates for the South African Population were also supplied by last mentioned.

Results

One hundred and sixty four patients (64 females, 100 males) died at the hospital, out of a total of 11 131 admitted during the study period. Age of the deceased ranged from 20 years to 86 years. Two (males) were excluded, as they had died while on leave-of-absence. Of the remaining patients, race representation was as follows: 78 Blacks, 78 Whites and 6 of other ethnic groups (Coloureds and Indians). 78.3% (n=127) of the patients were admitted involuntarily, 14.2% (n=23) as assisted admissions and the remaining 7.5% (n=12) was constituted almost equally by the other admission states (voluntary, emergency and state patients).

Information pertaining to the cause of death was not available for nine patients. In five cases, these patients had been transferred to medical hospitals where they died, and the necessary documentation had not been relayed to

Table I: Five-year sex-specific all cause mortality rate and mortality ratio

Sex	Total Population	Number Of Deaths	All Cause Mortality Rates	Adjusted All Cause Mortality Rates	Confidence Interval	Mortality Ratio
Male	6968	98	0.0141	0.0177	95% CI(0.0141-0.0213)	0.94
Female	3652	64	0.0175	0.0163	95%CI(0.0121-0.0206)	0.96

Weskoppies Hospital for record purposes.

The clinical records of two patients were missing. One patient had been referred for an anatomical pathology post-mortem and no record of this was available from the relevant department. The last patient had been referred for a forensic post-mortem and results for the toxicology were still pending.

The sex-specific all cause mortality rates, standardised to the South African population, were 0.0177 (95% CI 0.0141, 0.0213) and 0.0163 (95% CI 0.0121, 0.0206) for males and females respectively (Table I). The all cause mortality rates for the South African male and female population were 0.0188 and 0.0170 respectively (not significantly different as it falls within the 95% confidence interval of the standardised rates).

The prominent diagnoses of patients was schizophrenia (n=55; 33.9%), dementia (n=45; 27.8%) and psychotic disorder due to general medical condition

(n=22; 13.6%). These diagnostic entities are representative of the chronic inpatient population at Weskoppies Hospital.

The general medical conditions comprised of epilepsy (n=15), head injury (n=1), human immuno-deficiency virus infection (HIV) (n=5) and a combination of HIV and tuberculosis (TB) (n=1).

Ten (6.2%) patients had died as a result of external causes that included three accidental deaths and seven suicides (Table II). The mortality ratio for unnatural causes was 0.47. Hanging was the method of choice for five of the patients who had committed suicide. Three of the suicides occurred within the first month after admission. Two of these patients had been admitted under sections 77 and 78 of the Criminal Procedures Act 17 of 2001 following order of the court for psychiatric observation after allegedly committing a crime. The third case was that of a middle-aged chronic schizophrenic. Accidental causes included two patients who had choked to death and one

Table II: Causes of death

<i>Natural causes of death</i>	<i>N</i>	<i>%</i>	<i>Natural causes of death</i>	<i>N</i>	<i>%</i>
CIRCULATORY	33	20.4	NEOPLASM	13	8
Cardiac Failure	9	5.6	Breast	3	1.9
Cerebrovascular Incident	9	5.6	Cervix	2	1.2
Myocardial Infarction	7	4.3	Bladder	1	0.6
Arrhythmias	5	3.1	Colon	1	0.6
Hypovolaemic Shock	2	1.2	Liver	1	0.6
Cardiac Arrest	1	0.6	Lung	1	0.6
GASTRO-INTESTINAL	3	1.9	Lymphoma	1	0.6
Bowel Obstruction	2	1.2	Mouth	1	0.6
Volvulus	1	0.6	Oesophagus	1	0.6
METABOLIC / ENDOCRINE	7	4.3	Prostate	1	0.6
Renal Failure	3	1.9	OTHER	20	12.3
Metabolic Acidosis	2	1.2	End-Stage Dementia	8	4.9
Hypoglycemic Brain Damage	1	0.6	Cardio-respiratory Failure	6	3.7
Malnutrition	1	0.6	Status Epilepticus	3	1.9
INFECTION	49	30.2	Unascertained by Post Mortem	1	0.6
Pneumonia	26	16	Sudden Death	1	0.6
Septicemia	7	4.3	Cor-Pulmonale	1	0.6
HIV associated illness	6	3.7	UNNATURAL CAUSES OF DEATH	N	%
Meningitis	4	2.5	SUICIDE	7	4.3
Gastro-enteritis	3	1.9	Hanging	5	3.1
Tuberculosis	2	1.2	Asphyxia	1	0.6
Liver Abscess	1	0.6	Burns	1	0.6
RESPIRATORY	18	11.1	ACCIDENT	3	1.9
Respiratory Failure	10	6.2	Asphyxia	2	1.2
Embolism	5	3.1	Injuries	1	0.6
Aspiration Pneumonia	2	1.2			
Asphyxia	1	0.6			

who had died of injuries sustained during a fight.

Grouped broadly, the four most common natural causes of death were infections (n=49; 30.2%), circulatory causes (n=33; 20.4%), respiratory causes (n=18; 11.1%) and neoplasm (n=13; 8%) (Table II). Thirty patients died of pneumonia, seven of septicaemia as a complication of pressure ulcers in bed ridden patients and six of HIV-associated illnesses.

Breast (n=3; 1.9%) and cervical (n=2; 1.2%) carcinomas were the most common malignancies. The category "other" (n=20; 12.3%) comprised of causes of death that were not easily ascribed to the broad groupings due to the non-specific manner in which the deaths were noted in the hospital mortality reports or death notification certificates, and included: cardio-respiratory failure, multi-organ failure, status epilepticus, end-stage dementia and, identifiable cause unascertained by post-mortem.

Almost equal frequencies of death occurred in the broad age groupings of 40-49 years (n=29; 17.9%), 50-59 years (n=32; 19.7%), 60-69 years (n=36; 22.2%) and greater than 70 years (n=35; 21.6%), with approximately 9.3% of deaths in groupings 18-29 and 30-39 years. The mean age of death was 55 years.

Infective causes of death were predominant in patients with the following diagnoses; schizophrenia (n=18), dementia (n=12), psychotic disorder due to general medical condition (n=7) and mental retardation (n=5). Circulatory and respiratory causes were also significant. Of note was the number of deaths due to malignancies in the schizophrenic population (n=8).

A quarter of all deaths (n=40; 24.7%) occurred in the first month after admission. This must be interpreted within the context of the study protocol i.e. chronic patients returning from leave-of-absence would only have had the duration of that last admission considered. A further 18.5% (n=30); 22.2% (n=36) and 15.4% (n=25) of deaths occurred during the admission periods 2-12 months, 13-60 months and 61-120 months respectively. The mean length of stay was 72 months.

Hypertension (n=46; 28.4%), epilepsy (n=33; 20.4%), human immuno-deficiency virus infection (n=20; 12.3%), chronic obstructive airways disease (n=19; 11.7%) and congestive cardiac failure (n=18; 11.1%) were the five most common co-morbid medical conditions noted within the study population, often with patients having varying combinations of these. Of note was the percentage of patients that were HIV positive considering that testing patients' HIV status is not routinely undertaken. A predictable pattern of association, between cause of death and co morbid medical conditions, was noted, i.e. 8.6% (n=14) of patients dying of circulatory causes had hypertension, 8.6% (n=14) of patients dying of infective causes had HIV, and 6.1% (n=10) of patients with malignancies died of these.

Nicotine (n=51; 31.5%), alcohol (n=44; 27.2%) and cannabis (n=24; 15.1%) were the substances most frequently used. Infections, particularly pneumonia, were the major cause of death in patients suffering from chronic obstructive airways disease (26.3%) and those that smoked (28.8%).

Discussion

Mortality studies conducted throughout the world have indicated that there is an increased incidence amongst psychiatric patients as compared to the general population. Despite improvement in delivery of psychiatric care as well as treatment of mental illness, mortality of psychiatric patients is two to six times higher than that found in the general population.^{2,13,16-18}

The study population comprised 162 deaths that occurred at Weskoppies Hospital during the period 1st January 2001 to 31st December 2005. Our standardised mortality rates are not statistically significant different from the general population in contrast with the study conducted by Lawrence et al⁸ who found a standardized mortality ratio (SMR) of 2.57 for males and 2.18 for females, whereas a study by Rasanen et al¹³ found an all cause death risk for both males and females to be four times that of the general population. A meta-analysis of all studies on mortality in psychiatric patients found an overall SMR of 1.79 in long-stay patients with psychiatric illness in general and 1.57 in previous patients with psychiatric illness in general.¹⁴ This discrepancy is most likely as a result of the excess mortality in the general population in South Africa. This can be attributed to the high incidence of AIDS related deaths in this population, estimated to be approximately 71 % of the deaths of the South African population in 2006.¹⁹

Consistent with other studies, the common cause of death was as a result of natural causes. Eighty eight percent (88.2% (n=143)) of patients in this study population died of natural causes. The most common cause of death in this group was infective diseases which constituted 30.2% (n=49), followed by deaths as a result of cardio-vascular complications comprising 20.4% (n=33). This trend is in keeping with results of other studies^{2,7,13,16}, where infective diseases were the most common causes of death among psychiatric patients. These findings were, however, in contrast to a study conducted in Australia which showed that only 1% of deaths were as a result of infectious and parasitic diseases.⁸

Pneumonia was found to be the dominant infective cause in most studies. Various factors have been attributed to the increased incidence of pneumonia especially the 'setting phenomena'. This occurs as a result of increased exposure to infection due to overcrowding in psychiatric hospitals, as well as the poor hygienic behaviour found in the psychiatric population.³ Another factor explaining this increased incidence could also be the sedentary lifestyle in this population. Patients with psychiatric illnesses tend to exhibit self-damaging behaviour namely cigarette smoking, limited physical activity and a decreased awareness of physical illness.¹³ Chronic patients sometimes have a limited ability to recognise and communicate symptoms of possible somatic illness. The refusal of these patients to accept medical treatment or comply with treatment programmes can exacerbate the infective process.

An additional explanation for an increased infection rate in the patient sample is co-morbid HIV infection. A study conducted at this hospital by Van Wyk et al¹⁵ revealed an HIV prevalence of 9% in the in-patient

population. Results of the current study showed that 12.3% (n=20) of patients in this study population had a positive diagnosis of HIV, although these patients are not routinely tested for this illness. Patients are only tested under conditions of clinical suspicion and investigations are carried out with the patients' consent. Clearly this percentage could be much greater if these conditions are considered. Septicaemia and meningitis were the other common causes of death in the infective group.

In this study, 18.6% (n=30) of deaths occurred in the 18-39 year age group. A common cause of death in this age group as attributed by most authors is due to unnatural causes, most notably suicide. However, in this study the most common cause of mortality in this age group was natural causes. Infection was most prevalent among the natural causes of death, thus leading the investigators to speculate the possible role of immunosuppression in these deaths. Abnormal thermo-regulatory responses as a result of treatment with psychotropic medication can mask infective symptoms. This could thus also be a contributory factor to the increased mortality as a result of infective causes.⁵

A seasonal variation in the incidence of mortality in this population was also noted. Most of the deaths from natural causes occurred during the winter months in South Africa (May-July).

An explanation for the high infection rate could also be as a result of treatment with available first generation antibiotics that are not ideally appropriate for the treatment of nosocomial infections. These are used due to the budget restraints at the psychiatric hospital where only the essential antibiotics are available as per the Essential Drug List formulated by the Department of Health of South Africa. Patients have to subsequently be transferred to medical hospitals for further management. This is often met with reluctance by some personnel at the medical hospitals due to the stigma of treating psychiatrically ill patients.

Cardiovascular causes constituted 20.4% (n=33) of the total deaths in this study population. The increased mortality due to cardio-vascular illness in psychiatrically ill patients, especially those suffering from schizophrenia, has also been noted in previous studies.^{1,7,13,16} Increased risk of cardio-vascular diseases in these patients could be explained as a result of iatrogenic causes, psychosocial deprivation, and sedentary lifestyle which include excess smoking and physical inactivity. Of note was that 28.4% (n=46) of the patients in this study population had co-morbid hypertension and 31.5% (n=51) of these were smokers.

Treatment with psychotropic medication has been found to cause cardiac dysrhythmias and sudden death as reported in a number of studies. There is also an increased incidence of the metabolic syndrome. It has also been suggested in the literature that treatment with psychotropic medication may mask somatic symptoms.¹³

A prominent finding in this study was the high incidence of deaths that could not be ascribed to a particular causal group due to the non-specific method of death reporting. These causes were assigned to a group reported as 'other' and represented 12.3% (n=20) of the

total number of deaths. Causes of death in this group were cardio-respiratory failure, status epilepticus, end-stage dementia and a group of unascertained deaths as per forensic post-mortems performed.

In this study, 27.8% (n=45) of the subjects had a diagnosis of dementia. Patients with psychotic disorders constituted 53.7% (n=87) of total deaths and schizophrenia was the most common diagnosis in this group. Hewer et al², reported that the incidence of mortality rose in congruence with increasing cognitive impairment as such, that patients with dementia and delirium carried a high risk. They did not find the high level of mortality in these patients surprising, as persons with advanced cognitive deficits are admitted to hospital during the later stages of illness, commonly for palliative care.

A further explanation for an increased mortality within the first month in this study is that patients were inappropriately admitted to psychiatric hospital for treatment, for example patients with delirium. These patients must be managed in general hospitals as psychiatric hospitals do not have laboratory and radiological facilities. Furthermore, pharmacy budgets in this health department exclude medications used for the treatment of physical disorders.

An important finding consistent with other studies is co-morbid medical illnesses. Miller et al¹ concluded that 50% of psychiatric patients had known co-existing medical conditions, 35% had undiagnosed medical disorders and 20% had medical conditions that could have caused or worsened their psychiatric condition. The most common co-morbid medical illnesses in this study population were hypertension (n=46; 28.4%), epilepsy (n=33; 20.4%) and HIV (n=20; 12.3%). There were also a significant number of patients with a diagnosis of COPD (n=19; 11.7%) and with a diagnosis of a malignancy (n=15; 9.2%). These findings could be as a result of increased concomitant substance use in this population as well as the tendency not to report medical complaints.

The incidence of Diabetes and Glucose Intolerance was lower than expected, especially when considering the metabolic syndrome associated with use of psychotropic medication. It must be realised that second generation anti-psychotics are used in a limited group of patients and specific protocols are adhered to for the use of second generation anti-psychotic medication at this hospital.

6.2% (n=10) of deaths in this population represented deaths due to unnatural causes. The mortality ratio was 0.47 compared to the general population. This rate was significantly lower than the results of the Iowa record linkage study which found an SMR for all non-natural causes of death of 4.19 in men and 10.20 in women.²⁰ The mortality ratio in this study should be interpreted with caution, bearing in mind the excess mortality due to unnatural causes in the general population in South Africa. A study conducted by the Medical Research Council of South Africa in 2000 found homicide and violence to be the second most common cause of mortality and road traffic accidents and suicide ranking fourth and eleventh respectively.²¹

A third of the patients in the present study had committed suicide within the first month of admission to

hospital. Hanging was found to be the method of suicide. It would thus infer that regular assessments of mental state and vigilant monitoring of high risk patients are indicated. Consideration should also be given to limiting the periods of seclusion where indicated and where necessary to increase the periods of observation of high risk patients in certain instances. Accidental causes of death included two patients that choked to death. Psychiatric and geriatric patients often tend to have difficulty swallowing food particles, thus predisposing them to choking and aspiration.⁶ The third patient died of injuries sustained during a fight prior to admission to hospital.

The Mental Health Care Act 17 of 2002 in South Africa makes provision for six-monthly periodical assessments of both physical and mental health of the chronic or long-stay patients. 25% of these assessments were not available in the clinical notes of the patients in this study. These assessments had either not been completed or not recorded. Completion of these assessments is important as they would allow for timely detection of co-morbid physical illnesses. This would enable early interventions, improving the quality of care provided and thereby attempting to decrease the rate of mortality in this patient population.

Limitations

- The quality of clinical note-keeping restricted the amount of data available for each subject.
- Completion of death notification forms was non-specific, broadly categorised and inadequately completed.
- Disparities between internal mortality reporting and official death notification reports.
- Limited data available for deaths that occurred at medical hospitals.
- Misplaced clinical notes that limited the availability of pertinent information.
- Due to the large catchment area of the hospital, that includes other provinces, the mortality ratio was standardised to the general population of South Africa and not limited to the Gauteng Province only.
- The exclusion of patients who died whilst on LOA or during periods of abscond would limit a comprehensive description of the profile of deaths.

Conclusion

The aim of the study was to investigate the causes of death as well as to determine the mortality rates in a psychiatric hospital in an effort to identify potential risk factors, and make appropriate recommendations which include the following:

- Developing targeted interventions with special attention focused on health education of psychiatric patients, including promoting and supporting healthier lifestyles. Screening for malignancies, for example conducting routine pap-smears, blood investigations and regular radiological investigations.
- Hyper-vigilance for infections, for physical signs and infective markers, especially for frail-care patients as well as low functioning patients.
- Improvement in methods of clinical note taking,

allowing for quick reference to pertinent information, for example substance use and habits, co-morbid medical conditions as well as socio-demographic details upon admission and discharge.

- Improved death reporting with specific attention to the causes of death as there was a discrepancy in the method of death reporting as well as feedback from medical hospitals with prompt relay of death notification reports upon death of psychiatric patients.
- Timely completion of the prescribed periodical assessments including physical and mental health examination of patients as stipulated by the Mental Health Care Act. Assessments would also assist in identifying potential risk factors. These would be important in determining the quality of care provided to patients and to assess the efficiency of psychiatric service delivery.
- Refresher workshops for clinicians and other members of the multi-professional treatment team attending to psychiatric patients. These professionals need to be aware of the impact of iatrogenic effects on the health of patients including cardiovascular, metabolic and other side-effects that could adversely affect the physical health of this patient population.
- Management of patients who are high suicide risks, with regular mental health assessments and vigilant monitoring of high risk patients.

Results of this study revealed lower mortality rates than those found in other studies from developed countries with regard to both natural and unnatural causes. This discrepancy is most likely as a result of the excess mortality in the general population in South Africa.

Mortality studies are important tools for determining quality of health care provisions to patients, and also aid in developing preventative measures that should focus on timely identification and treatment of general medical conditions. They also assist in service planning and delivery. Studies of this nature are also important in identifying risk factors and the possible control and management of these factors in an attempt at lowering the mortality in severe mental illness.

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References

1. Miller BJ, Paschal CB, Svendsen DP. Mortality and Medical Co-Morbidity Among Patients With Serious Mental Illness. *Psychiatric Services* 2006; 57(10): 1482-1487.
2. Hewer W, Rossler HW, Fatkenheuer B, Loffler W. Mortality among patients in psychiatric hospitals in Germany. *Acta Psychiatr Scand* 1995; 91: 174-179.
2. Lim L CC, Sim LP, Chain PC. Mortality of Public Mental Health Patients: A Singapore Experience. *Australian and New Zealand Journal of Psychiatry* 1993; 27: 36-41.
3. Malomo IO, Aina OF, Ladapo HT, Owoeye AO. Ten-year mortality review in a pioneer psychiatric hospital in West Africa. *East*

- African Medical Journal* 2003; 80(7):79-83.
5. Chong TWH, Castle DJ. Layer upon layer: thermoregulation in schizophrenia. *Schizophrenia Research* 2004; 3(2):149-157.
 6. Burns A, Horan M, Clague J, McLean G. *Geriatric Medicine for Old Age Psychiatrists*. Taylor and Francis, London New York 2006; 193-6.
 7. Kamara SG, Peterson PD, Dennis JL. Prevalence of Physical Illness among Psychiatric In-Patients Who Die of Natural Causes. *Psychiatric Services* 1998; 49(6): 788-793.
 8. Lawrence D, Jablensky AV, Holoman CDJ, Pinder TJ. Mortality in Western Australian Psychiatric patients. *Soc Psychiatry Psychiatr Epidemiology* 2000; 35: 341-347.
 9. Hannerz H, Borga P. Mortality among persons with a history as psychiatric in-patients with functional psychosis. *Soc Psychiatry Psychiatr Epidemiology* 2000; 35: 380-387.
 10. Boroffka A, Olatawura MO. Community psychiatry in Nigeria: The current status. *Int J Soc Psychiatry* 1976; 23: 1154-1158.
 11. Ndosi NK, Kisesa AF. Causes of death among mental patients at Muhimbili Medical Center, Dar es Salaam. *East African Medical Journal* 1997;74(2): 82-4.
 12. Hansen V, Arensen E. J, Jacobsen BC. Total mortality in people admitted to a psychiatric hospital. *Br J Psychiatry* 1997; 170(2): 186-190.
 13. Rasanen S, Hakko H, Villo K, Meyer-Rochow VB, Mary J. Excess mortality among long-stay psychiatric patients in Northern Finland. *Soc Psychiatry Psychiatr Epidemiology* 2003; 38: 297-304.
 14. Harris EC, Barraclough B. Excess mortality of mental disorders. *Br J Psychiatry* 1998; 173:11-53.
 15. Van Wyk S, von Brandis-Martini P, Pretorius HW, Webber LM. HIV seroprevalence and associated factors in 200 acute psychiatric admissions. *The South African Journal of Epidemiology and Infections* 2004; 19(2): 63-68.
 16. Jones DR, Macias C, Barreira PJ, Fisher WH, Hargeaves WA, Harding CM. Prevalence, Severity, Co-Occurrence of Chronic Physical Health Problems of Persons with Serious Mental Illness. *Psychiatric Services* 2004; 55(11): 1250-1257.
 17. Licht RW, Mortensen PB, Gouliaev G, Lund J. Mortality in Danish psychiatric long-stay patients, 1972-82. *Acta Psychiatr Scand* 2003; 87: 336-341.
 18. Valenti M et al. Mortality in Psychiatric Hospital Patients: A Cohort Analysis of Prognostic Factors. *International Journal of Epidemiology* 1997; 26(6): 1227-1235.
 19. Durrington R, Johnson L, Bradshaw D, Daniel T.J. The Demographic Impact of HIV/AIDS in South Africa: National and Provincial Indicators for 2006. *Medical Research Council* 2006; South Africa.
 20. Black DW, Carrack G, Winkour G. Excess mortality among psychiatric patients. *The Iowa Record- Linkage Study*. *JAMA* 1985; 253:58-61.
 21. Bradshaw D, Groenewald P, Loubscher R et al. Initial Burden of Disease Estimates 2000. *Medical Research Council* 2003; South Africa.
 22. South Africa. Department of Statistics. *South African Statistics, 2006*. Pretoria: Dept of Statistics; 2006.
 23. TG Schwar, JD Loubser, JA Olivier. *The Forensic ABC in Medical Practice*. Kagiso Publishers 2nd impression 1997; 395-426.

Appendix

Natural or unnatural death is not defined in the existing legislation of South Africa. An entrenched practical approach adopted by the forensic pathologist defines these categories broadly i.e.

Unnatural death:

- A death caused by the application of force or any other physical or chemical factors, direct or indirect, and with or without complications.
- Any death, including a death which is normally considered to be the result of natural causes, but which, in the medical practitioner's considered opinion was caused by an act or an omission on the part of somebody.
- Any death in terms of section 56 of the Health Professions Act, e.g. anaesthetic death.
- Any death that is sudden, unexpected or unexplained. These are considered unnatural until proven otherwise.

Natural death:

- This category encompasses all causes of death not included under unnatural deaths i.e. infectious diseases, neoplasms, endocrine conditions, nervous system disorders, cardiovascular disorders, respiratory disorders, digestive disorders etc.23