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Characteristics of Deaths of Children in the Pediatrics Department of Hôpital Spécialisé Mère-Enfant Blanche Gomes (Republic of the Congo) from 2019 to 2021

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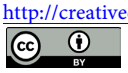
Abstract

Introduction: The United Nations Sustainable Development Goals (SDGs) aim to decrease the global maternal mortality ratio to below 70 per 100,000 live births and eliminate preventable deaths of newborns and children under the age of five in all countries by 2030. The pediatric department at Spécialisé Mère-Enfant Blanche Gomes Hospital (HSMEBG) is divided into two sectors, one catering to children aged one month to four years and the other dedicated to children aged five to 17 years. According to department records, over the past three years, there has been an average of 1050 hospitalizations per year, with an average duration of five days. **Objectives:** This study aims to describe the socio-demographic characteristics of children who died while in the pediatrics department of the HSMEBG and analyze the factors associated with their deaths. **Methodology:** A retrospective analytical cross-sectional study was conducted, collecting data over a three-year period, covering the years 2019, 2020 and 2021. Data were collected from medical records of deceased children using Excel software version 2016, and statistical calculations and logistic regression were performed using Epi info software version 7.2.5.0. **Results:** During the three years of operation, the pediatric department at



HSMEBG recorded 3060 new admissions, of which 271 resulted in death, representing an overall frequency of 8.8%. December and January had the highest mortality rates, accounting for 15.5% and 12.5%, respectively. Out of the 271 recorded deaths, 143 (52.77%) occurred in children under the age of one, and 230 (84.87%) occurred in children under the age of five. The average age at death was 2.4 years, ranging from one month to 17 years. The sex ratio was 1. More than half of the deaths (51.66%) occurred during the night, and 165 (60.89%) sought medical help more than three days after the onset of symptoms. Weekend deaths accounted for nearly half (45.7%) of the cases. Upon admission, slightly over half of the children (55.72%) had impaired consciousness, 219 (80.81%) presented with respiratory distress, and 194 (71.59%) had a fever. The average time from admission to administering the first medication was 72 minutes. Respiratory infections were the leading cause of death, accounting for 83 (30.26%) cases, followed by severe forms of malaria (anemic and neurological) at 23.25%. Among the 271 recorded deaths, 33 (12.18%) received no treatment before their demise, and 136 (50.18%) died within the first 24 hours of hospitalization. The average duration of hospitalization for patients who spent less than 24 hours was 15 hours, while those who died after the 24th hour had an average hospital stay of five days, ranging from one to 41 days. Children under the age of five who were admitted with impaired consciousness had roughly double the risk of dying compared to those without this condition ($p = 0.001$). **Conclusion:** The overall mortality rate in the pediatric department at HSMEBG is 8.8%. Acute respiratory infections are the primary cause of death. Improving this rate necessitates reducing consultation and treatment durations.

Keywords

Death, Children, Associated Factors, Brazzaville

1. Introduction

Spécialisé Mère-Enfant Blanche GOMES Hospital (HSMEBG) is a level 3 health facility in the Poto-Poto district. Established as a public administrative health establishment (EPAS) by law n˚21-2015 on October 29, 2015, the hospital covers an area of 10,000 m^2 and operates autonomously. It focuses exclusively on caring for mothers and children, with a total capacity of 200 beds. After undergoing rehabilitation work, the hospital reopened in 2018. It comprises four departments: gynecology-obstetrics, pediatric surgery, neonatology, and pediatrics. According to the PNDS Congo 2018-2022 report (page 41), it is classified as a third-level health facility, equivalent to a general hospital.

The United Nations Sustainable Development Goals (SDGs) aim to reduce the global maternal mortality ratio to less than 70 per 100,000 live births and eliminate preventable deaths of newborns and children under the age of five in all countries by 2030. To achieve these goals, it is widely recommended to conduct

audits and reviews of maternal and perinatal deaths as interventions to enhance care quality and reduce mortality rates [1]. In this context, the present audit was initiated to improve care for hospitalized children, since no previous similar studies have been carried out within the hospital. Specifically, the objectives were to describe the socio-demographic characteristics of children who died in the service and analyze the factors associated with their deaths.

2. Methodology

This study utilized an analytical cross-sectional design with retrospective data collection spanning three years. All records of children (excluding newborns) who died in the HSMEBG pediatric department in 2019, 2020, and 2021 were examined, while dead on arrival were excluded. The pediatrics department is on the third floor of the hospital's new functional building, featuring 39 beds, including 6 in intensive care. It is divided into two sectors, one for children aged one month to four years and the other for children aged five to 17 years. The department is managed by a pediatrician with the support of three other pediatricians and eight general practitioners. Over the past three years, the department has recorded an average of 1050 hospitalizations per year, with an average length of stay of five days. The overall mortality rate is 7%, and the rate of patient escape is 0.02% based on department records. The pediatric department has four intensive care rooms, two ventilators, and four multi-parameter monitors. The staff includes four pediatricians, eight general practitioners, four state-certified nurses, two health assistants, two physiotherapists, two technical health workers, two child nurses, and two nutritionists. Admitted children undergo initial care at the pediatric emergency department, where a pediatrician and a general practitioner provide treatment. A weekly staff meeting is held where the cases of hospitalized children, therapeutic protocols or topics relating to pediatrics are discussed.

Socio-demographic (age, sex, origin, health insurance or not), clinical (fever, respiratory distress, seizures, dehydration, consciousness disorder, heart murmur), and paraclinical parameters (biological and biochemical analyzes, and morphological examinations) were analyzed. Data were collected from medical records of deceased children, using Excel software version 2016, and statistical calculations and logistic regression were performed using Epi info software version 7.2.5.0. Multiple logistic regression analysis was conducted to determine factors associated with recorded deaths. Initially, a simple binomial logistic regression was performed to assess the influence of each factor on death occurrences. Then, using the Likelihood Chi-square test, the likelihood of the multiple regression model was evaluated based on the variables that showed significance during the simple regression. This model included the age of the children, whether or not impaired consciousness at admission, time to consultation, time between admission and administration of the first parenteral drug, and finally the day and time of admission.

3. Results

3.1. Frequency

Over three years, the pediatric department at HSMEBG recorded 3060 new admissions, including 271 deaths. This accounts for an overall frequency of 8.8%. Table 1 displays the distribution of death cases based on the year and month of admission, compiled from the data collected over the three years.

3.2. Socio-Demographic Characteristics

Of the 271 deaths recorded, 143 (52.77%) were less than one year old and those under 5 years of age accounted for 84.87% (230 cases). Slightly over half (50.18%) of the deaths were children from a lower-level health facility. Only one child had health insurance. Further socio-demographic characteristics can be found in Table 2.

3.3. Temporal Characteristics and Antecedents

3.3.1. Temporal Characteristics

Most deaths occurred at night, specifically more than half (51.66%). Additionally, 165 (60.89%) of the deaths sought medical consultation more than three days after the onset of symptoms. Table 3 provides information on the other temporal characteristics related to the deaths.

Table 1. Distribution of deaths by year and month of admission.

		Enrollment/Total Admissions (N = 271/3060)	Proportion (%)
Admission year			
	2019	36/663	5.40
	2020	105/958	10.91
	2021	130/1439	9.03
Admission month			
	January	**34**	**12.55**
	February	**31**	**11.44**
	March	22	8.12
	April	15	5.54
	May	**32**	**11.81**
	June	17	6.27
	July	16	5.9
	August	13	4.8
	September	11	4.06
	October	15	5.54
	November	23	8.49
	December	**42**	**15.5**

Table 2. Distribution of patients according to their socio-demographic characteristics.

Socio-demographic characteristics		Number (N = 271)	Proportion (%)
Age (Med = 1 year, av = 2.42 years, min = 1 month, max = 17 years)			
	1 month - 1 year	**143**	**52.77**
	13 months - 5 years	87	32.10
	6 - 17 years old	41	15.13
Sex (sex ratio = 1.00)			
	Male	136	50.18
	Feminine	135	49.82
Origin			
	Residence	135	49.82
	Referral	136	50.18
Health insurance			
	Yes	1	0.37
	No	270	99.63

Table 3. Distribution of death cases according to temporal characteristics.

		Effective	Proportion (%)
Consultation period			
	<24 h	43	15.87
	24 - 72 h	63	23.25
	>72 h	**165**	**60.89**
Admissions Schedule			
	Morning (6 am - 12 am)	77	28.41
	Afternoon (1 pm - 6 pm)	82	30.26
	Night (7 pm - 5 am)	**112**	**41.33**
Death Schedule			
	Morning (6 am - 12 am)	63	23.25
	Afternoon (1 pm - 6 pm)	68	25.09
	Night (7 pm-5 am)	**140**	**51.66**
Day of death			
	In Week	147	54.25
	Weekend	**124**	**45.75**

3.3.2. Background

Of the 271 cases of death recorded, 68 (25.09%) had already been hospitalized at least once. The other antecedents are shown in Table 4.

3.4. Clinical Aspects

More than half of the children (55.72%) had a disorder of consciousness on admission, 219 (80.81) were admitted with respiratory distress, and 194 (71.59%) had a fever. Other symptoms on admission are reported in Table 5.

3.5. Paraclinical Aspects

Of the 271 recorded death cases, 83 (30.63%) did not undergo any assessment before their demise. Among the 159 cases that underwent assessment, 155 had a pathological complete blood count (CBC). Based on frontal chest X-ray findings, pathological lesions were observed in 43.54% (118 cases). Nine cardiac ultrasounds were performed, and each revealed a cardiac pathology. Additionally, one patient underwent a cerebral MRI, which revealed cerebro-meningeal hemorrhage likely caused by a left mycotic sylvian aneurysm rupture. Table 6 reports the other paraclinical aspects.

3.6. Etiological Aspects

Acute respiratory infections represented the first cause of death with 83 (30.26%) cases, followed by malaria in its severe forms (anemic and neurological) with

Table 4. Distribution of death cases according to medical history.

Background	Effective	Proportion (%)
Previous hospitalization	68	25.09
Congenital heart disease	12	4.43
sickle cell anemia	4	1.48
Epilepsy	2	0.74
Asthma	1	0.37

Table 5. Distribution of death cases according to symptoms on admission.

Main symptoms on admission	Number (N = 271)	Proportion (%)
Respiratory distress	**219**	**80.81**
Fever	**194**	**71.59**
Pallor	**172**	**63.47**
Consciousness disorder	**151**	**55.72**
Convulsive seizures	126	46.49
Dehydration	62	22.88
Heart murmur	11	4.06
Epistaxis	3	1.11

Table 6. Distribution of cases of death according to additional examinations.

Additional tests	Number (N = 271)	Proportion (%)
CBC	**159**	**58.67**
Blood smear	**85**	**31.37**
CRP	32	11.81
creatininemia	25	9.23
CSF Analysis	12	4.43
Blood electrolytes	8	2.95
Chest x-ray	**123**	**45.39**
Echocardiography	9	3.32
Brain CT	1	0.37
Brain MRI	1	0.37

23.25%. Digestive infections complicated by severe sepsis accounted for 13.28% of cases. Table 7 presents the distribution of cases according to the diagnosis of death.

3.7. Therapeutic Aspects

Of the 271 recorded death cases, 33 (12.18%) received no treatment before their demise, while 136 (50.18%) died before the 24th hour of hospitalization. An anticonvulsant was administered in 126 cases (46.49%), with diazepam as the first line intrarectal (42.19%) and then combined with phenobarbital in 51.56%. Artesunate was the first-line antimalarial drug used in 67 cases (24.72%).

Parenteral antibiotic therapy was initiated in 211 children (77.86%), with 165 cases (80.88%) receiving mono-antibiotic therapy based on a third-generation cephalosporin. Twenty-three cases (11.27%) received bi-antibiotic therapy combining cephalosporin and an aminoglycoside, and five cases underwent antibiotic therapy. The average time from admission to administration of the first drug was 72 minutes. Among patients who spent less than 24 hours in the hospital, the average duration of hospitalization was 15 hours. For those who died after the 24th hour, the average hospitalization time was five days, ranging from one to 41 days. Table 8 shows the death case distribution based on the type of treatment received.

3.8. Associated Factors

Children under 5 years old admitted with a disorder of consciousness had about twice the risk of dying than those with the opposite event (OR = 2.7 and 2.3, p = 0.001). Administration of the first drug from the second hour after admission increased the risk of death four times (OR = 4.68, p = 0.021). Age less than 5 years, disorder of consciousness on admission and delay in administration of the first drug are the factors significantly associated with death. All the factors associated with death are presented in Table 9.

Table 7. Distribution of deaths according to etiology.

Diagnostic	Number (N = 271)	Proportion (%)
Severe malaria	**63**	**23.25**
Acute respiratory infections	**83**	**30.26**
Gastroenteritis + Severe dehydration	15	5.54
Digestive infection and severe sepsis	**36**	**13.28**
Urinary tract infection and severe sepsis	1	0.37
Meningitis	**20**	**7.38**
Pediatric AIDS and OI*	11	4.06
Tetanus	3	1.11
Stridulous laryngitis	1	0.37
Congenital heart disease	**22**	**8.12**
Sickle cell anemia and complications	3	1.11
Severe malnutrition and complications	**10**	**3.69**
Rupture of MSA**	1	0.37
Hematological malignancy	2	0.74

*OI = Opportunistic Infections, **MAS = Mycotic Sylvian Aneurysm.

Table 8. Distribution of death cases according to the type of treatment.

Treatments	Effective	Proportion (%)
None	33	12.18
Antimalarial	67	24.72
Antibiotic therapy	**211**	**77.86**
Antimalarial + Antibiotic	7	2.58
Anticonvulsant	**126**	**46.49**
Oxygen therapy	**265**	**97.79**
Intubation	3	1.11
Blood transfusion	45	16.60

Table 9. Results of logistic regression of factors associated with death.

Variables		OR	95% CI	p-value
Age				
	>5 years	1		
	<5 years	2.7084	[1.16; 6.29]	0.0206
Disorder of consciousness on admission				
	No	1		
	Yes	2.3813	[1.39; 4.07]	0.0015

Continued

Consultation period				
	<24 h	1		
	24 - 48 h	0.2612	[0.10; 0.63]	0.003
	>72 h	0.3049	[0.13; 0.66]	
Admissions Schedule				
	6 am - 12 pm	1		
	1 pm - 6 pm	0.3145	[0.10; 0.91]	0.0334
	7 pm - 5 am.	0.2669	[0.09; 0.71]	
Admission-first drug delay				
	<30 min	1		
	1 h - 2 h	1.1883	[0.16; 8.37]	
	>2 h	4.6824	[1.26; 17.39]	0.0211
Day of admission				
	In Week	1		
	Weekend	0.1122	[0.0485; 0.2597]	<0.001

4. Discussion

4.1. Frequency

The frequency of 8.8% observed in our study is linked to the fact that the pediatric department of the HSMEBG includes pediatric intensive care where the overall mortality is a little higher. Balenga *et al.* [2] reported a frequency of 13% in the Democratic Republic of Congo (DRC) in 2020. In the series by Doumbia *et al.* [3] in Mali in 2016, the frequency was 3.3%. These variations in frequencies can be attributed to differences in selection criteria. Infant mortality is a significant public health concern in resource-limited countries with often weak healthcare systems. According to the World Health Organization (WHO) [4], in 2019, sub-Saharan Africa and central and southern Asia accounted for over 80% of the 5.2 million deaths among children under the age of 5, despite representing only 52% of the world's population in that age group.

4.2. Periodicity

Among the three years analyzed, December and January had the highest number of deaths. This observation aligns with the findings by Balenga *et al.* [2] in the DRC. The peak during these months could be attributed to the rainy season, which promotes the spread of vector-borne infectious diseases. Additionally, children are more vulnerable to acute respiratory infections due to the maturation phase of their respiratory system, making it more fragile than adults. Their faster breathing rate also leads to increased inhalation of pollutants.

4.3. Age

The under-5 age group is the most exposed to acute malnutrition and vaccine-preventable diseases, and therefore to higher mortality. These observations are consistent with the findings of most authors [2] [3] [5] [6] [7] [8]. While global progress has been made in reducing the under-5 mortality rate, disparities persist among regions and countries. Sub-Saharan Africa has the highest under-5 mortality rate, with one in 13 children dying before their 5th birthday. This rate is 20 years behind the global average, which reached a rate of 1 in 13 in 1999 [4].

4.4. Admission Symptoms

The preponderance of respiratory distress (80%) and fever (71%) is linked to the predominance of respiratory and infectious diseases in our series. Also, respiratory distress can be witness to a pulmonary pathology, but also the reflection of a metabolic, functional or infectious disturbance of any other organ (hypoglycemia, severe anemia, severe sepsis). Slightly over half (55%) of the deceased children exhibited a disorder of consciousness. In the series by Doumbia *et al.* [3] in Mali, the main reasons for consultation were fever (36.1%), convulsions (23.5%), pallor (21.6%), and weight loss (19.1%). The predominance of infectious pathologies could explain the high frequency of fever in these two countries. Disturbances of consciousness in children under five years of age often follow convulsive seizures, either due to fever or related to an epileptogenic encephalopathy, infectious or not.

4.5. Causal Pathologies

Acute respiratory pathologies and malaria dominate the diagnoses of death. The country's tropical climate favors the development of microbes responsible for severe infections; Malaria also evolves there in endemic mode. In 2019, the WHO [4] reported that ARIs were the leading cause of death for children under five (newborns excluded), followed by malaria and diarrheal diseases. Ntuli *et al.* [5] in South Africa also reported pneumonia as the leading cause of death, whereas, in the series by Balenga *et al.* [2], severe malaria was the primary cause of death, followed by acute bronchiolitis in infants and diarrhea. Regardless, infectious pathologies still largely dominate the causes of child mortality in Africa, with unsanitary conditions and low socio-economic status being the main contributing factors. Effective control of vaccine-preventable and vector-borne diseases including malaria could significantly reduce child mortality.

4.6. Associated Factors

In binary logistic regression, the factors associated with death in our study were age under five years, impaired consciousness upon admission, long consultation delay, prolonged administration of the first medication, and admissions occurring at night and on weekends. Gender was not statistically correlated with death. The long delay in drug administration observed in our study is related to the lack of social security coverage. Indeed, all medicines and other health prod-

ucts are the responsibility of the patient who must buy them himself. The recurrent shortage of products in the hospital pharmacy also contributes to this delay. The patient's companions are sometimes forced to use pharmacies outside the hospital. In the same direction, Boukaka kala *et al.* [9] in a study in the same hospital underlined the need for the implementation of a social cover because the low socio-economic level has a considerable impact on the delays in taking care of patients. However, in a study by Almossawi *et al.* [10] in the UK in 2021, gender was significantly associated with infant death. In Ethiopia, a logistic regression model developed by Tesema *et al.* [11] identified maternal age and male gender as risk factors for increased mortality. The differences in these risk factors stem from variations in methodology. Our model focused on unique factors related to the child, while aspects such as family history, socio-economic level, and inter-birth spacing were not considered. In Nepal in 2019 [12], infants with a birth interval of less than 24 months and those who were never breastfed had a higher mortality risk. The interval between birth (previous and next) and the child's birth size was significantly associated with infant mortality.

5. Conclusion

Pediatric mortality remains high in our practice context. Improvements require reducing consultation and care times, raising the socio-economic level and enhancing the technical capabilities of hospitals, but also through the establishment of a system of universal health insurance.

6. Limitations and Biases

This study has the same limitations as all retrospective studies. The difficulty was to have reliable data on files dating back 3 years. Newborns were not included because neonatology represents a separate service within the hospital, separate from pediatrics. The dead on arrival were excluded because of the absence of precise information on the circumstances of the so-called community or extra-hospital death. We could not exploit the socio-economic level of the parents and the nutritional status of the children because of the insufficiency of the related data in the files. The other limitation of this study is that most patients (50.18%) died before the 24th hour. This did not make it possible to obtain paraclinical analyzes that could corroborate a precise etiological diagnosis, especially since a third of them did not carry out any assessment before death, either for lack of financial constraints, or due to a lack of technical facilities.

Conflicts of Interest

The authors declare no conflict of interest, and the families of the children who died and were enrolled in this study did not receive any remuneration.

Authors' Contributions

The study was initiated by Dr. BINGUI Diogène, who wrote the research proto-

col, developed the survey sheet, and provided data collection training to the participating doctors. Dr. BINGUI Diogène also compiled the data, performed the analysis using EPI info, and wrote the article for submission.

As the head of the pediatrics department, Dr. GUEMBO, born PANDZOU Nelly, supervised and coordinated the data collection, analysis, and writing process. Dr. GUEMBO also provided the necessary literature for the discussion of the results.

Dr. MADZOU NGANIE Rolyne Vanissia supervised the data collection team, reviewed the survey forms, completed the Excel database, and provided the total number of hospitalized patients during the study period. Additionally, Dr. MADZOU NGANIE participated in data compilation and writing up the results.

Dr. BOMELEFA-BOMEL Verlem, Dr. DIATEWA Benoite, Dr. NKOUNKOU MILANDOU Kadidja Grâce, Dr. MOUENDENGUIA Jean Brice, Dr. LAMAH Luopou, Dr. NIANGUI-BAKALA Audrey, and Dr. BANGA Dorthéa collected the data and contributed to the production of the results.

Full Professor in pediatrics MABIALA BABELA Jean-Robert validated the manuscript before submission, assisted by Dr. BOUKAKA KALA Rel Gérald.

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