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Mortality in national psychiatric hospitals in Sudan: a fifteen-year review of hospital deaths

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Abstract

Background Mortality rates in psychiatric hospitals reflect the intricate challenges faced within mental healthcare systems globally. Mortality auditing of in-patient psychiatric hospitals for a period extending 14 years is rare in low-income countries. We are reporting a 15-year mortality review of Sudan's National Psychiatric Hospitals. It is intended to enhance the standard of care in low-resource settings.

Methods A retrospective audit was conducted in primary psychiatric hospitals across Sudan's capital city over a 15-year period. Missing or incomplete data were addressed by cross-referencing available hospital records, consulting medical staff for clarifications when possible, and excluding cases where critical information was unavailable. Data on deceased patients were collected from hospital records, encompassing demographic details, medical histories, psychiatric diagnoses, pharmacological interventions, and causes of death.

Results The study identified 108 deaths out of 28,085 admissions, yielding a mortality rate of 0.38 per cent. The majority of deceased patients were male 71 (65.7%), aged below 40 years 65 (60.2%), and experienced shorter durations of hospital stay before death, with significant mortality occurring within the first week of admission. Common causes of death included infections 30 (27.7%), circulatory failure 27 (24.3%), and no clear cause 17 (15.7%). The main diagnoses of deceased patients were, major mood disorders and mania 42 (38.9%), schizophrenia / schizophrenia-like psychosis 27 (25.0%) and organic psychosis and drug-induced psychosis 16 (14.8%). Haloperidol emerged as the most frequently prescribed medication before death.

Conclusion Infection and circulatory failure are the leading causes of mortality in Sudanese mental hospitals, necessitating a thorough examination to find remedies for these avoidable problems. Additionally, enhanced monitoring and early intervention, particularly in the critical initial phase of hospitalization, are essential for mitigating mortality risks associated with psychotropic medications.

Keywords Mortality, Psychiatric hospital, Sudden death, Sudan

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Introduction

The World Health Organization recognizes the increased mortality and morbidity rates among those with mental disorders as an important threat to public health [1]. It is widely acknowledged in all contexts that individuals with mental illness face comparatively significant mortality risks, which could result in early death and 10–20 years of potential life lost (YPLL) [2, 3]. In comparison to the general community, the death rate in mental units is usually reported to be 3 times greater [4–6]. Not only this, the mortality rate for inpatients with mental illness is greater compared to mentally ill outpatients which is sometimes attributed to having more severe psychiatric illnesses and a higher prevalence of medical comorbidities of inpatients than those receiving outpatient care [7]. Unfortunately, this mortality gap has shown to have increased in the recent decade [6]. The issue holds major importance because mortality rates decreased at a faster rate for the general population compared to psychiatric patients in Western countries [8]. This could be owing to several co-occurring medical disorders, including diabetes, hypertension, stroke, and a predisposition to develop metabolic syndrome, which increases the risk of cardiovascular accidents (CVAs) [9]. The gravity of medical comorbidities that psychiatric patients experience, such as lung disease, diabetes, and liver disorders, has long been recognized by researchers and doctors [10, 11]. Recent studies have also shown an increased mortality rate for inpatients with mental disorders having COVID-19 comorbidity [8].

A recent study in Australia revealed that 60% of premature deaths in this community that are not related to suicide are caused by physical health issues in people with schizophrenia [12]. Furthermore, a recent thorough review that included eleven articles from different countries revealed a significant decline in the average life expectancy of around 14.5 years among individuals having schizophrenia. According to a meta-analysis encompassing 135 studies conducted between 1957 and 2021, the all-cause death rate was considerably greater in individuals with schizophrenia when compared to a control group without schizophrenia (RR = 2.52, 95% CI: 2.38–2.68) [13].

The main causes of this elevated death rate are expected to be poor physical health as well as lower healthcare utilization among individuals with schizophrenia. Additionally, schizophrenia has been linked to a higher death rate from several cancers, including blood, liver, pancreatic, lung, colon, and breast cancers [14–16].

Conversely, individuals with mental illnesses face the potential repercussions of inherent aspects of their conditions, including diminished motivation, self-neglect, apathy, cognitive limitations, substance abuse issues, homelessness, and poverty. These factors can culminate in malnutrition, deficiencies in essential vitamins, liver and lung disorders, and heightened susceptibility to infections. As a result, depending on the medical context of the patient, these challenges predispose them to a spectrum of severe illnesses that can ultimately lead to mortality [17, 18]. Furthermore, patients having mental illness are far less inclined to get early medical attention, which means that several silent ailments - including cancers - could very well manifest at a later stage. These issues are further compounded by the side effects of psychotropic drugs, which include sedation, electrophysiological disturbances, weight gain, and fatigue [19].

According to reports from Japanese and European experts, the occurrence of pulmonary thromboembolism (PTE) is higher in patients who receive antipsychotic medications, such as clozapine [20, 21]. Studies from Western nations, such as the USA, have revealed that PTE is frequently observed in patients receiving treatment with second-generation antipsychotics (SGAs), such as clozapine, or conventional antipsychotic drugs. They have suggested that hormonal side effects from antipsychotic drugs, such as hyperprolactinemia could cause this phenomenon [22, 23]. Additionally, they raise the possibility of related metabolic disorders such as hyperglycaemia, diabetes, and dyslipidemia [4]. As a result, reasons for death in mental issues are frequently associated with long-term pharmaceutical usage, such as metabolic syndrome, or directly with psychotropic drugs as side effects, such as neuroleptic malignant syndrome (NMS) and arrhythmias [24].

Researchers from other continents have drawn attention to the possible hazards of arrhythmias associated with the use of antipsychotics, which have strong cholinergic effects and may lengthen the QT interval, which could result in ventricular fibrillation and the torsade de pointes (TdP) phenomenon [25, 26]. If congenital long QT syndrome, cardiac failure, low potassium, bradycardia, individual susceptibility, drug-induced QTc prolongation, and electrolyte imbalance coexist, the likelihood of arrhythmias occurring increases [27]. To shed more light on this, the authors of a significant study noted that 1.6% of 6,790 inpatient clients had a prolonged QT interval and 27.3% of them had aberrant ECGs [28]. Therefore, it is clear that the administration of specific psychiatric medicines significantly increases the risk of drug-induced arrhythmia and prolonged QT. Drugs like haloperidol, quetiapine, thioridazine, tricyclic antidepressants (TCA), and other neuroleptics having strong cholinergic effects on the cardiac muscles can cause fatal arrhythmia [29]. In a 26-year study, unexpected natural deaths in inpatients were found to be the most common cause of death, with researchers proposing antipsychotics as potentially impacting cardiac repolarization, thus increasing the risk of ventricular fibrillation [30]. However, identifying

the reason for an unexpected and sudden death is rarely simple, particularly when doing retrospective mortality studies.

The picture of the causes of death in underdeveloped nations is somewhat different, with infections, malnourishment, and circulatory failure being identified as the main culprits in both inpatient as well as outpatient settings [31, 32]. According to a recent Nigerian study, over a ten-year period, infection was the main cause of death in acute psychiatric institutions. This appears to be caused by the similar appearance of functional psychosis and pathological psychosis, particularly to a general practitioner [32]. The present audit aims to scrutinize mortality patterns across an extended timeframe within a context characterized by resource constraints. Its primary objective is to elucidate the fundamental challenges of mortality within such resource-limited settings, thereby fostering a comprehensive understanding aimed at optimizing healthcare provision and improving patient outcomes.

Methods

The present investigation adopts a retrospective audit-style approach to analyse all instances of mortality within primary psychiatric hospitals situated in Sudan's capital city. A designated audit team investigated the records of patients deceased during the specified study period. The capital city of Sudan hosts five prominent psychiatric hospitals, commonly referred to as national psychiatric hospitals due to their wide-ranging service provision and the population they cater to, primarily from Khartoum and surrounding areas. Despite serving predominantly local populations, these hospitals attract patients from various regions across the country, thus holding a national scope in their service delivery.

Baashar Teaching Hospital as well as Eltigani Elmahi Teaching Hospital stand as the largest psychiatric facility in Sudan, with Eltigani Elmahi renowned as a leading institution in the Middle East and Africa. Both hospitals serve a population of 6 million individuals and regularly receive referrals from nearby provinces. Their staff comprises 23 psychiatric registrars, 25 senior psychiatrists, 45 psychologists, 18 medical doctors, 120 nurses, and 30 social workers, ensuring comprehensive care and support. The remaining three hospitals include Khartoum Teaching Hospital Psychiatric Unit, Omdurman Military Hospital, as well as Abdelaal Psychiatric Hospital, which specializes in forensic services. These hospitals are staffed by 26 psychologists, 16 psychiatrists, 22 training and resident doctors, and 14 social workers, contributing to the provision of psychiatric care across different settings in Sudan.

The study group created an Audit Master sheet with detailed information on mortality risk factors. Medical and psychiatric diagnoses, psychotropic medication types and forms, administration routes, medical treatments, time of administration with respect to mortality, and sociodemographic data were all included. Additionally, vital signs of the dead patients' cardiovascular conditions were documented. Included were the tests that pointed to organic diseases or medication side effects. The audit's foundation was a thorough investigation of the risk factors and mortality connection to pinpoint any inadequacies in the prevalent standard of care. Hospital records of Sudan's capital city, Khartoum, National Psychiatric Hospitals from January 1, 2001, to December 31, 2015, were used to identify all of the deceased patients. The research team then carried out a comprehensive audit of every case note and a study of every significant incident report that was acquired for additional reference. We asked the relevant teams for more clarification as needed. Exclusion criteria included incomplete records lacking essential demographic or medical information. Causes of death were determined primarily through clinical judgment based on documented medical history, vital signs, and physician assessments, as postmortem examinations were not routinely performed.

Data were analyzed using descriptive statistics, including frequency distributions and percentages. Trends over the 15-year period were assessed by examining variations in mortality rates, diagnostic categories, and causes of death across different timeframes.

Consent and ethical clearance

The ethical committee of the Khartoum Medical School examined and approved the research. Every member of the hospital administration team who participated in the study provided their written consent. Every patient received a unique Patient Identifiable Number (PIN) that could be readily tracked down through the hospital's medical records departments. The Ethics Committee exempted the informed written permission to be obtained from next of kin because the current study was done on patient records that had already passed away. The current report makes no mention of patient details.

Data collection

The audit was overseen by four psychiatric registrars, who are presently consultants and specialists, and a senior consultant psychiatrist. Clinical records were used to extract sociodemographic data and the length of time the patient was an inpatient before they passed away. Information was kept regarding antipsychotic drugs given to patients, including the dosages, timing, and reported results. The Audit Master sheet contained a record of all clinical features, diagnoses, medical examinations, and symptoms, both mental and physical. 2 members of the research team reviewed each case, and

Table 1 Mortality characteristics

Age	No. of Cases	Men	Women	Duration of Stay	No. of Patients
Less than 40	65	45	20	Less than 10 days	69
40–50	20	12	8	10–20 days	22
Greater than 50	23	14	9	More than 20 days	17
Total	108	71	37	-	108

Table 2 Physical co-morbidity as well as psychiatric diagnosis

Co-Morbidity	No.	%	Psychiatric Diagnosis	No	%
Fever before psychotropic	18	16.6	Organic psychosis	10	9.3
Fever after psychotropic	12	11.1	Major Mood Disorders	33	30.6
Cardiovascular abnormalities	7	6.5	Schizophrenia & Psychosis	27	25
Others physical abnormalities	7	6.5	Mania	9	8.3
Some derangements	26	24.1	No clear diagnosis	20	18.5
No Physical Illness	23	21.3	Drug-induced psychosis	6	5.5
Malaria/ Typhoid	4	3.7	Alcohol-related	1	0.09
No Information	3	2.8	Postpartum psychosis	1	0.09
Acutely ill -No Diagnosis	8	7.4	Dementia	1	0.09
Total	108	100		108	100

the senior researcher gave his approval. The care teams' recorded mortality audits were also looked into. All deaths that took place at Sudan's National Psychiatric Hospital between 2001 and 2015 comprised the study's participant base.

Data analysis

SPSS Version 20.0 was employed for the analysis of data to produce quantitative and descriptive statistical measurements. P values for significant correlates were measured together with the frequencies of fatalities and the Chi-Square test. Together with the frequency as well as % of psychotropic medications given to people visiting the national psychiatric institutions, death rates were also computed. In addition to assessing the frequencies of significant correlations, the % of cardiovascular-related conditions was also determined.

Results

Over a fifteen-year period, 108 individuals died out of 28,085 admissions to Sudan's primary national psychiatric hospitals. This translates to an average of 3.8 deaths per thousand admission episodes or 7.2 deaths annually. Of the patients that passed away, 37 (34.3%) were women and 71 (65.7%) were men. No matter how long their psychiatric condition had been, the majority of the deceased patients ($n = 69$, 63.9%) passed away in the first week of their hospital admission (evenly distributed).

Table 1 presents the distribution by age, gender, and duration of stay in psychiatric hospitals before death. The table shows that out of a total of 108 cases, the majority of the patients deceased were below the age of 40, constituting 60.2% (65 cases) of the total cases. The second age group, aged between 40 and 50 years, comprised 20 cases, representing 18.5% of the total. Additionally, 23 cases were recorded in the age group older than 50 years, accounting for 21.3% of the total cases. One interesting fact was the duration of stay in psychiatric hospitals before death, where the majority of patients (69 cases) died within 10 days following the hospital admission, making up 63.9% of the total cases. 84.3% (91) cases had a duration of stay of less than 20 days. This indicated a critical time for serious events including deaths. Thus, where the age distribution underscores the predominance of younger individuals among the deceased, duration of stay shows a considerable number experiencing shorter durations of stay in psychiatric hospitals before death.

Table 2 provides insights into the co-morbidity and psychiatric diagnoses among deceased patients in psychiatric hospitals over 15 years.

In addition to a specified diagnosis in line with the International Classification of Diseases, Tenth Revision (ICD-10), Table 2 displays reported symptoms along with physical measures pointing to organic /physical issues at the time of admission as well as at the course of the treatment. Even before any psychiatric medication was given, the underlying organic ailment was assessed in 18 (16.7%) of the patients deceased who had organic disease symptoms and infection manifesting in fever. However, 12 patients (11.1%) were the ones who developed a fever after medication, indicating potential adverse reactions or manifestations of underlying infections among patients. Seven patients (6.5%) exhibited cardiovascular abnormalities, and an equal number displayed other physical abnormalities, highlighting the prevalence of physical health complications. Additionally, 26 patients (24.1%) showed various derangements, while 23 patients (21.3%) had no documented physical illness, suggesting

underlying health challenges in medical assessment and diagnosis. Furthermore, four patients (3.7%) were diagnosed with malaria or typhoid, and eight patients (7.4%) were acutely ill without a specific diagnosis, indicating the vulnerability of psychiatric patients to infectious diseases and diagnostic complexities. 20 patients (18.5%) could not fit to specific ICD-10 category of diagnosis.

Regarding psychiatric diagnoses, the data reveal a diverse spectrum of mental health conditions among deceased patients. Ten patients (9.3%) were diagnosed with organic psychosis, while 33 patients (30.6%) had major mood disorders such as severe depression. Similarly, 27 patients (25%) were diagnosed with schizophrenia and similar psychoses. However, a substantial proportion of patients, 20 (18.5%), did not have clear psychiatric diagnoses recorded, raising concerns about diagnostic accuracy and the need for improved practices in psychiatric care settings. Additionally, six patients (5.6%) were diagnosed with drug-induced psychosis, and one patient (0.9%) was noted to have an alcohol-related disorder.

Table 3 provides valuable insights into the various causes of death among patients in psychiatric hospitals.

All infections collectively account for a substantial number of deaths, with 30 patients (27.0%) experiencing fatal infections. Tragically, suicide was responsible for the deaths of two patients (1.8%) Other cardiovascular-related conditions such as cardiac failure, fibrillation, and cardiovascular ischemic heart disease were cited as contributing factors in the deaths of two (1.8%), four (3.6%), and one cases respectively. Regarding 11 deaths (9.9%), clinical correlations suggestive of neuroleptic malignant syndrome (NMS) were reported. These manifest as fever from the start of antipsychotics without any infection-related symptoms found, together with autonomic blood pressure changes and elevated white blood cell counts. A notable portion of patients, totalling 17 (15.7%), had no clear cause of death documented, indicating potential gaps in the diagnostic and reporting processes within psychiatric care facilities. This underscores the need for better record-keeping, systematic medical assessments, and enhanced diagnostic protocols to reduce uncertainty in determining the cause of death. Other less common causes of death include complications related to electroconvulsive therapy (owing to ventricular arrhythmia along with a background of imbalance of electrolytes with high potassium), gastrointestinal bleeding, respiratory issues, renal failure, and alcohol-related incidents.

Table 3; Fig. 1, offers insight into the pharmaceutical interventions administered to patients before their demise in psychiatric hospitals. Haloperidol emerges as the most frequently prescribed drug, with 52 patients (37.1%) receiving it in the last 48 h before death. The mean dose of Haloperidol administered was 12 ± 5 mg per day. Both intramuscular (IM) and oral routes were utilized for Haloperidol administration. Promethazine follows as another commonly prescribed medication, with 25 patients (17.9%) receiving it before death. The mean dose of Promethazine was 100 ± 25 mg per day. Other frequently used medications include Diazepam (11, %), Olanzapine (13, %), Sodium Valproate (6, %), and Sertraline (5, %), each administered to a notable number

Table 3 Causes for the mortality as well as psychiatric drug treatment before death

Cause of Death	No. of Patients	Drugs Used Before Death	No. of Patients	Mean dose/day mg	Route of Administration
Circulatory Failure	27	Haloperidol	52	12 ± 5 sd	IM + Oral
All Infections	30	Promethazine	25	100 ± 25 sd	IM + Oral
Cardiovascular Ischemic Heart Disease	01	Diazepam	11	15 ± 5 sd	-
Suicide	02	Olanzapine	13	15 ± 5 sd	IM + Oral
Diabetes	03	Sodium Valproate	06	1500 ± 250 sd	Oral
Cardiac Failure	02	Sertraline	05	150	Oral
Fibrillation	04	Citalopram	02	40	-
Respiratory	01	Fluphenazine decanoate	02	200	IM
Sudden Death	04	Risperidone	01		Oral
Neuroleptic Malignant Syndrome	11	Quetiapine	01	-	Oral
ECT Complication	01	Clomipramine	05	500	Oral
GIT Bleeding	01	Carbamazepine	1	800	Oral
Renal Failure	03	Lorazepam	2	4 ± 2 sd	Oral
Alcohol-related	01	Thioridazine	1	400	Oral
No clear cause recorded.	17	Clopixol Acuphase	02	200	-
		SSRI + Anti-psychotic	5		IM + IV
		TCA + Anti-psychotic	7		-
		Mood Stabilizer + Anti-psychotic	17		IM + IV + Oral
		No Information	3		-

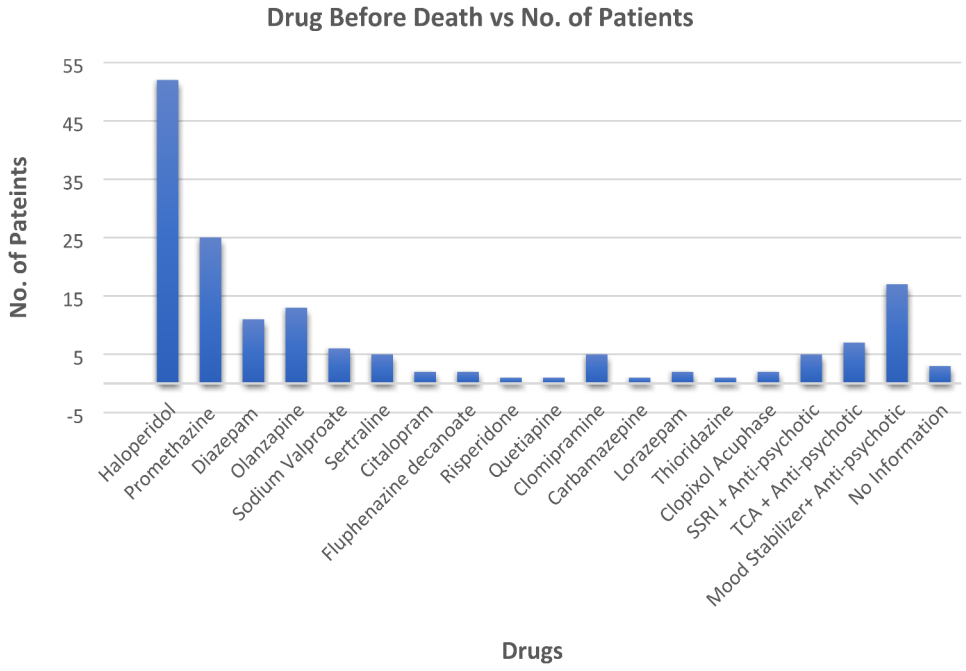

Fig. 1 Drugs that were prescribed

of patients before death. Notably, a subset of patients received combinations of medications, such as SSRIs (Selective Serotonin Reuptake Inhibitors) with antipsychotics or Tricyclic Antidepressants (TCA) with antipsychotics. Furthermore, a considerable proportion of patients received Mood Stabilizers in combination with antipsychotics.

The results show the diversity of pharmacological interventions administered to patients in psychiatric hospitals before their death. Haloperidol and Promethazine emerge as commonly prescribed medications, reflecting their widespread use in managing psychotic symptoms and agitation in psychiatric patients.

Discussion

During a 15-year period, the inpatient psychiatric treatment in Sudan had a mortality rate (MR) of 108/28,085, which resulted in a fatality rate of 3.8/1000 and 7.2/year. This sample's age ranged from 23 to 72 years old. Numerous research from high- and low-income nations are mirrored in these numbers. With a male-to-female ratio of 1.92, there were 71 (65.7%) men and 37 (34.3%) women among the deceased patients. No matter how long their psychiatric condition had been, the majority of the deceased patients ($n = 69$, 63.9%) passed away in the first week of their hospital admission (evenly distributed). This suggests that factors beyond the length of psychiatric illness may be contributing to the increased mortality rate during the initial stages of hospitalization. According to a previous study, 80% of patients passed away within two weeks after being admitted to the hospital. Young men under the age of 40 made up two-thirds of the deceased. This is consistent with accounts from other developing nations [33]. However, a recent report from a National survey in China showed an opposite trend where most of the inpatients who died during psychiatric hospitalization belonged to an overall age of older than 70 years [34]. The predominance of younger individuals among the deceased, with 60.2% aged below 40 years, highlights potential vulnerabilities within this demographic group. This is in line with what was reported in India and Nigeria [32, 33], however, a recent National level audit from China showed contrary findings where the above 70 age group was found to be the most affected by mortality [34]. Moreover, the predominance of men (65.7%) was similar to investigations in developed countries [35–39]. A multi-factorial interpretation could be offered related to this reported finding of mortality in a relatively young age group. Moreover, the significant proportion of patients experiencing shorter durations of stay in psychiatric hospitals before death underscores the need for prompt intervention and vigilant monitoring, particularly during the initial phase of hospitalization. The critical period within the first 10 days of admission, during which the majority of deaths occurred, underscores the importance of early identification and management of risk factors to mitigate adverse events [40]. Although this critical time and associated risk factors for inpatients have been attributed to the beginning of new treatments, the major shift they experience, and in certain situations, experiencing alcohol or drug abstinence syndrome [41]. Other possible factors influencing this outcome could include

the severity of the patients' conditions upon admission, the ineffectiveness of immediate medical interventions, or underlying health complications exacerbated by acute psychiatric crises. Understanding and addressing these factors could be crucial in improving patient outcomes and potentially reducing early mortality rates within psychiatric hospital settings.

The analysis revealed significant findings regarding the physical health characteristics and psychiatric diagnoses among deceased patients in psychiatric hospitals. Notably, 16.7% of patients exhibited evidence of organic illnesses, primarily infections and other organic diseases. Additionally, 11.1% experienced adverse reactions, such as fever, following medication administration, suggesting potential complications or underlying infections exacerbated by treatment. Psychiatrically, major mood disorders, including severe depression, were prevalent among 30.6% of patients, while 25% were diagnosed with schizophrenia or similar psychoses. Similar diagnostic categories have been quoted in South Africa, India, and Brazil [33, 42, 43]. Thus, major mood disorders, schizophrenia, and organic psychosis were among the most prevalent diagnoses, highlighting the multifaceted nature of psychiatric morbidity within this population emphasizing that if targeted treatment strategies and interventions are adopted then there is the possibility of cutting down on mortality rates. However, the notable proportion of patients without clear psychiatric diagnoses underscores the diagnostic challenges and potential limitations in clinical assessment and documentation. The classification of 15.7% of deaths as having 'no clear cause' highlights potential gaps in medical documentation and diagnostic accuracy. This underscores the need for improved record-keeping, systematic medical assessments, and enhanced diagnostic protocols to minimize uncertainty in cause-of-death determinations. Kaggwa et. all., have recently shown in their 25-year mortality audit of psychiatric in-patients in Uganda that the causes of most of the deaths (66.7%) were unknown and heart attack was found to be the leading cause of death [7]. According to a recent study, the majority cause of mortality, with 65 (56.5%) of the 115 cases reported, was acute myocardial infarction, according to the necropsy results supported by the medical documentary information and was attributed to the cytotoxic drug effects. Not only this, the study showed that in 14 cases (12.2%), the cause of death was attributed to pulmonary thromboembolism, which has also been shown due to the administration of antipsychotic drugs which poses an increased risk of deep vein thrombosis [41]. In another National Survey of Mortality of psychiatric inpatients conducted in China, it was shown that unexplained causes of death accounted for 41.9% of total mortality [34]. Previously, another analysis of 333 cases over a 26-year period in an Indian hospital revealed that cardiovascular system illnesses accounted for 43.6 per cent of the deaths of psychiatric inpatients, with respiratory problems coming in second with 14.9% [33]. Thus, the intervention of the cardiologist is usually advocated since the admission of patients to the hospital particularly during the administration of drugs with potential cardiotoxic effects.

This prompts the question of how much the development of this category was caused by mental health treatment. In a 26-year study of inpatient mortality in a mental health facility in New York, Manu and Correll discovered similar findings [30]. The earlier investigation had previously suggested the likelihood of ventricular fibrillation due to TdP, particularly since there was no ECG evidence reporting this deterioration to rule out this possibility. Just before death, a significant proportion of patients were taking a combination of injectable and oral haloperidol and promethazine at a mean dose of 12 mg ± 5, 75–100 mg ± 50, respectively. Given that these medications are known for lengthening the QT interval, ventricular fibrillation might have resulted [25, 26, 44]. Owing to limited resources in underdeveloped nations, it appears that the major treatment regimen of inexpensive drugs with probable quinidine-like effects is the reason for this large proportion of circulatory failure. Since there was no ECG confirmation recorded shortly before death, the relationship between these psychotropics and circulatory failure, remained speculative. Future research should investigate this link further. However, compared to non-users, antipsychotic drugs (FGAs along with SGAs) were found to have a 2.39 sudden cardiac death ratio [28, 29, 45–47]. Another aspect is the number of deaths from diabetic complications and renal failure, which was found to be substantial, raising concerns about whether such patients were receiving care in the right medical setting.

However, this study was not designed to determine causality between medication use and mortality. The absence of systematic ECG monitoring, metabolic screening, and postmortem examinations limits definitive conclusions regarding the impact of these medications. It is unclear whether psychotropic drug use was appropriate, excessive, or contributed to adverse outcomes. Future research should focus on evaluating these aspects in greater detail, particularly with prospective designs that include comprehensive medical monitoring and drug safety assessments. Additionally, an emphasis should be placed on differentiating between necessary therapeutic interventions and potential medication overuse. The frequent use of haloperidol without systematic ECG monitoring raises safety concerns, particularly given its known cardiotoxic effects. While no direct causal relationship was established in our study, international literature suggests an increased risk of sudden cardiac death with certain psychotropic drugs.

Moreover, the premorbid health state, medical conditions, and nutritional factors are crucial considerations when assessing inpatient mortality. It is possible that the primary psychiatric illness or an untreated medical condition led to poor physical health, malnutrition, and increased susceptibility to infections, further exacerbating mortality risk. Limited medical assessments upon admission and during hospitalization may contribute to these issues. Future studies should incorporate a more comprehensive evaluation of patients' physical health and nutritional status to determine their role in mortality outcomes. Given the retrospective nature of the analysis, it is not possible to determine causality or isolate the impact of specific factors without statistical adjustments. Future studies should incorporate multivariate analyses to control for confounding variables and better assess the relative contributions of different factors to inpatient mortality.

According to research conducted in low-income nations, infections - particularly septicaemia and malaria - are a major cause of death for mental health patients [31, 32, 43]. Most of the patients who passed away had been diagnosed with psychosis, namely schizophrenia and organic psychosis (a subacute confused state characterized by delusions and hallucinations, brought on by a tropical infection). Occasionally, cases of organic psychosis make it past the medical screening and into psychiatric units despite alerts from earlier audit findings [43]. It is important to emphasize that this study found fewer unnatural deaths, such as suicide and accidents. There could be several factors at play here. The admittance policy in Sudan mandates that a family member remain with the patient for the duration of treatment for safety concerns; this may play a role in the inpatient care model, which is a collaboration between the hospital and the patient's family. There have been reports of comparable policies in other low-income nations [33]. The elevated mortality rate in hospital settings can be partially attributed to a combination of factors, including deficiencies in fundamental medical competencies among trained healthcare practitioners, shortages of critical emergency medications, and limited availability of ECG monitoring, and a lack of regulated laboratory assistance [28]. Enhanced monitoring, early intervention, and multidisciplinary approaches are essential for improving patient outcomes and reducing mortality rates in psychiatric hospital environments.

Social and structural factors, including socioeconomic conditions, hospital infrastructure, and staffing levels, play very important role role in influencing mortality rates in psychiatric hospitals. Limited resources may lead to delays in medical intervention, inadequate monitoring, and increased patient vulnerability. Understaffing can impact the quality of care, particularly in emergency situations, while poorly equipped facilities may limit diagnostic and treatment options. Future research should focus on assessing how these structural challenges contribute to mortality and explore strategies to improve healthcare delivery in under-resourced psychiatric settings.

Conclusion

In conclusion, the findings of this study shed light on the complex interplay of factors contributing to mortality rates within psychiatric hospital settings in Sudan. Factors such as younger age, undiagnosed conditions, and medication-related complications contribute to early deaths. Improving diagnostic practices, access to medical resources, and staff training are crucial steps toward reducing mortality and enhancing patient outcomes in psychiatric care settings.

Additionally, hospital administrations in developing nations are advised strongly to provide staff with easy access to ECG machines so that they can closely monitor patients who are on psychotropic drugs, particularly in the 1st week after admission. This is because parenteral treatment is often required during this critical care period, which is also when two-thirds of deaths occur during this period. Reading ECGs and using portable ECG devices should be taught to all medical personnel. Medical internists should always provide liaison support to psychiatric hospitals in developing nations, helping them with important patient care and guiding organic illnesses.

Strengths, limitations, and clinical/future implications

Strengths

This study presents a comprehensive 15-year mortality audit of national psychiatric hospitals in Sudan, providing valuable insights into mortality trends in psychiatric inpatients within a low-resource setting. The extended study period enhances the robustness of the findings by capturing long-term patterns, reducing the risk of bias associated with short-term fluctuations. Additionally, the study's large sample size, encompassing 28,085 admissions, allows for meaningful statistical analysis and generalizability to similar contexts in other low-income countries.

Another strength is the study's focus on identifying key causes of mortality, including infections and circulatory failure, which can inform targeted interventions. By integrating sociodemographic data, medical histories, and psychiatric diagnoses, the study highlights potential vulnerabilities among psychiatric inpatients, particularly the high mor tality rates within the first 10 days of admission. This finding underscores the need for early risk identification and tailored medical interventions.

Limitations

Despite its contributions, the study has several limitations. First, its retrospective design relies on existing hospital records, which may contain missing or incomplete data, particularly regarding the exact cause of death. The high proportion of cases labeled as "circulatory failure" or "no clear cause" suggests potential gaps in diagnostic precision and documentation. A lack of postmortem examinations further limits the accuracy of cause-of-death attributions.

Another limitation is the study's confinement to psychiatric hospitals in Sudan's capital city. While these institutions serve a broad patient population, the findings may not be fully representative of psychiatric mortality patterns in rural areas or other healthcare settings with different referral practices. Additionally, the study does not systematically assess the impact of specific healthcare policies, treatment protocols, or medication safety monitoring practices that may have influenced mortality outcomes.

Clinical and future implications

The study's findings highlight critical areas for clinical and policy interventions to reduce psychiatric inpatient mortality. The predominance of infection-related deaths calls for enhanced infection control measures, routine screening for infectious diseases, and improved general medical care within psychiatric hospitals. Given that a substantial proportion of deaths occurred within the first 10 days of admission, early monitoring of newly admitted patients should be prioritized, with regular assessment of vital signs, metabolic status, and cardiovascular health.

Furthermore, the study underscores the need for better medication management, particularly for antipsychotics with potential cardiac side effects. The high prevalence of circulatory failure and neuroleptic malignant syndrome suggests that psychiatric facilities should implement standardized protocols for ECG monitoring, electrolyte balance assessment, and early detection of adverse drug reactions.

Future research should consider prospective designs with real-time data collection to improve diagnostic accuracy and explore causative mechanisms in greater detail. Establishing multidisciplinary teams that integrate psychiatric, medical, and cardiology expertise within psychiatric hospitals could enhance overall patient safety and reduce preventable mortality.

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Author contributions

Abdelgadir Osman supervised the project, including data collection, literature review, and draft writing. Mohga Mohamed, Khalid Abdalhai, and Lubaba Elawad contributed significantly to project design, proposal, data collection and analysis. Ibtihal Osman conducted literature review project liaison, data entry and analysis and technical support. All authors have been involved in reviewing, and editing the manuscript, and have all read and approved the final draft.

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Data availability

Data can be requested from the corresponding author.

Declarations

Ethics approval and consent to participate

Not applicable. The need for written informed consent was waived by Khartoum Medical School's Research council's ethic committee and approved the study, due to the retrospective nature of the study. Informed consent was obtained from the four Hospitals administrations participated in this study, the authors are attesting that the participants were aware of the study's purpose, risks, and benefits. and written permissions were obtained.

Competing interests

The authors declare no competing interests.

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