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Research Article

Analysis of Mortality at the National University Hospital Center of Fann, Dakar, Senegal from 2021 to 2024

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Abstract:

Introduction: Hospital mortality is an important outcome indicator for assessing the severity of the conditions being treated, the quality of care, and how well health facilities operate. In African countries, its interpretation has to take into account the referral role of university hospitals, delays in accessing care, and the coexistence of both infectious and non-communicable diseases. **Objective:** Analyze the evolution of mortality at the National University Hospital Center of Fann in Dakar between 2021 and 2024, describing its distribution by year, place and department of death, the sociodemographic characteristics of the deceased patients, as well as the factors associated with death during hospitalization. **Patients and methods:** A retrospective, descriptive, and analytical cross-sectional study was carried out using the death records from CHNU de Fann for the period 2021–2024. Data were collected between March 10 and July 31, 2025, using a structured form, and then entered into KoboToolbox. After cleaning in Microsoft Excel 2021, the analysis was done with R version 4.4.3. Associations were studied using the χ^2 test and binary logistic regression. The significance level was set at 5%. **Results:** Out of 37,196 hospitalization and emergency visit records, 3,309 deaths were recorded. After excluding 11 records, 3,298 deaths were analyzed. The overall death rate was 8.87% (95% CI: [8.58–9.16]). It ranged from 5.66% in 2022 to 11.13% in 2023. The average age of deceased patients was 53.4 ± 21.8 years, with a median of 57 years and ages ranging from 0 to 94 years. Men accounted for 58.1% of deaths, giving a male/female sex ratio of 1.3. Deaths occurred mainly during hospitalization (68.7%) and in the emergency room (30.9%). Non-communicable diseases accounted for 65.37% of the recorded causes, compared to 25.04% for communicable diseases; the cause was not recorded in 9.58% of cases. Neurological disorders were the leading cause among non-communicable diseases, while tuberculosis dominated among communicable diseases. In multivariate analysis, the place of death was linked to the region of residence, cause category, age, and year of occurrence. Patients living in Dakar were less likely to die in the hospital than those from other regions (adjusted OR = 0.40; 95% CI: 0.31–0.51; $p < 0.001$). Communicable diseases were associated with a higher likelihood of in-hospital death (adjusted OR = 1.51; 95% CI: 1.13–2.00; $p = 0.005$). Children aged 0 to 14 also had a higher likelihood compared to patients aged 30 to 44 (adjusted OR = 3.41; 95% CI: 1.80–6.43; $p < 0.001$). **Conclusion:** The mortality observed at CHNU de Fann is high and mainly due to non-communicable diseases, while there's still a substantial burden of infectious diseases. Changes over time and differences depending on the place of death suggest the need to strengthen early care, organize emergency services, ensure continuity of care, and systematically review deaths.

Keywords: hospital mortality; death; non-communicable diseases; associated factors; Senegal

Introduction

Mortality is a key indicator of the health status of populations and the performance of health systems. In hospitals, death is an outcome event that needs to be interpreted in light of the severity of the patients admitted, the types of illnesses treated, the timeliness of care, and the resources available. Hospital mortality is thus used as a quality indicator, in line with Donabedian's approach, which distinguishes between the structural, process, and organizational aspects of care quality **[1]**.

Worldwide, non-communicable diseases are becoming an increasingly common cause of death, while infections, respiratory conditions, and acute illnesses still weigh heavily on mortality in low- and middle-income countries **[2]**.

This change is part of an epidemiological transition that doesn't mean infectious diseases are being replaced by chronic ones, but rather that they coexist. Health systems therefore need to meet the needs of managing infectious illnesses, cardiovascular diseases, cancers, neurological disorders, and injuries all at the same time **[3]**.

In many African countries, hospital mortality is still influenced by late access to care, insufficient human and material resources, drug shortages, and the concentration of serious cases in referral facilities. So, when interpreting a mortality rate, you have to take into account the referral profile and the tertiary referral role of the facility being studied. This situation has been observed in many African hospital settings, especially in units dealing with life-threatening emergencies and severe conditions **[3,4]**.

In Senegal, hospital mortality data is still underused, even though it can help identify potentially preventable deaths, improve medical records, and guide hospital policies **[5,6]**.

The Fann National University Hospital Center, a public tertiary-level facility located in Dakar, receives patients from all over the country and is especially a reference center in several medical and surgical fields. Its activity has also been affected by the impact of the COVID-19 pandemic and by fluctuations in the demand for care.

Analyzing mortality in this facility is therefore interesting both from an epidemiological and institutional perspective. It helps to understand how the phenomenon changes over time, describe the profiles of patients who died, identify which departments are particularly affected, and look for factors associated with where the death occurred. The aim of this study was to analyze mortality at CHNU de Fann between 2021 and 2024.

Patients and methods

Study framework

The study was conducted at CHNU de Fann, a public university-affiliated health facility, ranked at level 3 in the Senegalese health system. The hospital serves as a national and sub-regional reference point, while also taking part in teaching, medical training, and clinical research.

The facility has around 384 functional beds spread across several medical and surgical departments, including neurology, neurosurgery, infectious diseases, pulmonology, medical and pediatric cardiology, plastic and cardiovascular thoracic surgery, ENT, psychiatry, geriatrics, and emergency services. It also includes related services, such as the Medical Imaging and Diagnostic Center, physical medicine, and reception units. The staff includes university hospital doctors, hospital practitioners, biologists, pharmacists, interns, nurses, technicians, and other medical-technical professionals.

Type and study period

It was a retrospective, cross-sectional, descriptive, and analytical study, focusing on deaths recorded at the CHNU of Fann from January 1, 2021, to December 31, 2024. Data collection was carried out from March 10 to July 31, 2025.

Study population and inclusion criteria

The study population consisted of all the patients whose deaths were recorded in the hospital records of the CHNU de Fann during the study period. Patients of all ages and sexes for whom a death was documented in the facility's records were included.

Incomplete or unavailable files, as well as files corresponding to undocumented out-of-hospital deaths, were not included. Recruitment was comprehensive for files meeting the inclusion criteria available in the records.

Data collection and variables studied

The data were collected from hospital death records using a structured form. The information gathered included sociodemographic characteristics, such as age, gender, region, department, and neighborhood of residence; details related to care, like the hospital ward and mode of admission; as well as variables directly linked to the death itself, including the date, place, length of hospital stay before death, any COVID-19 test results, and the cause recorded in the register.

The main dependent variable of the study was hospital mortality, defined as the occurrence of a death recorded within the hospital during the study period. For the multivariate analysis, a specific binary variable was created: death during hospitalization versus death in the emergency department. Deaths recorded outside the hospital were described in the descriptive analysis but are not included in this binary comparison as defined in the report.

Causes of death were grouped into non-communicable diseases, communicable diseases, injuries, and unspecified causes. Non-communicable diseases included things like tumors, cardiovascular diseases, chronic respiratory diseases, digestive diseases, neurological disorders, diabetes, kidney diseases, and other chronic conditions. Communicable diseases included respiratory infections, tuberculosis, HIV and sexually transmitted infections, malaria, intestinal infections, other infectious diseases, and maternal, neonatal, or nutritional conditions.

Statistical analysis

The initial data entry was done in KoboToolbox. The database was then exported to Microsoft Excel 2021 for completeness checking, cleaning, and recoding, and then analyzed with R software version 4.4.3.

The descriptive analysis included calculating counts, proportions, the mean, the median, and the standard deviation. The overall mortality rate was calculated as the ratio between the number of deaths and the total number of hospital and emergency visits. The 95% confidence interval for this proportion was calculated from the raw counts.

The relationships between qualitative variables were studied using the χ^2 test. Variables with epidemiological relevance or a p-value below 0.20 were considered for multivariate analysis. Binary logistic regression was used to identify factors independently associated with in-hospital death. The results are presented as

adjusted Odds Ratios (aOR), along with their 95% confidence intervals. The α error risk was set at 5%.

Due to the lack of detailed data on all hospitalized patients, especially by age and sex, the bivariate and multivariate analyses were conducted on the deaths recorded. So, the interpretation mainly focuses on the distribution of causes and place of death among the patients who died, rather than on the individual risk of death calculated for each subgroup of hospitalized patients.

Ethical considerations

The study was carried out after obtaining administrative approval from the CHNU of Fann. The data was collected anonymously and used solely for scientific purposes. The principles of confidentiality and protection of individual information were respected.

Results

Descriptive

Folder selection

Between 2021 and 2024, 37,196 hospitalization and emergency visit cases were recorded at the CHNU of Fann. Among them, 3,309 deaths were recorded. After excluding 11 cases that did not meet the inclusion criteria, 3,298 death cases were kept for analysis (**figure 1**).

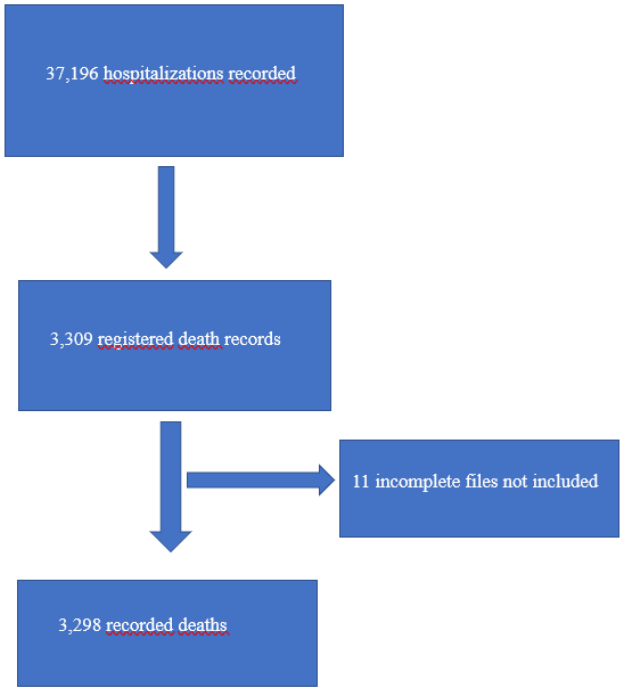

Figure 1: Flowchart of collected deaths

Inclusion flow: 37, 196 saved files → 3, 309 recorded deaths → 11 excluded files → 3, 298 analyzed deaths.

Distribution of deaths by age:

The study involved 3,298 patients. The 60 to 74 age group was the most represented, with 950 patients (28.8%).

The average age of the patients was 53.4 ± 21.8 years, with extremes ranging from 0 to 94 years. The median age was 57 years.

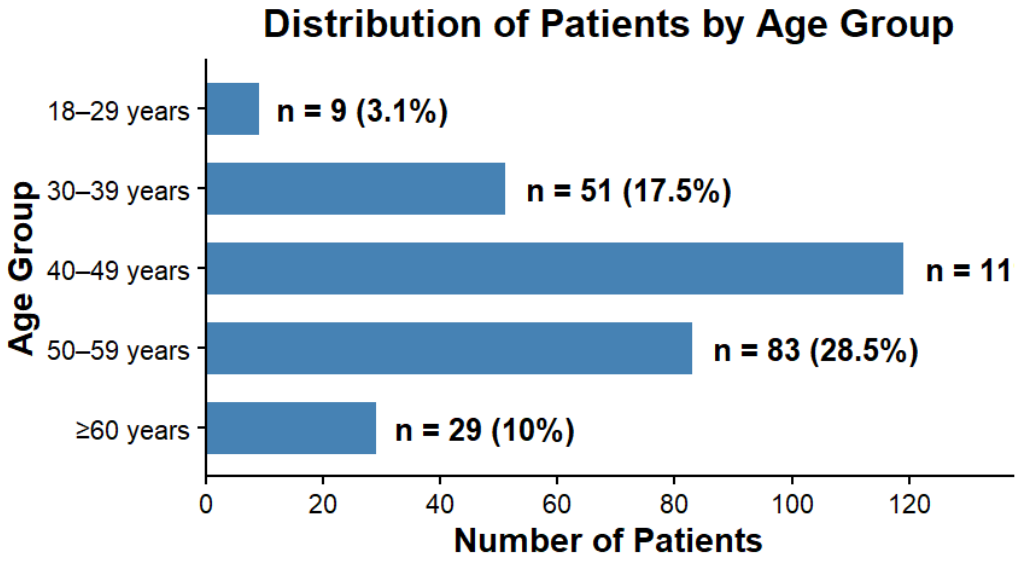

Figure 2: Distribution of deaths by age group

Distribution of deaths by sex:
Death was observed in 1,917 male subjects (58.1%) and 1,381 female subjects (41.9%), giving a male-to-female ratio of 1.3.

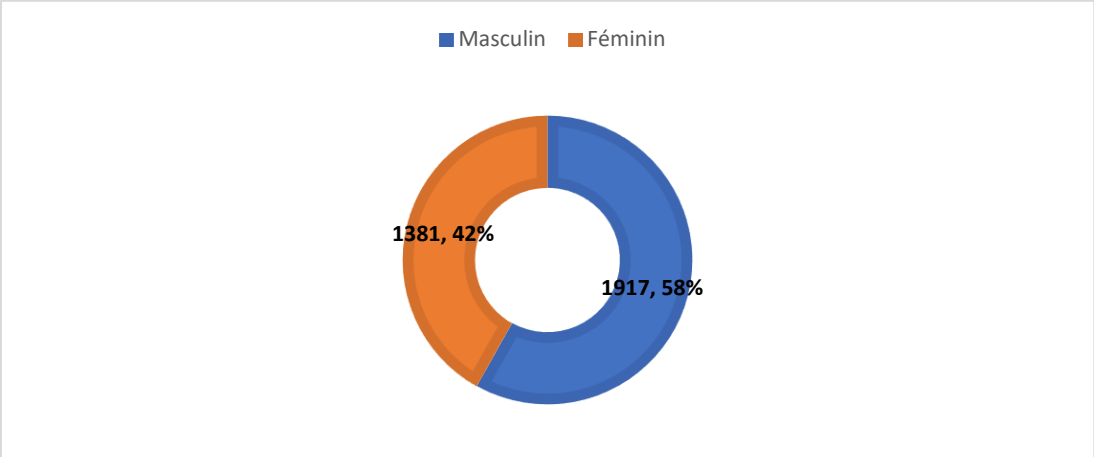

Figure 3: Distribution of deaths by sex

Annual change in mortality
The overall death rate was 8.87% among the 37,196 cases recorded. Yearly trends showed a decrease in 2022, followed by a sharp increase in 2023. The rate calculated from the raw numbers was 9.00% in 2021, 5.66% in 2022, 11.13% in 2023, and 9.58% in 2024.

Table I: Distribution of deaths by annual evolution

Year	Hospitalizations and emergency visits, n	Deaths, n	Calculed mortality rate, %	Share of deaths for period, %
2021	9, 632	867	9.00	26.29
2022	8, 928	505	5.66	15.31
2023	9, 094	1, 012	11.13	30.69
2024	9, 542	914	9.58	27.71
Total	**37, 196**	**3, 298**	**8.87**	**100.00**

Place and service where the death occurred
Most of the deaths happened in the hospital, about 68.7% of them, compared to 30.9% in the emergency room. Eleven deaths, or 0.3%, were recorded outside the hospital (**table II**).

Table II: Distribution by place and service where the death occurred

Death place	Cases number, n	Proportion, %
Hospitalization	2, 267	68.7
Emergencies	1, 020	30.9
Outside the hospital	11	0.3
Total	**3, 298**	**100.0**

Among the deaths broken down by hospital department, neurosurgery had the highest proportion, with 615 deaths (27.15%), followed by infectious diseases with 505 deaths (22.30%), cardiology with 431 deaths (19.03%), and pulmonology with 290 deaths (12.80%). Neurology had 200 deaths (8.83%), geriatrics 101 (4.46%), oto-rhino-laryngology (ENT) 115 (5.08%), and psychiatry 8 (0.35%).

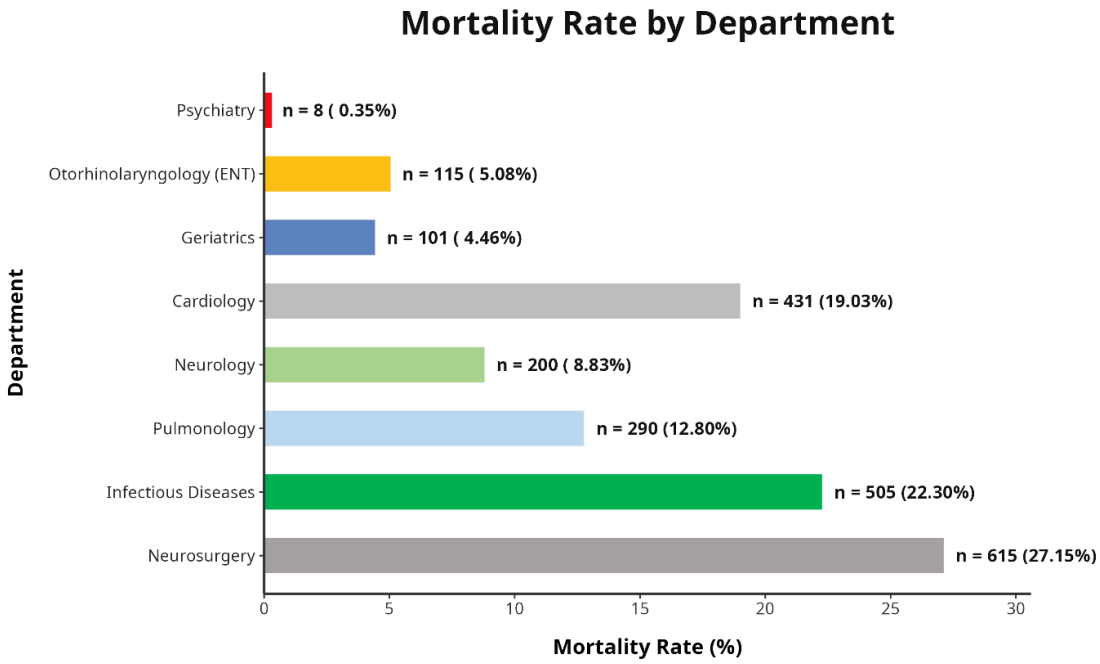

Figure 4: Distribution of mortality rate by department

Distribution of mortality by service :

The table III shows that the neurosurgery service recorded the highest number of deaths, with 615 deaths, representing 27.15% of all deaths for which the hospitalization service was documented. It was followed by the infectious diseases service, which accounted for 505 deaths (22.30%), and the cardiology service, with 431 deaths (19.03%). Together, these three services accounted for 1,551 deaths, representing 68.48% of all deaths distributed by hospitalization service.

Table III: Distribution of mortality by service

Hospitalization service	Deaths, n	Proportion of deaths by department, %
Neurosurgery	615	27.15
Infectious diseases	505	22.30
Cardiology	431	19.03
Pneumology	290	12.80
Neurology	200	8.83
Geriatry	101	4.46
Oto-rhino-laryngology (ENT)	115	5.08
Psychiatry	8	0.35
Total	**2 265**	**100.00**

Distribution of mortality rate by location :

Most of the deaths happened in the hospital with 2,265 cases (68.8%), while 1,020 deaths (30.9%) were recorded in the emergency room. 11 deaths were recorded outside the hospital, which is 0.3%.

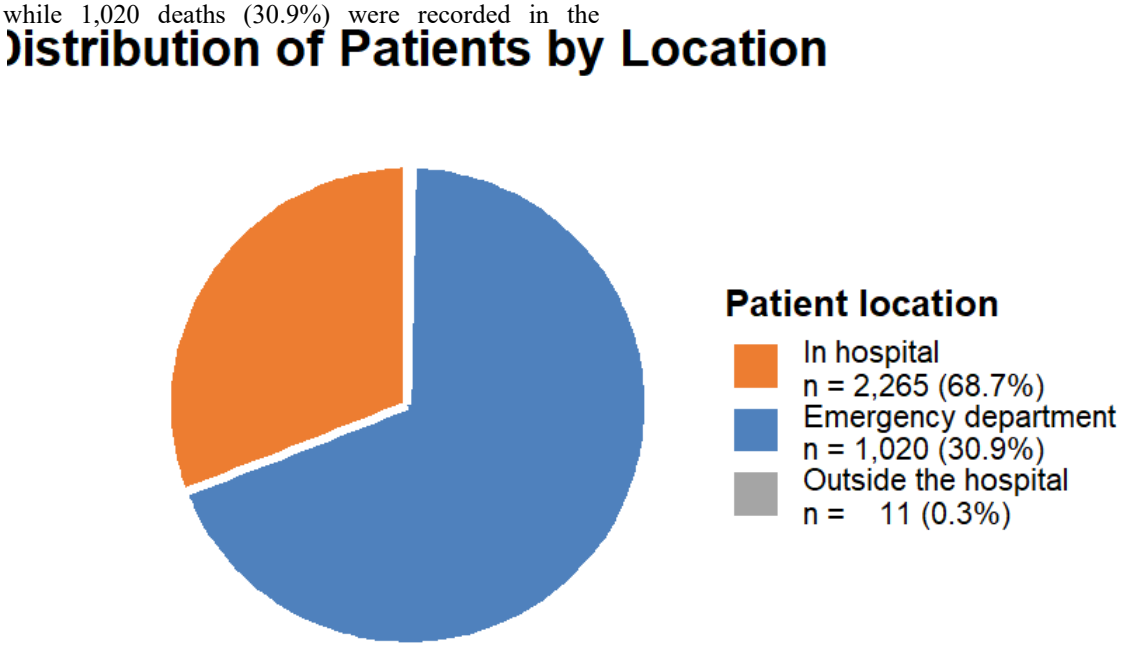

Figure 4 : Distribution of mortality rates by location

Sociodemographic characteristics

The average age of the patients who died was 53.4 ± 21.8 years. The median was 57 years, with a range from 0 to 94 years. The 60 to 74 age group was the most represented, with 950 deaths, making up 28.8% of the total.

Men accounted for 1,917 deaths (58.1%) and women 1,381 deaths (41.9%). The male-to-female ratio was 1.3.

Distribution by causes of deaths

Noncommunicable diseases were the top category of causes recorded, with 2,156 deaths (65.37%). Communicable diseases accounted for 826 deaths (25.04%), while the cause wasn't listed in 316 cases (9.58%).

Among non-communicable diseases, neurological disorders were the leading cause, with 912 deaths (42.3% of non-communicable diseases), followed by tumors, with 362 deaths (16.8%). Among communicable diseases, tuberculosis was the most common cause, with 283 deaths (34.2%), followed by respiratory infections, with 232 deaths (28.1%). Other documented infectious causes included tetanus, toxoplasmosis, infectious syndrome, non-necrotizing dermohypodermatitis, hepatitis, and rabies.

Table IV : **Distribution by causes of deaths**

Causes	Deaths, n	Proportion, %
Non-communicable diseases	2, 156	65.37
Communicable diseases	826	25.04
Unregistered cause	316	9.58
Total	**3, 298**	**100.00**

Non-communicable diseases :

Neurological disorders were the leading cause of death among non-communicable diseases, with a count of n = 912, or 42.3%, followed by tumors with n = 362 (16.8%).

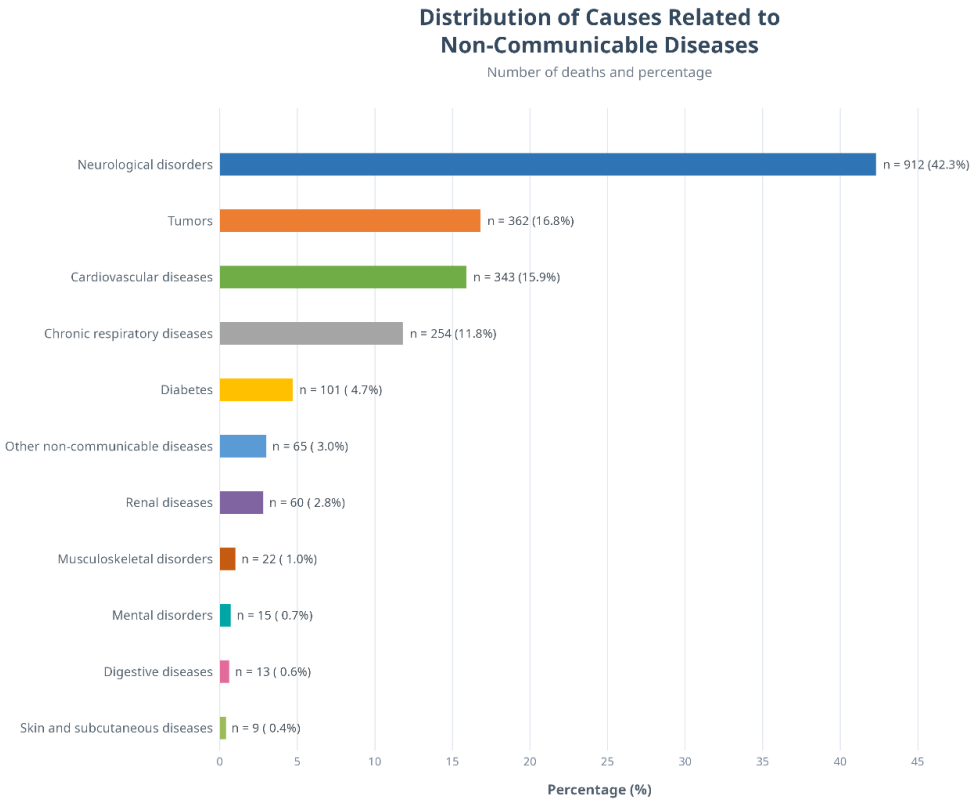

Figure 5: Distribution of causes related to NCDs

Communicable diseases :

Tuberculosis was the leading cause of death, with a total of n = 283, or 34.2% of cases, followed by respiratory infections with n = 232 (28.1%). Other infectious diseases accounted for 20% of deaths related to communicable diseases. These mainly included tetanus with n = 53 cases (6.4%), toxoplasmosis with n = 40 cases (4.8%), infectious syndrome with n = 33 cases (4.0%), non-necrotizing dermohypodermitis with n = 19 cases (2.3%), hepatitis with n = 11 cases (1.3%), and rabies with n = 9 cases (1.1%).

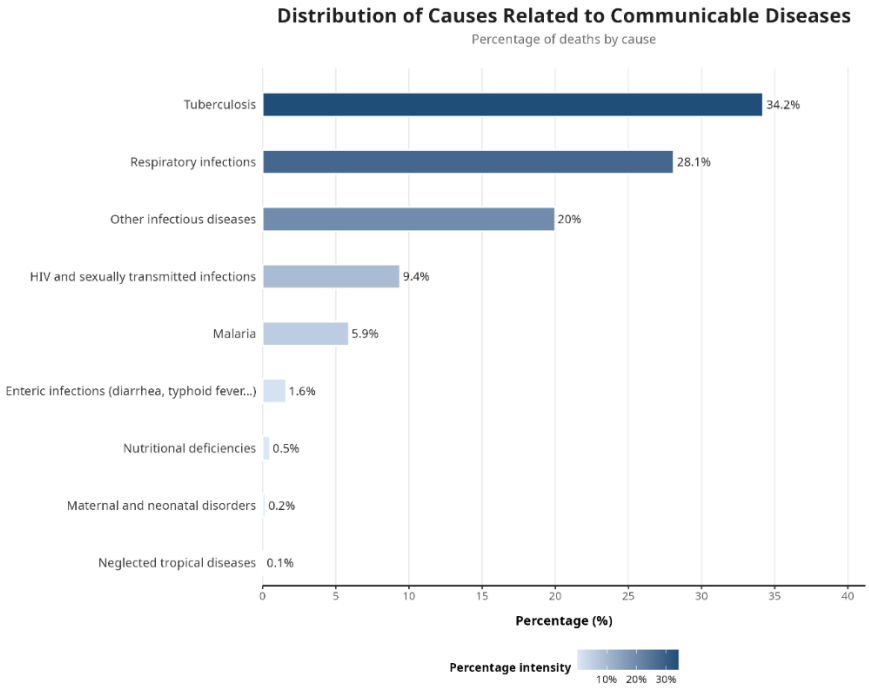

Figure 6: Distribution of causes related to Communicable Diseases

Analytical

Bivariate analysis

A statistically significant association was observed between the year of death and the category of cause ($\chi^2 = 67.47$; $p < 0.001$), indicating a variation in the distribution of communicable diseases, non-communicable diseases, and unrecorded causes over the study period.

A significant association was also found between sex and cause category ($\chi^2 = 19.25$; $p < 0.001$). Non-communicable diseases were more common in both men and women, while the proportion of communicable diseases was higher in men in the analyzed data.

Finally, the place of death varied significantly depending on the year it occurred ($\chi^2 = 165.10$; $p < 0.001$), which reflects a temporal change in the distribution of deaths between hospitalization, emergency rooms, and deaths recorded outside the hospital.

Multivariate analysis

The binary logistic regression model had hospital death as the dependent variable, as opposed to death in the emergency room. The reference categories were female sex, other regions of residence, non-communicable diseases, the 30 to 44 age group, and the year 2021.

Table V: Multivariable binary logistic regression analysis of factors associated with hospital mortality

Variable	Compared method	ORa	IC95 %	p-value
Sex	Male vs female	1,09	0,93–1,28	0,290
Region of residence	Dakar vs others regions	0,40	0,31–0,51	< 0,001
Cause of deaths	NCDs vs Communicable diseases	1,51	1,13–2,00	0,005
Age	0–14 years vs 30–44 years	3,41	1,80–6,43	< 0,001
Age	15–29 years vs 30–44 years	1,24	0,89–1,74	0,209
Age	45–59 years vs 30–44 years	0,71	0,55–0,92	0,010
Age	60–74 years vs 30–44 years	0,55	0,43–0,71	< 0,001
Age	75 years or more vs 30–44 years	0,40	0,30–0,52	< 0,001
Year	2022 vs 2021	0,55	0,44–0,70	< 0,001
Year	2023 vs 2021	2,70	2,15–3,37	< 0,001
Year	2024 vs 2021	1,18	0,96–1,45	0,113

After adjustment, sex was not significantly associated with the place of death. However, patients living in Dakar had a lower chance of dying in the hospital compared to those living in other regions. Infectious diseases were linked to a higher likelihood of death in the hospital. Children aged 0 to 14 had a higher chance than patients aged 30 to 44, while the age groups 45 to 59, 60 to 74, and 75 or older had lower odds.

Compared to 2021, the year 2022 was linked to a decrease in the odds of death in hospitalization, and 2023 to an increase; the association observed in 2024 wasn't statistically significant.

Discussion

Our study focused on hospital mortality at the Fann National University Hospital Center in Dakar between 2021 and 2024. During this period, 3,298 deaths were recorded out of 37,196 admissions, giving an overall hospital mortality rate of 8.87%. This figure should be interpreted considering the profile of the facility. Fann NUHC is a referral center that receives patients with severe illnesses, complications, or specialized care needs. In this context, the observed mortality cannot be seen as an isolated indicator of care quality; it should be considered alongside the initial severity, referral delays, comorbidities, and available resources, in line with risk adjustment principles **[7,8]**.

The yearly change in the mortality rate is one of the main findings of the study. The lowest rate was observed in 2022, while the highest was recorded in 2023. This trend could reflect changes in hospital activity, the mix of admitted patients, pressure on services, resource availability, or the health context. However, on its own, it doesn't allow us to attribute the change to a specific cause.

Drawing causal conclusions is limited by the retrospective nature of the study and the lack of detailed data on clinical severity and treatment timing.

Deaths were mainly recorded in hospitals, but nearly a third occurred in the emergency room. This high proportion of deaths in the ER could be due to patients arriving at an advanced stage of illness, late transfers, or severity that made initial stabilization impossible. It could also reflect the hospital's role as a referral center and the concentration of critical cases. In systems where access to specialized care is uneven, geographical distance and referral delays can affect where death occurs, without that location alone being a direct measure of care quality **[5, 6]**.

The breakdown by department shows a concentration of deaths in neurosurgery, infectious diseases, cardiology, and pulmonology. This distribution makes sense given that these units handle potentially life-threatening conditions and patients who need continuous monitoring. It shouldn't be taken as a ranking of department performance, because we don't have complete data on the number of patients admitted to each unit or how severe their conditions were at admission. Making a fair comparison of mortality rates by department would require having that data and adjusting for risk.

The average age of the patients who died was 53.4 years, with the 60 to 74 age group being the most represented. This reflects the impact of chronic and degenerative diseases among older adults, in a context of demographic and epidemiological transition. Cardiovascular diseases, cancers, and neurological disorders are playing an increasing role in mortality profiles, while severe infections continue to affect a significant portion of hospitalized patients **[4,9,10]**.

The predominance of men, with 58.1% of deaths and a sex ratio of 1.3, has also been reported in several African hospital series. This may reflect differences in exposure, healthcare-seeking behavior, severity of illnesses, or the makeup of the admitted population, but it was not an independent factor in the adjusted model.

Non-communicable diseases made up 65.37% of the causes recorded. This dominance matches the evolution of Senegal's epidemiological profile and the increase in cardiovascular and metabolic risk factors reported in the Senegalese population **[4,5].** However, the 25.04% proportion attributed to communicable diseases confirms that the epidemiological transition is still incomplete. Healthcare facilities therefore need to maintain a strong capacity for diagnosing and treating serious infections, while also strengthening prevention and management of chronic diseases.

Neurological disorders were the leading cause among non-communicable diseases. This might be connected to the historical role of CHNU de Fann as a referral center for neurology and neurosurgery. Studies conducted at CHNU de Fann have already reported significant mortality in the neurology departments and among patients hospitalized for stroke **[11,12].**

This focus highlights the importance of the neurovascular field, quick access to imaging, monitoring for complications, and continuity in rehabilitation.

Among contagious diseases, tuberculosis and respiratory infections were at the top. The persistence of tuberculosis as a major cause of hospital deaths reflects the seriousness of cases diagnosed late, the frequency of comorbidities, and the challenges that can affect access to diagnosis and treatment. The data in the report align with observations reported in studies on extrapulmonary tuberculosis in Senegal **[13].**

They also remind us of the need for close monitoring of patients with severe respiratory infections and for quickly diagnosing organ failures.

The bivariate analysis highlighted an association between the year and the cause category, as well as between sex and the cause category. These associations show that the composition of deaths wasn't stable over time and varied according to sex. However, they don't allow us to conclude a causal relationship. Key clinical factors, such as severity at admission, comorbidities, treatments received, and delays in care, weren't available in a sufficiently complete way to be included in the analysis.

The multivariate analysis focused on the place of death. Sex was not independently linked to death in hospitalization, which suggests that the observed difference in the overall distribution of deaths between men and women could be related to the structure of diseases, age, or other unmeasured factors. On the other hand, the region of residence was strongly linked to the place of death. Patients living in Dakar had lower odds of dying in the hospital compared to patients from other regions. This association might reflect differences in geographic proximity, access delays, care pathways, and severity upon arrival. However, it should be interpreted with caution, as the place of residence does not directly measure delay in seeking care or the quality of referral.

Communicable diseases were associated with higher odds of hospitalized deaths. This relationship may be explained by the need for prolonged management, continuous monitoring or specific treatments in severe infections. Conversely, some patients with non-communicable diseases may die very early in the emergency department, particularly in the event of acute decompensation or delay in referral. However, this hypothesis cannot be verified without individual data on admission times, initial severity and interventions performed.

Age was also linked to the place of death. Children aged 0 to 14 had higher odds of dying in the hospital compared to patients aged 30 to 44. This could reflect the need for specialized monitoring and the severity of certain pediatric conditions. Patients aged 60 or older, on the other hand, had lower odds of dying in the hospital in the model studied. This result doesn't mean that older people have lower overall mortality; it just indicates, among the deaths analyzed and compared to the reference category, a lower likelihood that death would be recorded in the hospital rather than in the emergency room.

Finally, the differences observed between the years 2021, 2022, and 2023 highlight the possible influence of the time context. The increase in the odds of death during hospitalization in 2023 could reflect changes in patient flow, service workload, or the profile of illnesses. It might also be affected by the health and organizational context. Additional analyses, including admissions by department, referral times, comorbidities, and severity indicators, would be needed to clarify these mechanisms.

Limits of study

The retrospective nature of the study and the use of death registers expose it to a risk of information bias. Some variables were incomplete, poorly recorded, or missing, especially detailed clinical information and certain patient characteristics. The cause of death was not recorded in 9.58% of the files, which might affect the description of the etiological profile.

The study doesn't allow for generalizing the results to the entire Senegalese population or to all healthcare facilities. The CHNU of Fann is a referral center with a specific type of patient intake. In addition, the lack of complete data on hospitalized patients by age, sex, region, and other characteristics limited the estimation of specific rates and the ability to perform risk-adjusted mortality analyses.

The multivariate analysis focused on the place of death, defined as death in hospitalization versus death in the emergency room, rather than on the occurrence of death among all admitted patients. So, the odds ratios should be interpreted as associations with the place of death among documented deaths, not as risks of death in the hospitalized population.

Finally, the study period covered a particular health context, including the possible impacts of the COVID-19 pandemic. The variations observed from year to year may therefore result from epidemiological, organizational, or social factors that could not be separated in this study. An internal inconsistency in the report concerns the number of in-hospital deaths: the narrative text mentions 2,265 cases, while the table dedicated to the place of death totals 2,267; both values were kept in their respective tables to avoid altering the source data. Similarly, the table of causes shows 65.37% of non-communicable diseases, the value used in this article, while the thesis summary mentions 66.1%. Finally, the source summary reports an OR of 2.52 for the region of residence, whereas the multivariate table and detailed interpretation report an ORa of 0.40; this latter value, consistent with the reference category and the textual interpretation, was used.

Conclusion

The mortality recorded at CHNU de Fann between 2021 and 2024 accounted for 3,298 deaths out of 37,196 hospital and emergency visits, which is an overall rate of 8.87%. It varied a lot from year to year, peaking in 2023 and hitting the lowest in 2022.

The profile of deaths was dominated by non-communicable diseases, especially neurological disorders, while communicable diseases still played a significant role, mainly tuberculosis and respiratory infections. Most deaths occurred in the hospital, but the share in emergency settings remained high. In the multivariate model, the region of residence, cause category, age, and year of occurrence were associated with the place of death, while sex was not after adjustment.

These results argue for strengthening hospital mortality monitoring, improving the quality and completeness of records, setting up systematic death audits, and reducing delays in referral to specialized care. They also highlight the importance of an integrated strategy that combines prevention and management of non-communicable diseases with maintaining an effective response to serious infections.

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