

# Factors Associated with Children's Death Due to Congenital Heart Disease in Two National Hospitals of Niamey

M'baye Salissou Seck M'baye<sup>1\*</sup>, Samaila Aboubacar<sup>2</sup>, Kamaye Moumouni<sup>2</sup>, Abdou Sidjo Hadjara<sup>2</sup>, Garba Moumouni<sup>2</sup>, Adehossi Irene<sup>2</sup>, Abdoul Djafar Mamoudou<sup>2</sup>, Tsague Kengni Hermann Nestor<sup>3</sup>, Amadou Douada<sup>4</sup>, Issoufou Alzouma<sup>5</sup>, Maliki Abdoulaye Moctar<sup>2</sup>, Mianroh Hybi Langtar<sup>6</sup>, Laouan Hamidou<sup>7</sup>, Ngo Yon Laurence Carole<sup>3</sup>, Guindo Aissata<sup>8</sup>, Ndofo Valerine<sup>9</sup>, Siddikatou Djibrilla<sup>10</sup>, Touré Ali<sup>2</sup>

<sup>1</sup>Faculty of Health Sciences, André Salifou University of Zinder, Zinder, Niger

<sup>2</sup>Faculty of Science of Health, Abdou Moumouni University, Niamey, Niger

<sup>3</sup>Faculty of Medicine and Science Pharmaceuticals, University of Douala, Douala, Cameroon

<sup>4</sup>General Reference Hospital in Niamey, Niamey, Niger

<sup>5</sup>Pedagogical and Research Unit, Mohamed V University, Rabat, Morocco

<sup>6</sup>Faculty of Health Sciences, Adam Barka University of Abeche, Abeche, Chad

<sup>7</sup>Faculty of Health Sciences, Dan Dicko Dankoulodo University of Maradi, Maradi, Niger

<sup>8</sup>Point G Hospital Center, Bamako, Mali

<sup>9</sup>Faculty of Medicine and Biomedical Sciences of Yaoundé 1, Yaoundé, Cameroon

<sup>10</sup>Faculty of Health Sciences, University of Buea, Buea, Cameroon

Email: \*Cecksalibaye@yahoo.com

**How to cite this paper:** M'baye, M.S.S., Aboubacar, S., Moumouni, K., Hadjara, A.S., Moumouni, G., Irene, A., Mamoudou, A.D., Nestor, T.K.H., Douada, A., Alzouma, I., Moctar, M.A., Langtar, M.H., Hamidou, L., Carole, N.L., Aissata, G., Valerine, N., Djibrilla, S. and Ali, T. (2024) Factors Associated with Children's Death Due to Congenital Heart Disease in Two National Hospitals of Niamey. *International Journal of Clinical Medicine*, 15, 502-511.

<https://doi.org/10.4236/ijcm.2024.1511033>

**Received:** August 22, 2024

**Accepted:** November 24, 2024

**Published:** November 27, 2024

## Abstract

**Introduction:** Congenital heart disease is a major cause of children's death. In Niger, despite the frequency of these pathologies, very few studies have been carried out on associated mortality in a paediatric environment. The objective of this work was to look for the risk factors of children with congenital heart disease's death in Niamey. **Patients and Method:** It is about a cross-sectional study for descriptive and analytical purposes in children aged from 0 to 15 years. Carriers of congenital heart disease followed from January 2016 to July 2021 in two national hospitals in Niamey. The variable depends and the main ante was the occurrence of deaths (yes or no). The explanatory variables were related to the characteristics of the patients, the type of heart disease and management among others. Chi's tests<sup>2</sup> Pearson's or Fischer's exact test were used ( $P < 0.05$ ). **Results:** During the period of the research, 514 cases of congenital heart disease were studied, including 132 deaths (25.68%). The average age of patients was 14.64 months [10 days - 15 years]. The sex ratio was 1.08. The most common reason for consultation was respiratory distress that was found

Copyright © 2024 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



in 74.90% of patients. Interventricular communication (IVC) and interatrial communication (CIA) were the most found type of heart disease with 36.53% and 20.44% of cases respectively. Only 9.54% of patients ( $n = 48$ ) had received surgical management. The risk factors associated with mortality were pulmonary arterial hypertension (54.17%), pulmonary disease (44.55%) and the presence of anemia (63.16%) [OR > 1;  $p < 0.05$ ]. **Conclusion:** Congenital heart diseases remain an important cause of death among children in Niger. The pulmonary arterial hypertension and the associated comorbidities such as broncho-pulmonary diseases were the main associated factors. In the meantime, an optimal technical management of these factors will help to reduce this mortality.

## Keywords

Congenital Heart Disease, Associated Factors to Lethality, Niger

## 1. Introduction

Congenital heart disease (CC) is malformations of the heart and/or large vessels occurring during intrauterine life. They are responsible for 3% of infant deaths worldwide and 46% of deaths by malformation and thus constitute a major cause of death in childhood among full-term new-borns [1]. In developed countries, the overall mortality rate from critical congenital heart disease varies from 15% to 25% and varies according to the type of cardiac malformation and the time of diagnosis [2]. The children heart diseases determine in Africa is the major public health that is difficult to manage, due to the density of the population young, the low socio-economic level and the lack of adapted technical platforms [3]. In Niger, despite the frequency of these pathologies, very few studies have been conducted specifically in a paediatric environment and no study has been carried out on the lethality of the CC. That is why we choose to examine the issue to contribute to the reduction of these risk factors for death of children.

## 2. Patients and Methods

### 2.1. Type and Period of Study

It was a transversal study for descriptive and analytical purposes in children aged from 0 to 15 years with Congenital cardio pathologies followed from January 2016 to July 2021 in two national hospitals in Niamey.

### 2.2. Study Population

The study concerned children aged 0 to 15 years with confirmed congenital heart disease by cardiac ultrasound and hospitalized or followed on an outpatient basis in Paediatrics Ward of the National Hospital of Niamey (HNN) and the National Hospital Amirou Boubacar Diallo (HNABD).

### **2.3. Inclusion Criteria**

All children whose medical record was exploitable with the presence of cardiac Doppler ultrasound results were included.

### **2.4. Non-Inclusion Criteria**

Children whose records were incomplete were not considered in the study.

### **2.5. Study Material**

We had carried out a comprehensive sampling of all patients with congenital heart disease diagnosed during the study period and meeting the inclusion criteria.

### **2.6. The Variables Used**

The data Socio-demographic, personal history and family, clinical parameters and paraclinical, etiological and therapeutic data as well as associated comorbidities.

### **2.7. Data Collection and Analysis**

The data were collected on a survey sheet collecting based on the variables to be studied. The records as well as the strains of death reports of the various paediatric services were used. The entries were made using Word and Excel 2013 software. The data analysis was carried out using the Epi-Info7.2.5.0 software. The results were expressed in frequency with regard to socio-demographic data. The explanatory variables were related to the characteristics of the patients, the type of heart disease and management among others. Chi's tests<sup>2</sup> Pearson's or Fischer's exact test were used ( $P \leq 0.05$ ).

### **2.8. Ethical Considerations**

The study obtained the authorization of the Faculty of Health Sciences (FSS) of Abdou Moumouni University in Niamey by issuing a research authorization and the agreement of the two hospitals' administration. Anonymity and medical secrecy were respected. The consent of the parents was a prerequisite for the inclusion of patients in the study.

## **3. Results**

### **3.1. Socio-Demographic Data**

The male sex accounted for 52% (N = 267) patients with a sex ratio of 1.08. Sixty-one decimal forty percent (N = 367) of our patients were less than 12 months old with an average age of 14.64 months and extremes ranging from 0.33 months to 180 months. Ninety-three comma ninety-two percent (N = 483) of our patients were infants with an average age of 5.56 months and extremes ranging from 0.10 months to 84 Month. 514 cases of congenital heart disease were recorded, among which we recorded 132 deaths, a case fatality rate of 25.68%. The patients lived in Urban environment in 70.98% (N = 365). Mothers of patients aged between 20

and 29 were the most represented with 43.58% (N = 224). The average age of mothers was 30.17 years  $\pm$  7.34 with extremes ranging from 17 to 50 years. The socio-economic level of the patients' parents was average in 65.53% of Case. Patients lived in urban areas in 70.98 %. Inbreeding between parents was found in 44% (n = 226) of cases.

### 3.2. Clinical Data

#### 3.2.1. Reasons for Consultation/Hospitalization

The most frequent reason for consultation/hospitalization was distress breathing with 74.9% of cases (385) (Table 1).

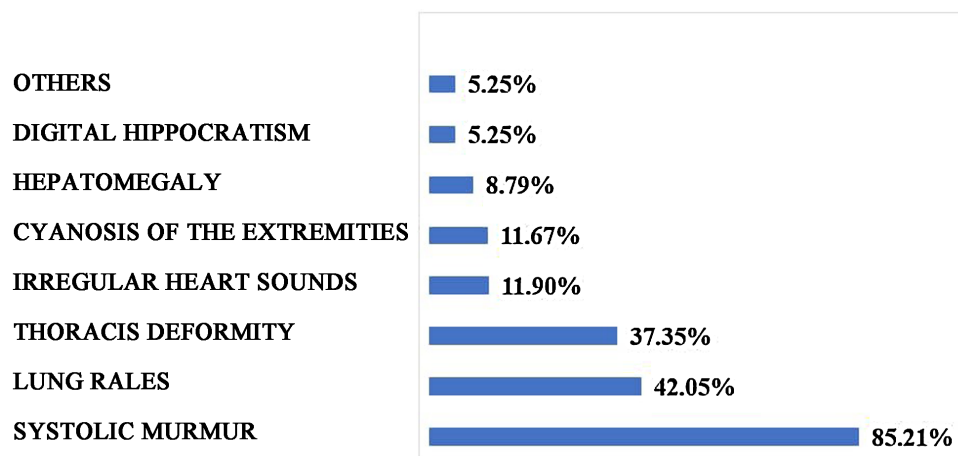
**Table 1.** Distribution of patients according to the reasons for consultation/hospitalization.

Reasons for consultation/Hospitalization	Frequency	Percentage
Respiratory distress	385	74.90
Fever	160	31.13
Cough	92	17.90
DAS	50	9.73
Cyanosis	34	6.61
Oedema	15	2.92
Other	74	14.40

SAR = severe acute deshydration.

#### 3.2.2. Main Signs at the Physical Examination

The main signs were systolic murmurs and pulmonary rales with 85.21% and 42.05% respectively (Figure 1).



**Figure 1.** Distribution of patients according to signs on physical examination.

### 3.3. Echocardiographic Data

The CIV was the most found congenital heart disease in 36.53% (N = 183) of cases

(Table 2).

**Table 2.** Overall distribution of congenital heart disease.

Cc	Frequency	Percentage
IVC	183	36.53
IAC	102	20.44
Tetralogy of de Fallot	102	20.48
AVC	82	16.53
PDA	46	9.33
POF	30	6.01
PHA Primitive	18	3.63
CC. Complex	16	3.42
PS	16	3.23
TLV	15	3.03
Coarctation of the aorta	4	0.81
Ebstein's disease	4	0.80
CAT	3	0.60
Synd Laubry Pezzi	3	0.60
Dextrocardia	2	0.40
OSPA	2	0.40
SV	2	0.40
TA	1	0,20
Mitral atresia	1	0.20
FT	1	0.20
PAIS	1	0.20
Aortic Bicuspidy	1	0.20

CIV = inter-ventricular communication, CIA = interatrial communication, AVC = atrio-ventricular communication, PDA = Persistence of the ductus arteriosus, POF = permeable oval foramen, PAH = pulmonary arterial hypertension, Cc = congenital heart disease, PS = Pulmonary stenosis, TLV = transposition of large vessels, CAT = common arterial trunk, APSO = open septum pulmonary atresia, SV = Single Ventricle, T A = tricuspid atresia, FT = Fallot trilogy, APSI = pulmonary atresia with intact septum.

### 3.4. Lethality Rate of Congenital Heart Disease

514 cases of congenital heart disease were recorded, among which we recorded 132 deaths, a case fatality rate of 25.68%.

### 3.5. Comorbidities

Pulmonary disease was the most found comorbidity in 44.55% of cases followed

by acute malnutrition about 34.82% and malaria in 13.81% (**Table 3**).

**Table 3.** Distribution of patients according to the associated comorbidities.

Comorbidity	Frequency	Percentage
Bronchopneumopathy	229	44.55
Severe acute malnutrition	179	34.82
Malaria	71	13.81
Trisomy 21	67	13,04
Severe anemia	21	4.09
Polycythemia	12	2.33
Sickly cell	7	1.36
Septicemia	6	1.17

### 3.6. Distribution According to the Operative Indication, Surgical Treatment and Place of the Surgical PEC

Heart disease had an indication of surgery in 73.76%. Nine decimal fifty-four percent (9.54%) of patients had benefited from surgical management. Fifty percent (50%) of patients were operated on in France.

### 3.7. Factors Associated with Death

Bronchopulopneumopathy is a factor associated with the death of statistically significantly ( $P = 0.001$ ). Mortality was more observed in the case of PAH with a statistically significant association ( $P = 0.001$ ). The lack of follow-up of patients is a statistically significant factor of association of death ( $P = 0.001$ ). Deaths from heart disease were more observed in children with anemia with a statistically significant link ( $P = 0.002$ ). The operative indication would be a risk factor associated with statistically significant death ( $P = 0.001$ ) (**Table 4**).

**Table 4.** Association between death and comorbidities, surgical indication and lack of follow-up.

Variables	Death		P value
	Yes	No	
<b>Bronchopneumopathies</b>			
Yes	96 (74.42%)	110 (36.07%)	0.001
No	33 (25.58%)	195 (63.93%)	
Total	129 (100%)	305 (100%)	
<b>Pulmonary arterial hypertension</b>			
Yes	26 (54.17%)	22 (45.83%)	0.001
No	90 (25.21%)	267 (74.79%)	
Total	116 (100%)	289 (100)	

**Continued****Lack of follow-up**

Yes	42(37.50%)	70(62.50%)	0.001
No	67(62.62%)	40(37.38%)	
Total	109(49.77%)	110(50.23%)	

**Anaemia**

Yes	72 (63.16%)	182 (77.78%)	0.002
No	42(36.84%)	52 (22.22%)	
Total	114 (100%)	234 (100%)	

**Surgical indication**

Yes	113 (86.26%)	244 (69.12%)	0.001
No	18 (13.74%)	109 (30.88%)	
Total	131 (100%)	353 (100%)	

**4. Discussion****Socio-Demographic Characteristics**

Patient characteristics: The male sex accounted for 52% (n = 267) of patients with a sex ratio of 1.08 slightly in favor of boys. This joins the results of Tougouma *et al.*, Kinda *et al.* [3] [4] who noted a slight preponderance of the male sex with a sex ratio of 1.1 respectively 1.4.

The average age of these children was 14.64 months with extremes ranging from 0.33 months to 180 months. Patients who were less than 12 months old were the most represented with 71.40%, Kinda *et al.* [4] in Ouagadougou had reported almost the same results: the age extremes were identical but on the other hand, the average age was lower than that of our study which is 5 months with extremes 01 day to 15 years and the most representative age group is 0 to 30 months. This high rate case of congenital heart disease in the age group of less than 12 months in our study could be explained by the fact that some congenital heart diseases such as IVD, ACI and PCA representing 66.33% (n = 341) of congenital heart disease had a spontaneous evolution towards closure but also congenital heart diseases of late discovery are most often benign and compatible with an almost normal life. Early diagnosis is one of the factors widely studied affects the results of congenital heart disease, and many studies have shown that early diagnosis was associated with good results [2] [5] [6].

Clinically, the most found reason for hospitalization was respiratory distress in 74.90% (n = 385) of cases. The most represented functional sign was dyspnea in 71.01% (n = 365). The most represented physical sign was heart murmur in 85.21% (438). Our results are close to those of Kinda *et al.* [4] and Diby *et al.* [7], who found dyspnea in 75% and 84.9% respectively. Our result is superior to that of Banou N *et al.* [8], which had recovered 58% of the cases of breath. Breath is an

almost constant sign in congenital heart disease in children [7].

From echocardiographic exploration, IVD was the most found congenital heart disease corresponding to 36.53% (n = 183) of cases. Our result is consistent with the many African studies conducted by Diby *et al.* [7] and Kandem F *et al.* [1] which found 31% and 31.1% respectively. However, our result was lower than that of Boussalah *et al.* [9] which had found 49.71%. On the other hand, Kinda *et al.* [4] had reported a lower frequency than ours which was 23.1%. This is related to the absence of cardiac surgery in our context.

Prognostically, 514 children were diagnosed with congenital heart disease in which 132 deaths were recorded, *i.e.* a case fatality rate of 25.68% (n = 132). This result is close to that of Ngouala *et al.* [10] which found a mortality rate of 24.4%. On the other hand, authors like Boussalah *et al.* [9], Lopez *et al.* [11], Diby *et al.* [7] and Knowles RL *et al.* [12] had found a mortality rate of 7.05%, 12%, 20.4% and 20% respectively. On the other hand, Rocha LA *et al.* [13] in Brazil and Mat Bah MN *et al.* [2] found a higher mortality rate than ours of the order of 42% and 34.8% respectively. This could be explained by the fact that in Rocha's study, there is a high rate of prenatal diagnosis of congenital heart disease and complex heart disease, which were 84.8% and 60.5% respectively. Despite the progress and major steps in the diagnosis and management of congenital heart disease, these conditions are still responsible for high mortality.

Pulmonary disease (74.42%) was the comorbidity most associated with congenital heart disease at the time of death. This would promote death by heart disease with a statically significant link with P value  $\leq 0.05$ . Rakotondrajaona O *et al.* [14] and Agus C *et al.* [15] had also reported that this comorbidity was the most common during congenital heart disease but with a lower frequency of 42%. The mortality was also more observed in the case of PAH which was present in 54.17% of the deceased children. PAH is a significant contributing factor of death from heart disease with  $P \leq 0.05$ . Prevention of PAH consists of performing surgery extremely early in life before the development of irreversible pulmonary vascular lesions. In addition, the lack of patient follow-up is a statistically significant factor in the association of death ( $P = 0.001$ ). This lack of follow-up will lead to not only the non-screening of possible complications and adapted care but also it will reduce the chance for these children to benefit from curative surgical treatment, hence the risk of death. Congenital heart diseases evolve more often towards the picture of global heart failure in the absence of early and appropriate treatment. Anemia is one of the most frequently associated comorbidities with this heart failure. It induces an increase in mortality course of the evolution of heart failure [16]. Our work reinforces this observation in the literature by showing an increase in death in children with congenital heart disease in case of anemia. The indication surgical is placed to avoid complications, some of which are fatal, that occurs during the evolution of congenital heart disease. In the absence of a surgical cure, this can logically increase the lethality of congenital heart disease. This corroborates the result of our series.

Limitations of the study. As in any retrospective study, the difficulties encountered were related to the exploitation of children's records that were incomplete and patient data insufficient (in both hospitals).

## 5. Conclusion

Congenital heart disease remains an important cause of death among children in Niger. The pulmonary arterial hypertension and the associated comorbidities such as bronchopulmonary diseases were the main associated factors. The study suggests that an optimal technical platform for the management of these factors will help reduce this mortality.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- [1] Kamdem, F., Noukeu, D., Jingi, A.M., Elono, E.A., *et al.* (2020) Echocardiographic Profile of Congenital Heart Diseases in Newborns and Infants at Douala. *Health & Medicine News*, **21**, 33-38.
- [2] Mat Bah, M.N., Sopian, M.H., Jamil, M.T., Alias, A. and Zahari, N. (2018) Survival and Associated Risk Factors for Mortality among Infants with Critical Congenital Heart Disease in a Developing Country. *Pediatric Cardiology*, **39**, 1389-1396. <https://doi.org/10.1007/s00246-018-1908-6>
- [3] Tougouma, S.J., Kissou, A., Yaméogo, A.A., Yaméogo, N.V., Bama, A., Barro, M., *et al.* (2016) Les cardiopathies de l'enfant au CHU Sourou Sanou de Bobo-Dioulasso: aspects échocardiographies et thérapeutiques. *Pan African Medical Journal*, **25**, Article 62. <https://doi.org/10.11604/pamj.2016.25.62.9508>
- [4] Kinda, G., Millogo, G.R.C., Koueta, F., Dao, L., *et al.* (2015) Congenital Heart Diseases: Epidemiological Aspects and Echocardiography's about 109 Cases at the Charles de Gaulle Pediatric University Hospital (CHUP-CDG) in Ouagadougou, Burkina Faso. *Pan African Medical Journal*, **20**, 20.
- [5] Holland, B.J., Myers, J.A. and Woods, C.R. (2015) Prenatal Diagnosis of Critical Congenital Heart Disease Reduces Risk of Death from Cardiovascular Compromise Prior to Planned Neonatal Cardiac Surgery: A Meta-Analysis. *Ultrasound in Obstetrics & Gynecology*, **45**, 631-638. <https://doi.org/10.1002/uog.14882>
- [6] Eckersley, L., Sadler, L., Parry, E., Finucane, K. and Gentles, T.L. (2015) Timing of Diagnosis Affects Mortality in Critical Congenital Heart Disease. *Archives of Disease in Childhood*, **101**, 516-520. <https://doi.org/10.1136/archdischild-2014-307691>
- [7] Diby, K.F., Azagoh, K.R., Yao, K.C., Yeboua, K., *et al.* (2019) Epidemiological, Clinical and Evolutionary Profile of Congenital Heart Disease in Côte d'Ivoire. EDUCI 2019. *Revue Internationale des Sciences Médicales*, **21**, 293-300.
- [8] Banou, N. (2020) Epided Profile Myological, Clinical and Evolutionary of Congenital Heart Disease at the Neonatology Department of the CHU Gabriel Touré-Bamako. Dissertation, University of Science of Technical and Technology de Bamako.
- [9] Boussalah, M., Ahmed Aouled, A., Salimi, S. and Dehbi, F. (2010) P400-Épidémiologie et pronostic des cardiopathies congénitales en pédiatrie. *Archives de Pédiatrie*, **17**, Article 150. [https://doi.org/10.1016/s0929-693x\(10\)70794-6](https://doi.org/10.1016/s0929-693x(10)70794-6)

- [10] Ba Ngouala, G., Affangla, D., Leye, M. and Kane, A. (2015) The Prevalence of Symptomatic Infantile Heart Disease at Louga Regional Hospital, Senegal. *Cardiovascular Journal of Africa*, **26**, e1-e5. <https://doi.org/10.5830/cvja-2015-031>
- [11] Lopes, S.A.V.D.A., Guimarães, I.C.B., Costa, S.F.D.O., Acosta, A.X., Sandes, K.A. and Mendes, C.M.C. (2018) Mortality for Critical Congenital Heart Diseases and Associated Risk Factors in Newborns. a Cohort Study. *Arquivos Brasileiros de Cardiologia*, **111**, 666-673. <https://doi.org/10.5935/abc.20180175>
- [12] Knowles, R.L., Bull, C., Wren, C., Wade, A., Goldstein, H. and Dezateux, C. (2014) Modelling Survival and Mortality Risk to 15 Years of Age for a National Cohort of Children with Serious Congenital Heart Defects Diagnosed in Infancy. *PLOS ONE*, **9**, e106806. <https://doi.org/10.1371/journal.pone.0106806>
- [13] Rocha, L.A., Froio, S.C., Silva, C.C., Figueira, S.D.A.N., Guilhen, J.C.S., Guinsburg, R., *et al.* (2018) Risk Factors for Mortality in Children with Congenital Heart Disease Delivered at a Brazilian Tertiary Center. *Brazilian Journal of Cardiovascular Surgery*, **33**, 603-607. <https://doi.org/10.21470/1678-9741-2018-0174>
- [14] Narindra Rakotondrajaona, O. (2014) Congenital Heart Disease at the Mother-Child Hospital Center Tsaralalana: Aspects Epidemioclinics. Medical Thesis, University of antananarivo Madagascar.
- [15] Cahyono, A. and Rachman, M.A. (2007) The Cause of Mortality among Congenital Heart Disease Patients in Pediatric Ward, Soetomo General Hospital (2004-2006). *Jurnal Kardiologi Indonesia*, **28**, Article No. 4.
- [16] Groenveld, H.F., Januzzi, J.L., Damman, K., van Wijngaarden, J., Hillege, H.L., van Veldhuisen, D.J., *et al.* (2008) Anemia and Mortality in Heart Failure Patients. *Journal of the American College of Cardiology*, **52**, 818-827. <https://doi.org/10.1016/j.jacc.2008.04.061>