JIMMA UNIVERSITY INSTITUTE OF HEALTH SCIENCE SCHOOL OF MEDICINE DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Prevalence and severity of anemia among children with Cardiac disease admitted to pediatrics ward, Jimma University Medical Center, Ethiopia --An institutional-based longitudinal study.

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A Research thesis submitted to the Department of Pediatrics and Child Health, Jimma University Medical Center as partial fulfillment for specialty certificate in Pediatrics and Child Health.

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Declaration

Assurance of principal investigator

I agree to accept responsibility for the scientific, ethical, and technical Conduct of the research project & for the provision of the required progress report as per terms and conditions of the college of health sciences in effect at the time of grant is forwarded as the result of this application.

Name of principal investigator	**Date**	**Signature**
Dr. Sabona Lemessa (MD)	_____	_____

Approval of the advisor

This thesis has been submitted with approval by the university advisor

Name of the advisor	Date	Signature
Dr. Diriba Fufa (MD)	_____	_____

Abstract

Background*: Anemia is prevalent in adult heart failure patients and appears to be an independent risk factor for morbidity and mortality but data are lacking in children with heart failure. The purpose of this study is to determine the prevalence and severity of anemia among children hospitalized with cardiac disease to pediatric ward JUMC.*

Objective: - *To assess prevalence and severity of anemia among children with cardiac disease admitted to pediatrics ward Jimma University medical center*

Methods: *- Institution-based longitudinal study design was conducted in different wards, Department of Pediatrics, Jimma University Medical Center during the study period. Data was entered into Epi-data version 3.1 and exported to SPSS version 20 for analysis. Descriptive analysis was used to identify the prevalence and severity of anemia among children with Cardiac disease at Jimma University Medical Center. Binary logistic regression was used to identify predictor variables; bivariate logistic regression was used to select the candidate variables at p-value ≤ 0.25, finally multivariate logistic regression was conducted to declare statistically significant variables with anemia at p-value < 0.05 with 95% CI of AOR.*

Results: *Children aged below 15 years were enrolled based on inclusion criteria. Etiologies of heart failure included were Rheumatic heart diseases (n=35), acyanotic CHD (n=50), and Cardiomyopathy (n=3). Acute heart failure at admission (n=67) and not in acute heart failure (n=21). Mean Hemoglobin at admission was* ***10.9 ± 3.021 g/dl.*** *The prevalence of anemia among children with cardiac diseases was* ***55.68 % (95% CI 46.6 to 64.8%)*** *at admission. Severe anemia occurs in 7/42(16.7%), moderate anemia 26/42(61.9 %), and mild anemia 9/42(21.4 %). Anemia among children with cardiac diseases had an association with severe wasting with* ***95 % CI, AOR 3.83(1.02, 14.41) and p-value <0.05,*** *acute heart failure with* ***95 % CI, AOR 4.96(1.35, 18.15)*, p-value <0.05, and*** *rheumatic heart diseases with* ***95 %, AOR 10.78(2.98, 38.98)*, p-value <0.05.***

Conclusion: *This study shows there was high prevalence of anemia among children admitted with cardiac diseases and also preventable precipitating factor for acute heart failure.*

Recommendation: *In this study, the high prevalence of anemia among children with cardiac diseases and precipitating factor for CHF. We recommend screening and treating anemia in children with cardiac diseases as a routine care for these populations to avert the preventable precipitator of acute heart failure.*

Keywords: *- Cardiac disease, Anemia, prevalence, severity, Acute heart failure, children*

Acknowledgment

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ABBREVIATION AND ACRONYMS

JUMC - Jimma University Medical Center

RBC - Red Blood Cell

MVC - Mean corpuscular volume

CHF - Congestive Heart Failure

RHD - Rheumatic Heart Disease

CHD - Congenital Heart Diseases

IDA - Iron deficiency anemia

HGB - Hemoglobin

ACEI - Angiotensin-converting enzyme inhibitor

DCM - Dilated cardiomyopathy

WHO- World Health Organization

HTN- Hypertension

LAMA- Leave against medical advice

MUAC- Mid upper arm circumference

NRU- Nutritional rehabilitation unit

CHAPTER ONE - Introduction

Anemia is defined as a reduction of the hemoglobin concentration of red blood cell (RBC) volume below the range of values occurring in healthy persons. Anemia is defined by hemoglobin levels according to age and gender. The risk factors for anemia are multifaceted including malaria, renal disease, and the nutritional deficiency(1,2). Studies also showed that schistosomiasis infection, hookworm infection, inherited disorders, diarrhea, and fever in 6–59-month children(3,4) are associated with the risk of developing anemia. Socio-economic factors like poverty, poor sanitation, low income, monotonous diet, parents' level of education, and community factors are also related to the prevalence of anemia(2,3).

Pediatric Heart failure is a clinical entity where the heart does not function to its level best as it does in its healthy state(5). It can result from cardiac and non-cardiac causes. Cardiac causes include those associated with congenital structural malformations and those involving no structural anomalies(5). Childhood cardiovascular disorders including HF are associated with high morbidity and mortality especially in sub-Saharan Africa where palliative and definitive treatments seem far from reach(6,7). Pediatric cardiac disease is the most common reason that infants and children who have heart disease receive medical therapy and accounts for at least 50% of referrals for pediatric heart transplantation(5).

Cardiac disease in children in developed communities is often due to cardiomyopathy causes or palliated congenital heart disease as opposed to developing countries where un-operated congenital heart disease and acquired heart disease are more prevalent(5). A study done by a Hospital-based retrospective review on admitted patients from February 2012 to October 2015 at Tikur Anbesa Specialized Hospital (TASH), a tertiary referral center of Ethiopia shows, out of **3672** pediatric admissions, the prevalence of Acute heart failure shows **106 (2.9%)(8)**. From this, Rheumatic heart disease covers **53.7%(8)**.

There is increasing recognition of the high prevalence and importance of comorbidity in congestive heart failure(9). Anemia plays a unique role, considering the similarities in symptoms and the importance of oxygen-carrying capacity in the manifestation of heart failure(9). In adult patients with heart failure, anemia is prevalent and appears to be an independent risk factor for higher mortality associated with CHF(9).

Although the mechanisms involved in the development of anemia in patients with heart failure are unclear, data suggest that renal dysfunction, neurohormonal and proinflammatory cytokine activation in heart failure lead to anemia of chronic disease with defective iron utilization, inappropriate erythropoietin responsiveness, and depressed bone marrow function(10). Likewise, the mechanisms by which anemia worsens heart failure outcomes are also uncertain and may be related to the increased myocardial workload to compensate for reduced tissue oxygen delivery leading to unfavorable cardiac remodeling, to the effects of factors that cause anemia in patients with heart failure or because of aggravation of other comorbidities seen in these patients(11,12).

The etiology of anemia in HF is likely multi-factorial including iron deficiency, renal dysfunction, anemia of chronic disease, and hemodilution. In advanced HF, it is believed to be due in part to renal dysfunction and a resultant decrease in erythropoietin production. Recent adult studies suggest that treating anemia with intravenous iron supplementation and erythropoietin stimulating agents may cause improvement in HF symptoms and functional capacity and may decrease the number of hospitalizations(11,12).

Tumor necrosis factor-alpha is elevated in HF and may contribute to anemia through bone marrow depression(12,13). The use of ACE inhibitors may reduce Hgb by inhibiting erythropoietin synthesis(12,13). Iron deficiency resulting from malabsorption, nutritional deficiencies, impaired metabolism(11,12,14), and aspirin-induced gastrointestinal bleeding may contribute. Renal impairment is encountered in about 66% of heart failure patients, which may partly contribute to the lower than expected increase of erythropoietin in response to hypoxemia and decreased perfusion(14,15). ACE inhibitors are also routinely used in the treatment of congestive heart failure in pediatric DCM patients. Hemodilution is common in congestive heart failure and is found with an incidence of 46% in anemic CHF patients(14).

Anemia is associated with an increased risk of mortality in both systolic and diastolic CHF(16). Estimates of the prevalence of anemia in HF vary considerably, depending on the definition of anemia used and the severity of HF, ranging from 4 to 79%(16). In a meta-analysis of over 150,000 adult patients with HF, anemia was identified in 37% and associated with an increased risk of mortality(16).

Despite this attention given to anemia in the adult HF literature in the last decade, very little is known about anemia in children with HF. In a retrospective study of anemia in pediatric patients with newly diagnosed dilated cardiomyopathy (DCM), one in four children with a Hgb concentration less than 10 g/dL, and a lower Hgb associated with an increased risk of death or transplant(17). The prevalence of clinically significant HF was not reported in a cohort, but 20% of patients had low cardiac output at the time of diagnosis(17,18). In another smaller study of children with mostly chronic HF, 64% of patients were anemic at enrollment, and a low Hgb concentration was associated with hospitalization but not with mortality(18).

Several studies in adults have demonstrated an association between anemia and mortality(19). Even a mildly decreased hemoglobin (Hgb) concentration (less than 13 g/dL) is associated with worsening symptoms and decreased functional capacity in adults with advanced HF(20). Among patients hospitalized with HF, anemia is associated with a longer length of stay and increased rates of readmission(20,21).

The etiology, prevalence, and severity of anemia have not been reported in children hospitalized with advanced HF. The influence of anemia on clinical outcomes in hospitalized pediatric HF patients remains poorly understood. Understanding the role of anemia among other risk factors in pediatric HF is vital since approximately 11,000–14,000 children are hospitalized for HF each year, with an inpatient mortality rate of 7%(22). In the study of children with acute heart failure aged from 4 months to 23 years, with a median of 7.5 years, the Mean hemoglobin concentration at admission was 11.8 g/dL(23). Mean the lowest hemoglobin before outcome 10.8 g/dl(23). Anemia (hemoglobin <10 g/dL) present in 18% of hospitalizations at admission and in 38% before outcome(23).

In the retrospective cross sectional study of Children with CHD 80 patients in Ghana, Tetralogy of Fallot (48.8%) is most common, followed by persistent truncus arteriosus (10%), transposition of great arteries (8.8%), and complete channel defect(7.5%)(24). 80 of patients, 48 (72.7%) have signs of relative iron deficiency(24). Thirty children have Hb levels above the maximum considered normal (14.0 g/dL) and 11 had Hb values below the lower limit of 11.0 g/dL. There is a wide inter-patient variability with hemoglobin content of RBCs ranging from a minimum of 8.0 to a maximum of 24.3 g/dL(24).

1.2 Statement of the problem

Anemia is common among adults with heart failure (HF) and is associated with poor outcomes. Several studies in adults have demonstrated an association between anemia and mortality. Even a mildly decreased hemoglobin(Hgb) concentration (less than 13 g/dL) is associated with worsening symptoms and decreased functional capacity in adults with advanced HF(20).

From a retrospective chart review for patients hospitalized at Texas Children's Hospital with acute decompensated HF from 2007-2012, out of 172 hospitalizations 66(38%) of patients were anemic but 106 of them were not anemic(23). The mean length to the outcome was 36.3 days for the anemic patients and 16.9 days for the non-anemic patients (23). Among the sample of 172 hospitalizations, 67 of the 30 (47%) for anemia and 35 (36%) nonanemic patients met the outcome of death, MCS deployment, and transplant(23).

The influence of anemia on clinical outcomes in hospitalized pediatric HF patients remains poorly understood. Understanding the role of anemia among other risk factors in pediatric HF is vital since approximately 11,000–14,000 children are hospitalized for HF each year, with an inpatient mortality rate of 7%(25). In Ethiopia, there is no data on the prevalence, severity, and influence on morbidity and mortality of anemia among pediatric patients with Cardiac disease, and there also is a lack of data as a whole. The purpose of this study is to determine the prevalence, severity, and impact of patient outcomes among children hospitalized with Cardiac disease to Jimma University Medical center pediatric department.

1.3 Significance of the study

There is a paucity of data on the prevalence and severity of anemia among children with cardiac disease in Ethiopia in general and Jimma University Medical Center in particular and this study may be a baseline for further research on etiologies of anemia among children with cardiac diseases.

Chapter Two: Literature Review

Globally, around 1.62 billion people are affected by anemia that accounts for more than 24.8% of the world population, and from 30 to 50% of anemia was caused due to iron deficiency(26,27). Iron-deficiency anemia (IDA) resulted in 273,000 deaths in the world, and 97% of deaths were occurred in developing countries(26). Anemia or low hemoglobin concentration is known to negatively affect cognitive and motor function, increase the risk of maternal and child death and cause fatigue and low work productivity(26,27).

Anemia among children is a public health problem globally(23,28). An estimated 273.2 million children aged 6–59 months suffer from anemia globally, Sub-Saharan Africa was the most affected, with a prevalence of 62.3%(28,29). World Health Organization (WHO) reflects if anemia prevalence is over 40% in the community, considering it as a major public health problem(29,30).

In 2016, Ethiopian Demography and Health Survey (EDHS) a community-based, cross-sectional study conducted from January 18, 2016, to June 27, 2016, with clinical and laboratory assessment on children age group 6-59 months, the prevalence of anemia suggests 57.6% and of those 25.1%, 29.4%, 3.1% of them have mild, moderate, and severe anemia respectively(31). Malnourished children (stunting and underweight), children with fever, children from anemic, uneducated, and young mothers, and children from large and poor families are at higher odds to develop anemia(31).

Heart failure (HF) in pediatric populations is a major public health concern. It is associated with high rates of hospital admissions, disability, and mortality in high-income countries (HIC)(32). In systematic Literature Review on the Incidence and Prevalence of Heart Failure in Children and Adolescents (December 2017), shows the prevalence of 83.3/100,000 in one large population-based study from Spain, HF associated with cardiomyopathies ranging from 36.1% (Japan) to 79% (US); associated with congenital heart disease from 8% (Norway) to 82.2% (Nigeria); associated with rheumatic heart diseases from 1.5% (Turkey) to 74% (Zimbabwe); associated with renal disorders from 3.8% (India) to 24.1% (Nigeria), and associated with HIV from 1% (US) to 29.3% (Brazil)(33). HF etiology varied across regions with lower respiratory tract infections and severe anemia predominating in lower-income countries and cardiomyopathies and congenital heart disease major causes in higher-income countries(32,33).

In Ethiopia, a retrospective study conducted in Tikur Anbessa Specialized Hospital (TASH), from 3672 admitted children age range 2 months up to 14 years, the prevalence of Acute heart failure were 106(**2.9%)**(8). Anemia is one of the Predictors of mortality based on laboratory results and outcomes (8). A study conducted in Hawassa university medical center of Ethiopia with a retrospective review of 2000 children suggests the prevalence of HF was 216 (10.8%)(34). Cough, feeding interruption, body swelling, and fast breathing in 60(27.8%), 55(25.5%), 34(15.7%), and 29(13.4%) are the most common presenting symptoms respectively(34). The majority of the patients had moderate to severe symptoms with NYHA/Ross class III and IV comprising 65(30.1%) and 139(64.4%) of HF cases(34). Case fatality rate shows 13.9% with possible comorbidities of malnutrition(34).

Anemia is common among adults with heart failure (HF) and is associated with poor outcomes. The prevalence of anemia in heart failure by 37.2%(16) in a recent meta-analysis of a total of 153,180 patients with heart failure across 34 published studies over seven years (2001–2007)(16). After a minimal follow-up of 6 months, 46.8% of anemic patients died compared with 29.5% of no anemic patients(16). A cross-sectional and prospective observational study done at Muhimbili National Hospital in Tanzania (**2017**), on age >18 yrs, the prevalence of anemia 57%(35), mild in 45%, moderate in 10%, and severe in 2% which shows anemia independently associated with the risk for hospitalization or death(35).

In a cross-sectional study with prospective collection of data, carried out from 1 January to 31 December 2010 in the Department of Cardiology at Brazzaville University Hospital, Congo, on a total of 272 patients with an age range of (range: 18–97years suggest anemia present in 42%, with an average hemoglobin level of 11.9 ± 4.4 g/dl (range: 4.7–15.2)(36). The total mortality rate was 17%, with a significant difference between the A and NA patients (26 vs 10%; p = 0.001)(36) and the average duration of hospital stay 19.1 ± 16.7 days.

In Ethiopia, a retrospective cohort study was done on the prevalence, clinical impact and prognostic factor of anemia among 370 patients (>18 years) admitted to Gondar University Referral Hospital in the period between December 02, 2010, and November 30, 2016, with heart failure, shows anemia in 41.9% of cases but it is not an independent predictor of mortality(37).

Anemia is common among adult heart failure patients and is associated with adverse outcomes, but data are lacking in children with heart failure. A retrospective chart review study done on the prevalence, severity and adverse outcomes of anemia in acute heart failure among 170 hospitalized children aged from 4 months to 23 years in Texas Tertiary children's hospital between 2007 to 2012 with clinical and laboratory assessment shows Anemia (hemoglobin <10 g/dL) in 18%(38) of hospitalizations at admission and 38% before outcome(38). Estimated glomerular filtration rate on admission done for 169/172 patients, with a mean of 93.2 ± 54.3 mL/min per 1.73 m2. Only four hospitalizations had an eGFR less than 30 ml/min per 1.73 m2(38). 46% of those hospitalizations that met the composite endpoint encountered anemia during admission and 33% of hospitalizations that did not meet the composite encountered anemia during admission(38). Rehospitalization within 90 days of discharge was encountered in 42% of the anemic patients and 38% of the no anemic patients(38). This shows Anemia occurs commonly in children hospitalized for acute heart failure and is associated with increased risk of transplant, mechanical circulatory support, and hospital mortality(38).

In a retrospectively medical records review study done on the prevalence of anemia and its influence on morbidity and mortality among 58 children with heart failure due to dilated cardiomyopathy (DCM) from the Department of Pediatric Cardiology of the University Heart Center Hamburg between 1997 and 2007 with clinical and laboratory assessment shows Anemia present in 64% of DCM patients(18). Anemic patients had a significantly higher hospitalization rate from decompensated CHF than those without anemia (mean 35.1 ± 40.5 days per year versus 9.97 ± 9.65, $P < 0.05$)(18). The shows Anemia is prevalent in pediatric patients with congestive heart failure from DCM and appears in all age classes. Hospitalization as a surrogate of morbidity is elevated in heart failure patients developing anemia, but low mortality(18).

A cross-sectional study done on Iron-deficiency anemia among 80 children under the age of 14 diagnosed with CHD between January 2010 and March 2016 at a teaching hospital in Ghana, with clinical and RBC indices assessment, shows 72.7% of them had signs of relative iron deficiency(24). Tetralogy of Fallot (48.8%), persistent truncus arteriosus (10%), transposition of great arteries (8.8%), and complete channel defect (7.5%) are underlying congenital cardiac lesion(24).

From retrospective Cohort study querying the Pediatric Health Information System (PHIS) database (comprised of 50 children's hospitals) from 01/2008 to 12/2017 on patients age group <21 years (yr) and congenital heart disease (CHD) exclusion, 2494 admitted patients inclusion criteria show Anemia in 26% (648) of the patients(39). The anemic group were undergo mechanical ventilation (64% vs 51%, p<0.001) and receive blood transfusions (40% vs 19%, p<0.001) compared to the non-anemic group(39). They were also more likely to have a liver failure (5% vs 2%, p=0.001) and kidney failure (42% vs 2%, p<0.001), and tended towards a higher frequency of ECMO (12% vs 9%, p=0.053)(39). The conclusion shows there is an association of anemia with more comorbidities and resource utilization in pediatric patients admitted for systolic HF and the suggestion of a need for examining anemia management strategies to optimize pediatric HF outcomes (39).

2.1. Conceptual framework

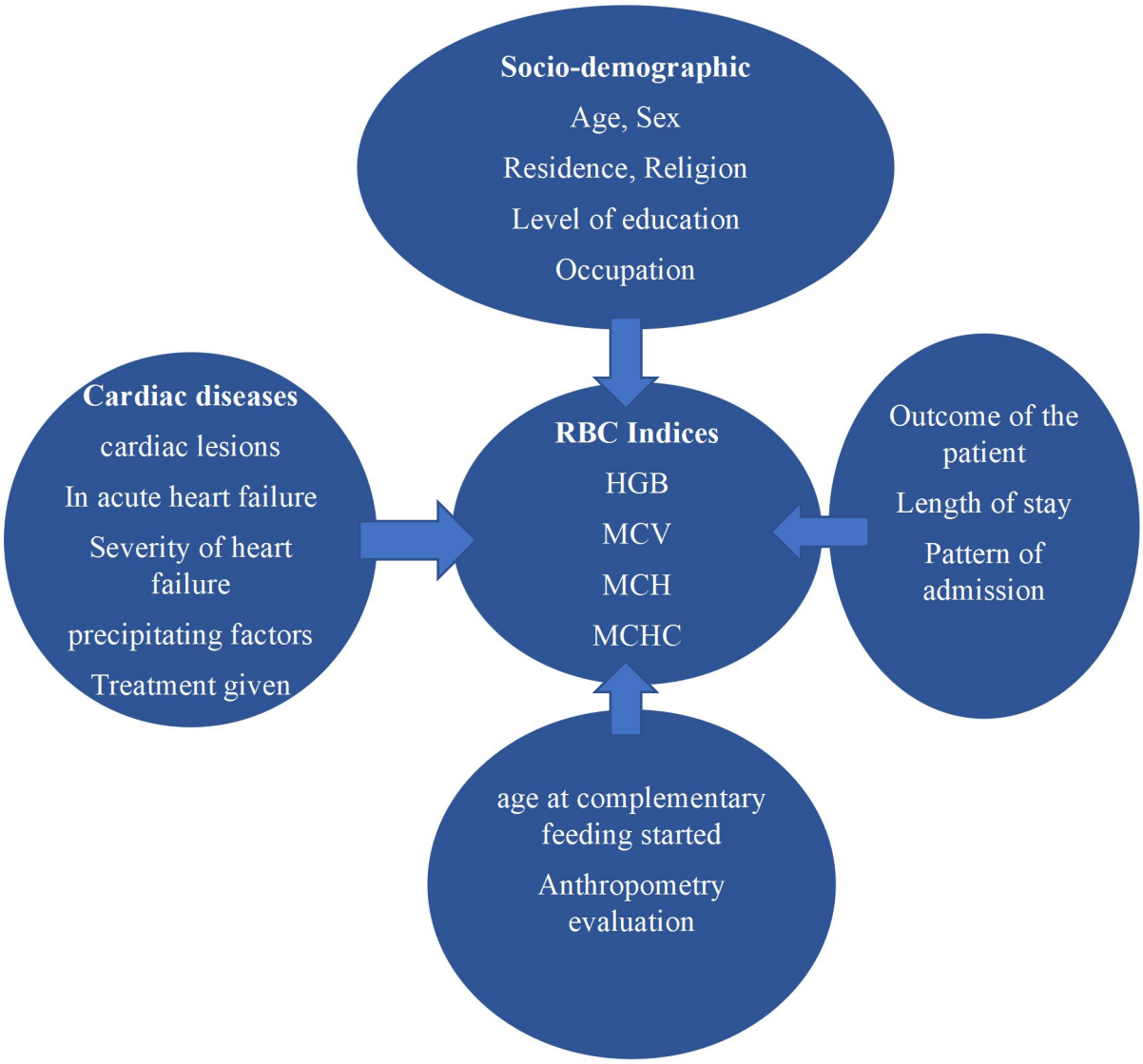

Figure 1: Developed conceptual framework after reviewing different literature.

Chapter Three: Objectives

3.1 General objectives

- To assess prevalence and severity of anemia among children with cardiac disease admitted to pediatrics ward, JUMC, South-West Ethiopia.

3.2 Specific objectives

- To assess the prevalence of anemia among children with cardiac disease admitted to JUMC pediatrics ward.
- To assess the severity of anemia among children with cardiac disease admitted to JUMC pediatrics ward.
- To assess associated factors with anemia among children admitted with heart diseases admitted to JUMC pediatrics ward.
- To assess the impact of anemia on patient outcome among children with cardiac diseases admitted to JUMC pediatric ward.

Chapter Four- Methodology

4.1 Study area

The study was conducted in Jimma University medical center pediatric in different Units of Pediatric ward, Jimma, South-west Ethiopia. Jimma town is located in the southwestern part of Ethiopia, Oromia region, 352km from Addis Ababa. It has an altitude of about 1780 meters above sea level. JUMC serves a total of almost 20 million catchment population from Jimma zone, Ilu Aba Bor, Buno-Bedele, Gambela, and Southern nation nationality population.

4.2 Study period

The study conducted from **May to October 2021**

4.3 Study design

An institution-based longitudinal study design with prospective data collection was employed.

4.4 Population

4.4.1 Source population

All pediatric age groups were admitted to the pediatric wards of JUMC.

4.4.2 Study Population

All children with Cardiac disease admitted to the Pediatric ward JUMC participated in this study.

4.5 Inclusion and exclusion criteria

4.5.1 Inclusion criteria:

- Children aged below 15 years and diagnosed to have Cardiac disease (CHD, Cardiomyopathy, VHD, decompensated heart failure) and admitted to different Pediatric wards, JUMC in the study period.

4.5.2 Exclusion criteria:

- Noncardiac causes of acute heart failure
- Cyanotic CHD
- Those children whose caregivers refused to consent.
- Those children died or disappeared before the caregiver interview

4.6. Sampling

4.6.1 Sample size determination

The sample size for this study was calculated using a formula for a single population proportion considering the following assumptions

$$n = \frac{(Za)^2 X\ P(1-P)}{d^2} = \mathbf{384}$$

n = minimum sample size
z=critical value for normal distribution at 95% confidence level which equals to 1.96
d= margin of error (5%)
P= prevalence of 50% used to calculate sample size because I couldn't find a similar study done.

- With correction formula:-

  Population size is **<10,000**
  Correction formula used

  $$\mathbf{Ns = \frac{no\ x\ N}{No + N}}$$

  N-Population =**100**, admitted cardiac patients over past 6 months after reviewed for Hospital record and I took this for correction formula. There is no study done on this line in our country and other sub-Saharan countries.

  no =384
  Total **Ns = 80**

With **a 10%** non-response rate total sample size was **88.**

4.6.2 Sampling method

All children who fulfill inclusion criteria were enrolled in this study until desired sample size was met with consideration as they come to the institution randomly.

4.7. Variables

Dependent variable

- Hemoglobin, MCV, MCH, MCHC

Independent variable

- Age
- Sex
- Place of residence
- Underlying Cardiac lesion
- The severity of Acute heart failure
- Medication given
- Anthropometric evaluation
- precipitating factors of acute heart failure other than anemia

4.8. Data collection and measurements

4.8.1 Data collection Instruments

A checklist was organized to capture all important information about the socio-demographic information, underlying cardiac disease, duration of Cardiac diagnosis, Complete blood count, Anthropometric assessment, signs, and symptoms as well as the severity of heart failure (using Modified Ross score for Heart failure in Children) and medications given. These all information captured on admission and chart of the patients were also reviewed to capture clinical information and outcome of the patients.

4.8.2 Data collection Procedures

Family or caregiver interviewed using structured questionnaires, chart of the patient reviewed to capture clinical presentation of patients, the severity of heart failure, full blood count taken from a chart that has done at admission. Echocardiography reports are taken from the chart of the patients and bedside Echocardiography is repeated depending on necessity. The questionnaire was prepared in English, Afaan Oromo, and Amharic which are most commonly used by the study population.

4.9 Data quality control

Data were collected by the trained person and quality control was assured by reviewing the filled checklist every day by the principal investigator and correction of the incomplete checklist was completed early. Anthropometry was reevaluated with the supervision of ward residents and trained data collectors using WHO growth standards (standard weight scale, height/length measuring board was used). The severity of heart failure was also assessed with a Modified Ross score of Heart failure for each participant at the time of admission. Complete blood count results were taken from a chart of the participants that were not done for research purposes and the same machine was not used to control the quality of the result.

4.10. Data analysis

Collected data were checked for completeness and consistency and variables were categorized then it was cleaned, coded, and entered into Epi-Data 3.1, exported, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) version 24.0. Hemoglobin was categorized based on definition of anemia and age categories. Severity of anemia also categorized based on age categories for above 6 months only but for less than 6 months there is no reference for cut of point to grade the severity of anemia. Univariate, bivariate, and multivariate analyses were done based on candidates. Candidate variables on binary logistic regression (P-value ≤ 0.25) were analyzed by multivariate logistic regression.

4.11. Ethical consideration

Ethical clearance was obtained from the ethical review board for human studies of Jimma University and permission was obtained from the authorities of the hospital. Written consent was obtained from each study participant's family or caregiver. Confidentiality was assured by collecting data anonymously. COVID 19 prevention techniques applied during family or caregiver interviews.

4.12. Dissemination of findings

The result of the study presented to the department of pediatrics and child health, Jimma University. The final result from the study submitted to the Research and Postgraduate Office, Jimma University in a form of a written report. Subsequently, the result of the study will be published in peer-reviewed journals.

Operational Definition

1. **Structural heart disease** is defined as a disease of the heart that is either congenital or acquired.
2. **Congenital heart disease (CHD)** is a problem with the heart structure and function that is present at birth.
3. **Rheumatic valvular heart disease (RVHD)** is an active or inactive disease of the heart that results from rheumatic fever and is characterized by reduced functional capacity caused by inflammatory changes in the myocardium or scarring of the valves.
4. **Acute heart failure** is defined as signs and symptoms of new-onset of HF and/or decompensation or worsening of chronic stable HF.
5. **Anemia** is defined as when the hemoglobin concentration is < 13.5 g/dl, <11g/dl, <10.5 <11.5g/dl, and <12g/dl in age group < 1 month, 1-6 months, 6-59 months, 5- 11years and 12-14 years of age respectively (40–42).
6. **Mild anemia** when hemoglobin between 10-10.9 g/dl, 11-11.4 g/dl, 11-11.9 g/dl for age range 6-59 months, 5-11 years, 11-15 years respectively(43).
7. **Moderate anemia** when hemoglobin between 7-9.9 g/dl, 8-10 g/dl, 8-10 g/dl for age range 6-59 months, 5-11 years and 11-15 years respectively(43).
8. **Severe anemia** when hemoglobin less than 7 g/dl, less than 8 g/dl, less than 8 g/dl for age range 6-59 months, 5-11 years and 11-15 years respectively(43).
9. **Microcytic anemia is defined** as anemia with a low MCV value for age
10. **Normocytic anemia is defined** as anemia with a normal MCV value for age.
11. **Macrocytic anemia is defined** as anemia with a high MCV value for age
12. **Treatment** is defined in this particular case as medical treatments given excluding surgery and/or catheter intervention of the cardiac lesions.
13. **Outcome** refers to the hospital discharge outcome of patients.
14. **Severe acute malnutrition** is defined by very low weight for height (below -3z scores of the Median, WHO growth standards), by visible severe wasting, or by the presence of nutritional edema.
15. **Comorbidities of Cardiac diseases** are a problem identified after the onset of cardiac disease and usually related to complications either due to disease progression or treatment-related complications.

CHAPTER-5 RESULTS

5.1. Socio-demographic characteristics among children with cardiac diseases admitted to JUMC, 2021

A total of 88 children were included in this study. This study revealed that the majority of participants were male 50 (56.8%). 33 (37.5 %) of them were between the age group of 6-60 months. The majority of participants came for health care visits with their mothers (45.5 %). The majority of the participants were fully vaccinated 47 (53.4 %) and 3 (3.4 %) of them were partially vaccinated. The majority of children were started their complementary feeding after 6 months 60 (68.2 %) and the complementary feedings started was cow milk (44.4 %) (Table 1).

Table 1: Socio-demographic characteristics of children with cardiac diseases admitted to JUMC, 2021

Variables (N=88)	Categories	Frequency	Percent (%)
Sex	Male	50	56.8
	Female	38	43.2
Age in months	≤ 1 month	7	8
	1-6 months	13	14.8
	6-60 months	33	37.5
	60-132 months	16	18.2
	132-168 months	19	21.6
Vaccination status	Fully vaccinated	47	53.4
	Vaccinated for age	20	22.7
	Partially vaccinated	3	3.4
	Not vaccinated	17	19.3
	Not sure	1	1.1
Reason for partial vaccinated and not vaccinated	Far distance	5	25
	No availability	1	5
	Due to illnesses	14	70
Complementary feeding started	Before 6 months	12	13.6
	After 6 months	60	68.2
	Not started yet	16	18.2
Complementary Feeding	Formula milk	13	18.1
	Cow milk	32	44.4
	Others	27	37.5

5.2. Characteristics of the families among children with cardiac diseases admitted to JUMC, 2021

In this study, the majority of caregivers were Muslim 67 (76.1%) followed by Orthodox 10 (11.4 %) and Protestant 11 (12.5 %). 71 (80.7 %) of participants are from Rural and the majority of participants' mothers and fathers did not attend formal education showing 57 (64.8 %), 51 (58 %) respectively. 65 (73.9 %) of the mother of the participants were housewives and 68 (77.3 %) of their fathers were farmers (Table-2).

Table 2: Characteristics of the families among children with cardiac diseases admitted to JUMC, 2021

Variable (N=88)	Categories	Frequency	Percent (%)
Residence	Rural	71	80.7
	Urban	17	19.3
Religion	Muslim	67	76.1
	Orthodox	10	11.4
	Protestant	11	12.5
Mother's education	No formal education	57	64.8
	Primary school	17	19.3
	Secondary School	14	15.9
Mother's Occupation	Farmer	11	12.5
	Merchant	4	4.5
	Governmental Employee	3	3.4
	NGO	2	2.3
	Daily Laborer	3	3.4
	Housewife	65	73.9
Father's education	No formal education	51	58
	Primary school	25	28.4
	Secondary school	12	13.6
Father's occupation	Farmer	68	77.3
	Merchant	9	10.2
	Governmental Employee	4	4.5
	NGO	1	1.1
	Daily Laborer	6	6.8

5.3. Anthropometric interpretation among children with cardiac diseases admitted to JUMC, 2021

In this study, 27 (30.7 %) of participants had severe wasting and 19 (21.6 %) had moderate wasting with BMI on Z score. 17 (19.3 %) of children were severely stunted and 22 (25 %) were severely Underweight. (Table-3)

Table 3: Anthropometric interpretation of the children admitted to JUMC, 2021

Variable (n=88)	Categories	Frequency	Percent (%)
Wasting	Severe Wasting	27	30.7
	Moderate Wasting	19	21.6
	Mild Wasting	16	18.2
	No wasting	26	29.5
WAZ	Severe Underweight	22	25
	Underweight	24	27.3
	Normal	42	47.7
HAZ	Severe stunting	17	19.3
	Moderate stunting	12	13.6
	Mild stunting	15	17
	Normal	44	50

5.4. Characteristic of Cardiac problems among children with cardiac diseases admitted to JUMC, 2021

In this study, only 19 (21.6 %) of the participants had previously diagnosed cardiac diseases and 69 (78.4 %) were diagnosed on the current admission. 18 (94.7 %) of those known patients were taking medication and only 1 (5.3 %) child was not taking medication (Table-4).

Table 4 list of medication taken among children with cardiac diseases admitted to JUMC, 2021

Variable	Categories	Frequency	Percent (%)
Known Cardiac patient (N=88)	Yes	19	21.6
	No	69	78.4
Underlying cardiac lesion (n=19)	CHD	7	36.8
	RVHD	12	63.2
Were on medication (n=18)	Yes	18	94.7
➢ Lasix		18	100
➢ Captopril		13	72.2
➢ Spironolactone		5	27.8
➢ Benzanthin penicillin		12	66.7
➢ Prednisolone		1	5.6

In this study, 50 (56.8 %) of the patients had Congenital Heart diseases (CHD) and 35 (39.8 %) rheumatic valvular heart diseases (RVHD). 25 (50 %) of children had VSD, 2 (4 %) ASD, 13 (26 %) PDA, 7 (14 %) AVSD and other lesions 6 (12 %).

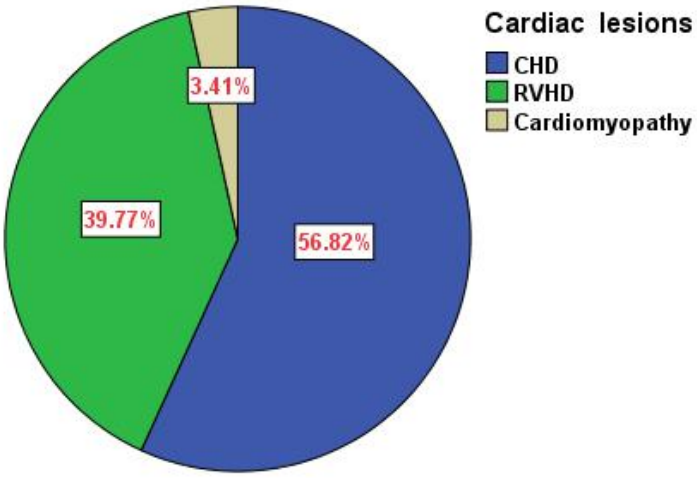

Figure 2: Identified cardiac diseases in children admitted to JUMC, 2021

In this study, Rheumatic valvular heart diseases were identified in 35 (39.88 %) of children, and a majority of them had Mitral Regurgitation 33 (94.3 %) (Table 5).

Table 5: Rheumatic Valvular lesions among children with cardiac diseases admitted to JUMC, 2021

Types of cardiac disorders (N=88)	Frequency	Percent (%)
Congenital heart diseases	50	56.82
Cardiomyopathy	3	3.41
Rheumatic valvular heart diseases	35	39.77
Mitral regurgitation	33	94.3
Tricuspid regurgitation	32	91.4
Mitral stenosis	8	22.9
Aortic Regurgitation	22	62.9
Aortic stenosis	1	2.9

In this study, 67 (76.1 %) of participants were in acute heart failure. The most common identified precipitating factor for acute heart failure was Pneumonia 33 (49.3 %) followed by moderate to severe anemia 11 (16.4 %) (Figure-2). This study also revealed that all participants had different symptoms of cardiac diseases at the time of admission (N=88). Diaphoresis or breastfeeding interruption 87 (98.9 %), Fast breathing or Shortness of breathing 88 (100 %), cough 78 (88.6 %), Orthopnea 30 (34.1 %) and body swelling 22 (25 %). All participants who were admitted with acute heart failure had S3 gallop 67 (100 %) and tender palpable liver 67 (100 %).

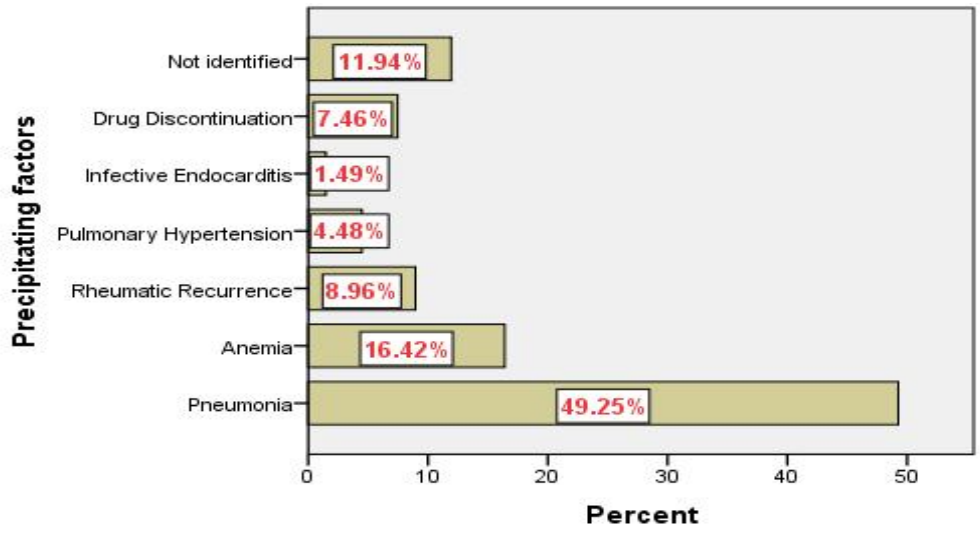

Figure 3: Histogram showing precipitating factors of acute heart failure among children admitted to JUMC, 2021

In this study, all participants had a Modified Ross score of severity of heart failure and 36 (40.91 %) of the participants were in severe congestive heart failure (**Figure-3**).

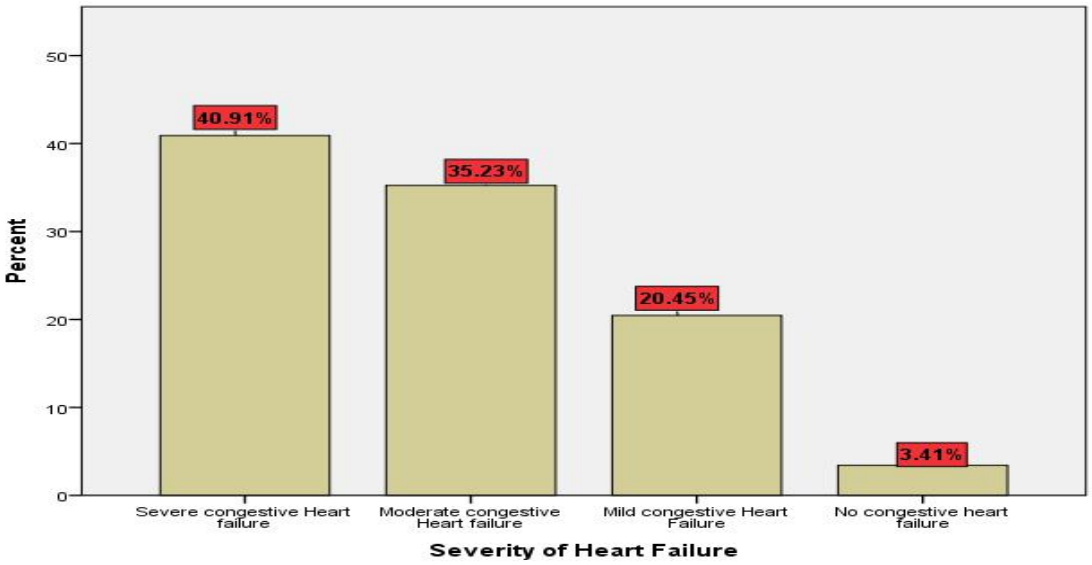

Figure 4: Histogram showing Modified Ross score among children with cardiac diseases admitted to JUMC, 2021

5.5 Currently given medications among children with cardiac diseases admitted to JUMC, 2021

In this study, 78 (88.6 %) of the participants were took medication for cardiac diseases. Medications used for Cardiac diseases among participants were Lasix 78 (100%), Captopril 70 (89.7 %), Spironolactone 8 (10.4 %), Digoxin 4 (5.2 %), Benzanthin Penicillin 35 (45.5 %), Prednisolone 7 (9.2 %) and Aspirin 3 (3.9 %) (Table 6).

Table 6 Showing currently given medications among children with cardiac diseases admitted to JUMC, 2021

Variables	Categories	Frequency	Valid Percent (%)
Currently on Medication (N=88)	Yes	78	88.6
	No	10	11.4
Lasix (n=78)	Yes	78	100
Captopril (n=78)	Yes	70	89.7
Spironolactone (n=78)	Yes	8	10.3
Benzanthin penicillin (n=78)	Yes	35	44.9
Prednisolone (n=78)	Yes	7	8.97
Aspirin (n=78)	Yes	3	3.84
Digoxin (n=78)	Yes	4	5.1

5.6 Prevalence of anemia among children with cardiac diseases admitted to JUMC, 2021

In this study, the prevalence of anemia was **49 (55.68 %) (95% CI 46.6 to 64.8%)** at admission (Figure 5).

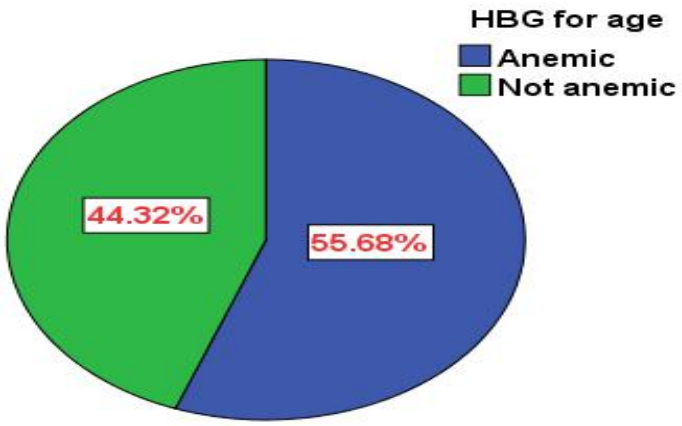

Figure 5: Pie chart showing the prevalence of anemia among children with cardiac diseases admitted to JUMC, 2021

The mean hemoglobin of the participants was **10.9 ± 3.021 g/dl** and had normal distribution (Figure-6). In this study, only 4 (4.5 %) of the children took blood transfusion before admission and all of them were told for being anemic. None of them took Iron tablets or syrup previously as well as on current admission.

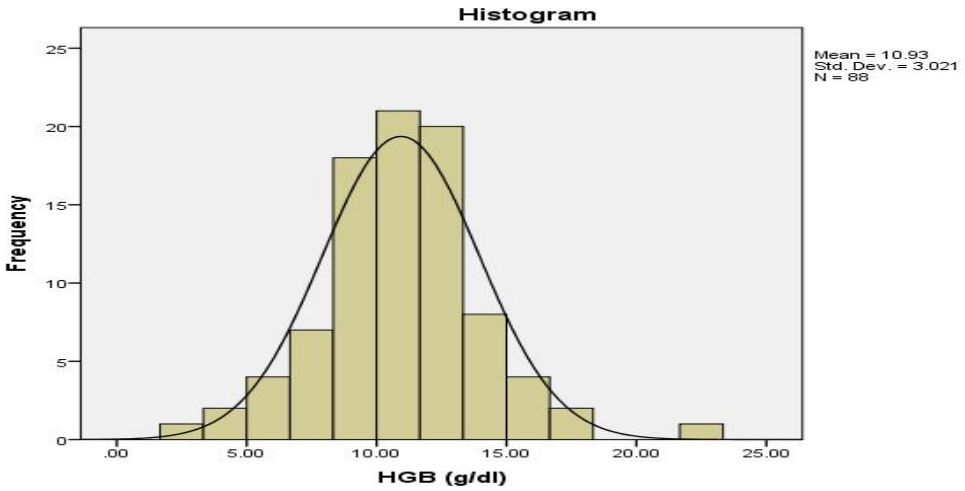

Figure 6 Histogram showing the distribution of Hemoglobin among children with cardiac diseases admitted to JUMC, 2021

In this study, grading of severity of anemia among anemic children was analyzed for those aged above 6 months only and the majority had moderate anemia 26/42 (61.9 %) with 95 % CI (45.2 to 76.2 %) and their mean corpuscular volume (MCV) showed Microcytic anemia 29/49 (59.2 %) of children (Table 7).

Table 7 Severity of anemia among children with Cardiac diseases admitted to JUMC, 2021

Variable	Categories	Frequency	Valid Percent (%) with 95 % CI
HGB status (N=88)	Anemia	49	**55.68 (46.6 to 64.8 %)**
	Normal	39	44.32
Severity of anemia (n=42)	Mild anemia	9	21.4 (9.5 to 33.3 %)
	Moderate anemia	26	61.9 (45.2 to 76.2 %)
	Severe anemia	7	16.7 (4.8 to 28.6 %)
MCV (fl) for age (n=49)	Normocytic	19	38.8
	Microcytic	29	59.2
	Macrocytic	1	2
MCH (pg) for age (n=49)	Low	30	61.2
	High	0	0
	Normal	19	38.8

5.7 Outcome among children with Cardiac diseases admitted to JUMC, 2021

In this study, only 6 (6.8 %) patients were readmitted during the study period, and from this only 1/6 (16.7 %) patient was admitted two times and 5/6 (83.3 %) admitted only once. The median length of stay in the ward was 8, IQR (5-13).

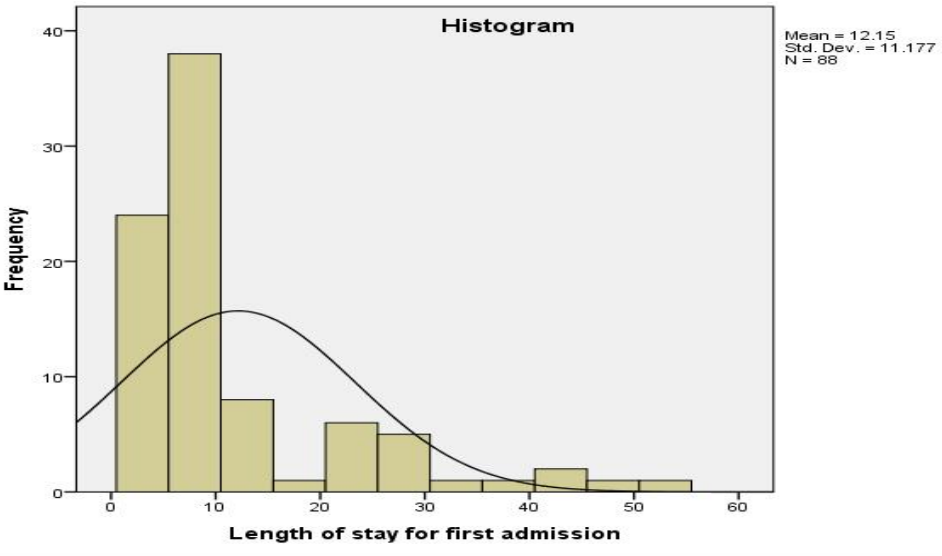

Figure-7 Histogram showing the distribution of length of stay inward among children admitted with cardiac diseases to JUMC, 2021

The majority of participants were discharged alive 72 (81.82 %) and 7 (7.95 %) were died (Figure 6).

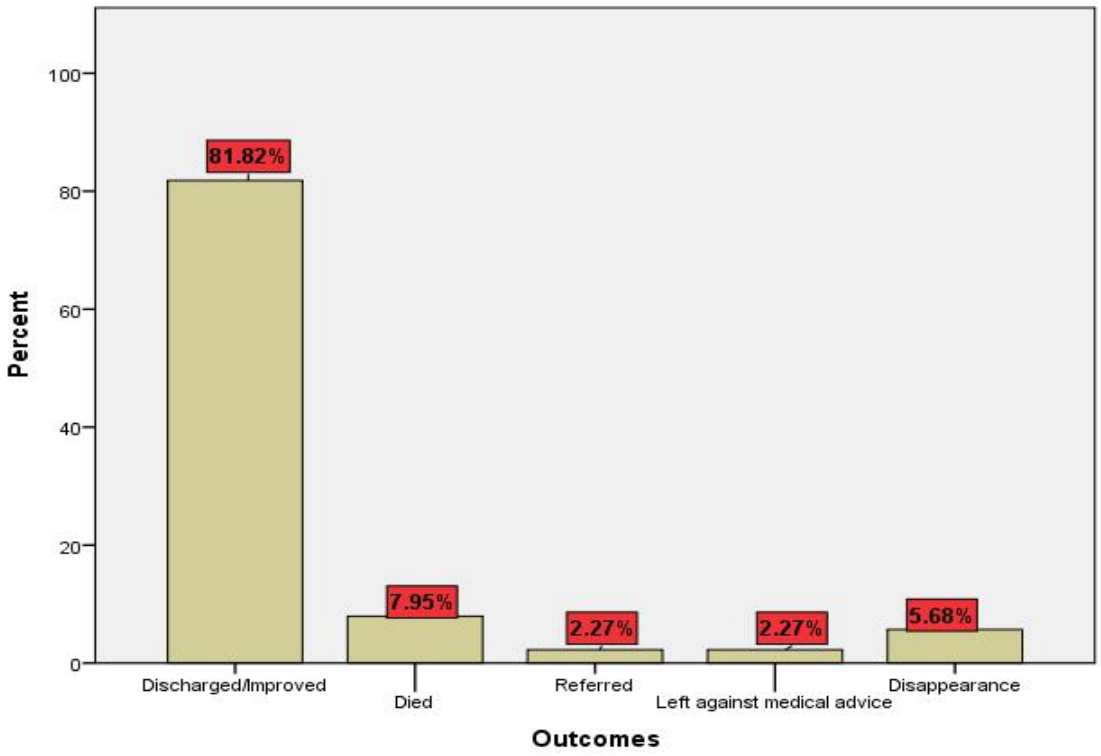

Figure 6: showing outcomes among children with cardiac diseases admitted to JUMC, 2021

5.8. Factors associated with anemia among children with cardiac disease admitted to JUMC, 2021

To get the predictors of the outcome variable, multivariable logistic regression analysis was performed after selecting the candidate variables through bivariate logistic regression. Age of the child, age at complementary feeding, BMI for age, weight for age, having acute heart failure, CHD, Rheumatic valvular heart diseases, Benzanthin penicillin, and outcome of the patient had shown association during the binary logistic regression at P-value ≤0.25. Out of these wasting, having acute heart failure and Rheumatic valvular heart diseases were found to be a significant association with anemia by multivariate logistic regression at p-value <0.05 with 95% CI AOR.

This study revealed that the odds of having anemia was 3.8 times higher than among children who had severe wasting than children who had normal nutritional status **(AOR=3.83,95% CI 1.02, 14.41, P=0.047).** Similarly, this study revealed that children who had acute heart failure were 4.9 times more likely to develop anemia compared to their counterparts **(AOR=4.96 95% CI 1.35, 18.15, P=0.015).** The odds of having anemia was 10 times higher than among children who had Rheumatic valvular heart diseases (RVHD) compared to their counterparts **(AOR=10.78, AOR 95% CI 2.98, 38.98, P<0.001)** (Table 8).

Table 8 Binary logistic regression model to identify factors associated with anemia among children with cardiac diseases admitted to JUMC, 2021

Variables (N=88)	Category	Hemoglobin status		COR 95%CI	P-value
		Anemia (%)	Normal (%)		
Age (Months) (n=88)	0-1	2 (28.6)	5 (71.4)	1	
	1-6	5 (38.5)	8 (61.5)	1.56(0.21,11.36)	0.659
	6-60	17 (51.5)	16 (48.5)	2.35(0.39,13.90)	0.345
	60-132	11 (68.8)	5 (31.2)	5.50(0.78,38.67)	0.087
	132-168	14 (73.7)	5 (26.3)	9.37(1.29,67.64)	0.026
Wasting (n=88)	Severe	18 (66.7)	9 (33.3)	5.10(1.60,16.24)	**0.006**
	Moderate	12 (63.2)	7 (36.8)	2.94(0.86,9.83)	0.085
	Mild	8 (50.0)	8 (50.0)	1.27(0.34,4.75)	0.717
	No wasting	11 (42.3)	15 (57.7)	1	
WAZ	Severe	15 (68.2)	7 (31.8)	2.36(0.79,6.96)	0.121
	Underweight	14 (58.3)	10 (41.7)	1.54(0.56,4.24)	0.403
	Normal	20 (47.6)	22 (52.4)	1	
Acute heart failure	Yes	41 (61.2)	26 (38.8)	4.48(1.54,13.06)	**0.006**
	No	8 (38.1)	13 (61.9)	1	
CHD	Yes	20 (40.0)	30 (60.0)	4.83(1.89,12.34)	0.001
	No	29 (76.3)	9 (23.7)	1	
RVHD	Yes	29 (82.9)	6 (17.1)	7.97(2.82,22.56)	**0.001**
	No	20 (37.7)	33 (62.3)	1	
Medication currently	Yes	47 (60.3)	31 (39.7)	6.06(1.2030.47)	0.029
	No	2 (20.0)	8 (80.0)	1	
Benzanthin penicillin	Yes	27 (77.1)	8 (22.9)	4.75(1.82,12.41)	0.001
	No	22 (41.5)	31 (58.5)	1	
Outcome of the patient	Discharged alive	47 (58.0)	34 (42.0)	1	
	Died	2 (28.6)	5 (71.4)	3.45(0.63,18.88)	0.152

Table 9 Multivariable logistic regression model to identify factors associated with anemia among children with cardiac diseases admitted to JUMC, 2021

Variables	Category	Hemoglobin status		AOR 95%CI	P-value
		Anemia (%)	Normal (%)		
Age (Months)	0-1	2 (28.6)	5 (71.4)	1	
	1-6	5 (38.5)	8 (61.5)	0.97(0.05,16.88)	0.984
	6-60	17 (51.5)	16 (48.5)	1.92(0.15,24.14)	0.614
	60-132	11 (68.8)	5 (31.2)	0.72(0.02,22.60)	0.854
	132-168	14 (73.7)	5 (26.3)	1.62(0.05,51.03)	0.784
Wasting	Severe	18 (66.7)	9 (33.3)	**3.83(1.02,14.41)***	**0.047**
	Moderate	12 (63.2)	7 (36.8)	2.69(0.64,11.27)	0.174
	Mild	8 (50.0)	8 (50.0)	0.42(0.07,2.33)	0.326
	No wasting	11 (42.3)	15 (57.7)	1	
WAZ	severe	15 (68.2)	7 (31.8)	0.81(0.13,4.76)	0.816
	Underweight	14 (58.3)	10 (41.7)	1.07(0.24,4.77)	0.326
	Normal	20 (47.6)	22 (52.4)	1	
Acute heart failure	Yes	41 (61.2)	26 (38.8)	**4.96(1.35,18.15)***	**0.015**
	No	8 (38.1)	13 (61.9)	1	
CHD	Yes	20 (40.0)	30 (60.0)	2.65(0.19,36.45)	0.465
	No	29 (76.3)	9 (23.7)	1	
RVHD	Yes	29 (82.9)	6 (17.1)	**10.78(2.98, 38.98)***	**0.001**
	No	20 (37.7)	33 (62.3)	1	
Medication currently	Yes	47 (60.3)	31 (39.7)	0.53(0.04,5.99)	0.606
	No	2 (20.0)	8 (80.0)	1	
Benzanthin penicillin	Yes	27 (77.1)	8 (22.9)	2.02(0.52,16.32)	0.999
	No	22 (41.5)	31 (58.5)	1	
Outcome of the patient	Discharged alive	47 (58.0)	34 (42.0)	1	
	Died	2 (28.6)	5 (71.4)	3.33(0.38,29.27)	0.278

*Indicates statistically significant association during multivariate binary logistic regression at **p-value <0.05 with 95% CI AOR.**

CHAPTER-6 DISCUSSION

Anemia among children is a public health problem globally(23,28). The overall prevalence of anemia was 51.5%(95%CI:50.8–52.2) and the magnitude of anemia across the wave of the EDHS surveys was 55.2%(95%CI:52.6–55.6.0) in 2005, 44.6%(95%CI:43.6-45.6) in 2011,and 57.6%(95%CI:56.5–58.7) in 2016(44,45). Childhood cardiovascular disorders including HF are associated with high morbidity and mortality especially in sub-Saharan Africa where palliative and definitive treatments seem far from reach(6,7).

The current study showed that the prevalence of anemia among children with cardiac diseases was **55.68 % (95% CI 46.6 to 64.8%)** at admission. The mean HGB was 10.9 ± 3.021 g/dl. This study shows similar result with EDHS data on prevalence of anemia in children(44,45). In a retrospectively medical records review study done on the prevalence of anemia and its influence on morbidity and mortality among 58 children with heart failure due to dilated cardiomyopathy (DCM), anemia present in 64% of the patient which is nearly comparable to our finding(46).

A retrospective chart review study done on the prevalence, severity and adverse outcomes of anemia in acute heart failure among 170 hospitalized children aged from 4 months to 23 years in Texas Tertiary children's hospital between 2007 to 2012 with clinical and laboratory assessment shows Anemia (hemoglobin <10 g/dL) in **19% (31/165)**(38) of hospitalizations at admission(38). In this study, the prevalence of anemia is lower than that of our study. This is maybe due to difference in cut point of HGB used to define anemia in children and in this study cut point of HBG to define anemia and severity of anemia were based on age depending on WHO criteria and standard textbook of pediatrics, which were more inclusive in our cases(42,47). Also there are differences in socioeconomic status among participants as compared to our side. Additionally included age group was more in our study than the above study. In this study, the majority of children were moderately anemic (26/42(61.9 %) and 7/42 (16.7 %), 9/42 (21.4 %) of children had mild and severe anemia respectively. In this study, the mean corpuscular volume of anemic patients shows the majority of them had microcytic anemia 29/49(59.2 %) whereas 19/49 (38.8 %), 1/49 (2 %) were normocytic and macrocytic anemia respectively. This finding is different from a study done in Texas Tertiary children’s hospital which showed normocytic

anemia (55/66) (83.3%). This may be due to underlying nutritional deficiency as possible etiology of anemia in our finding(48,49).

In this study, anemia was more prevalent among children who had Rheumatic valvular heart diseases whereas low prevalence in cardiomyopathy which were 2/88 (2.27 %) and 27 (30.68 %) respectively. When compared to the study done in the prevalence of Anemia in Children with Congestive Heart Failure due to Dilated Cardiomyopathy showed the prevalence of anemia was 64 %(50). This difference may be due to epidemiological background as possible etiologies of heart failure(51,52).

In our study frequency of death among children admitted with cardiac diseases was among anemic 2(4.1 %) and not anemic 5 (12.8 %). Readmission more than once was high in those not anemic children 1(16.67 %). In a study done retrospectively in Texas Hospital of children 30/64 (47 %) anemic and 35/98 (36 %) of not anemic children died, MCS or Transplantation done(53). This difference may be due to differences in parameters used to assess the outcome, progress of the diseases, and other related factors that may make the difference.

In this study, cardiac lesions identified were CHD 50(56.82 %), Rheumatic valvular heart diseases 35(39.77 %), and Cardiomyopathy 3(3.41 %). In a retrospective study done in Texas tertiary children's hospital dilated cardiomyopathy 125 (73%) was identified and CHD 6(3%)(53). But Rheumatic valvular heart diseases were not identified. This goes against our finding and may be due to epidemiological background(51,52,54).

In this study, children admitted with acute heart failure were 67/88 (76.14 %), and identified precipitating factors were Pneumonia 33 (49.3 %) followed by anemia 11 (16.4 %). A study done on Pediatric Heart Failure, Lagging, and Sagging of Care in Low-Income Settings in other institutions of this country revealed the same(55). But a high percentage of acute heart failure in our study is because of calculated for only cardiac patients against study done in Addis Ababa from all admitted patients(55).

In this study, upon multivariate analysis children who had acute heart failure was **4.9 times** more likely to develop anemia compared to their counterparts (AOR=4.96 95% CI 1.35, 18.15, P=0.015) which is on the line of a study done at Texas hospital of children on the prevalence of anemia among children with acute heart failure(56). This is likely due to hemodilution that occurs during acute heart failure(57). This study, revealed that the odds of having anemia was 3.8 times higher than among children who had severe wasting than children who had normal nutritional status (AOR=3.83,95% CI 1.02, 14.41, P=0.047), and a study done in other institution in Ethiopia reveals Anemic children had higher odds for SAM[AOR =3.76, 95% CI:1.54-9.18] which is almost similar with current study(58). In this study, the odds of having anemia was 10 times higher than among children who had Rheumatic valvular heart diseases (RVHD) compared to their counterparts (AOR=10.78, AOR 95% CI 2.98, 38.98, P<0.001). A study done at Departments of Pediatrics and Clinical Pathology, El-Shatby Children's Hospital, Alexandria University, Alexandria, Egypt on traumatic hemolysis among children with Rheumatic heart diseases shows, prevalence of anemia was 11/50 (22 %)(P-value <0.001)(59) and nearly similar with current study. This may be due to anemia of chronic illness, hemolysis and IDA that can occur in children with chronic diseases(57,60).

Study done in Germany on prevalence of anemia in children with DCMP shows, the mortality rate of pediatric heart failure patients, has no significant difference between Anemic and nonanemic patients in this study population (23% versus 15%)(61). In current study, has significant difference between anemic and nonanemic children **(28.6 % vs 71.6 %)** and mortality being higher among nonanemic children than anemic children but not statistically significant **(AOR=3.3, 95 %CI (0.379, 29.274, p-value=0.279).** In current study, the difference may be caused by progress of the diseases and anemia may not be independent risk factor for mortality.

6.1 Limitation and strength of the study

This study had a few limitations like full blood count were not done with the same machine, time of sample collection and the quality of the CBC result was not controlled. Echocardiography of a few children was not done by a cardiologist. There are no materials that suggest grading of anemia among infants below six months and the severity of anemia among them did not analyzed in this study.

CHATER-7 CONCLUSION AND RECOMMENDATION

7.1 Conclusion

This study shows there was high prevalence of anemia among children admitted with cardiac diseases and also preventable precipitating factor for acute heart failure. Associated factors with anemia among children with cardiac disease were severe wasting, acute heart failure, and chronic rheumatic valvular heart diseases with a statistically significant p-value.

7.2 Recommendation

Anemia is highly prevalent among children with cardiac diseases and associated with different factors thus further study with a large sample size may be required to investigate underlying causes of anemia. In this study, the high prevalence of anemia among children with cardiac diseases and precipitating factor for CHF. We recommend screening and treating anemia in children with cardiac diseases as a routine care for these populations to avert the preventable precipitator of acute heart failure.

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የፈቃደኝነት መጠየቂያና የመረጃ ገጽ

የመረጃ ገጽ

ስሜ **ዶክተር ሳቦና ለመሳ** ይባላል ፣በጅማ ዩኒቨርሲቲ የህፃናት ህክምና እና ጤና የሁለተኛ ድግሪ (ስፔሻለቲ) ተማሪ ነኝ ። እኔ የልብ በሽታ ባለባችዉ ህጻናት መካከል የደም ማነስ ስርጭት እና ከባድነት የማጥና ሲሆን የዚህ ጥናት ውጤት የበሽታውን መጠን ለማወቅ ያስችላል ። የእርስዎ በጥናቱ ላይ ተሳትፎ በፈቃደኝነት ላይ የተመሰረተ ነው። መሳተፍ ካልፈለጉ መተው ይቻላል። የእርስዎ ስምና ግለሰባዊ መርጃ ሚስጥራዊነቱ የተጠበቀ ነው። ስለእርስዎ መረጃ ጥናቱን ከሚያካሂደው ሰው ውጭ ሌላ ሰው አያውቅም። ፈቃደኛ አለመሆንዎ በሚያገኙት ማንኛውም የጤና እርዳታ ላይ ምንም አይነት ተፅዕኖ አይኖረውም። ስለ ተሳትፎዎ አመሰግናለሁ።

የፈቃደኝነት ቅጽ

በጥናቱ ለመሳተፍ ተስማምተዋል?

☐ አዎ ተስማምቻለው ☐ አይ አልተስማማሁም

በመጥይቁ ሞይው የሚፈረም፡ ከላይ በመረጃ ገጽ ላይ ያለውን ለጥናቱ ተሳታፊ በተገቢ ሁኔታ አንብቤ ማስረዳቴን በፊርማዬ አረጋግጣለሁ።

የተጠያቂው ፊርማ_____ቀን_____.

የጤያቂው ስም_____ፊርማ_____ቀን_____.

የተቆጣጣሪው ስም_____ፊርማ _____ቀን_____

Heyyama Hirmaataa/ttu qorannoo kanaa

Akkam jirtuu! Ani maqaan koo **Dr. Sabboonaa Lammeessaan** jedhama, kutaa yaalumsaa fi fayyaa daa'immanii hospitaala jimmaa keessatti barattuu waggaa 3ffaa fi isa xumauraati. Hanqina dhiigaa fi sadarkaa hir'inni dhiigaa irra jiru kan jedhu daa'imman dhibee onnee qabaniin qorannoo gaggeessuuf deema'.' Kanaaf iyyu fedhii keessaniin irratti hirmaachuudhaan fiixaan ba'umsa qorannoo kanaaf guumaacha akka gootan kabajaan isin gaafachaa, odeeffannoon isain naaf laattan icitiin isaa akka eegamuufi akkasumas dhimma biraaf akka hin oolle isiifan mirkaneessa. Hirmaachuu diduudhaaf mirga guutuu qabdu. Diduun keessanis ammo tajaajila argattan irratti dhiibba tokkoyyuu hinqabu. Yoo hirmaachuuf irratti walii galtan fedhii keessanin ta'uu isaa mallattoo keessaniin nuuf mirkaneessa. Galatoomaa!

Maqaa haadhaa/guddiftuu_____ lakk.Bilbilaa_____
Mallattoo_____ guyyaa_____
Mallattoo nama gaaffii gaafatuu_____ guyyaa_____
Mallattoo to'ataa_____ guyyaa_____

Consent form

Hello! My name is **Dr. Sabona Lemessa**, Pediatrics resident at Jimma University, Institute of health and inspired to conduct a study entitled "**Prevalence and severity of anemia among children with cardiac disease admitted to pediatrics ward JUMC, Jimma, Ethiopia--- A institutional-based longitudinal study**". Therefore, you are kindly requested to participate in the study voluntarily by considering your participation is incredible for and it is entirely based on your willingness and your refusal doesn't affect the service you get from us. You have the right to participate and/or refuse and you can interrupt at any point to ask questions.

Any information obtained from you and your medical records will remain confidential and needed only for study purposes. If you agree to participate in the study, please proceed with the interview after signing below. Thank you!

Name of care give_____ phone no._____

Signature _____ Date_____

Interviewer's signature _____ Date _____

Supervisor signature _____ Date _____

Data Collection Format

Part I. Socio-demographic Medical record Number (MRN) _____

1. Date of admission_____
2. Sex: 1. Male 2. Female
3. Age of the patient _____
4. Ethnicity: 1. Oromo 2. Amhara 3. Tegaru 4. Others_____
5. Where was the patient Admitted?
   1. Critical Ward 2. Level II 3. NRU 4. Oncologic Unit
6. Who is Caregiver? 1. Mother 2. Father 3. Siblings 4. Others (specify)_____
7. Caregiver's religion
   1. Orthodox 2. Muslim 3. Protestant 4.Waaqeffataa 5.Others (specify)_____
8. Residence of care Givers: 1. Urban 2. Rural
9. What is the mother's/care giver's education status?
   1. No formal education 2. Formal education (completed grades_____)
10. What is the father's/care giver's education status?
    1. No formal education 2. Formal education (completed grades_____)
11. What is mother's/caregiver's occupation?
    1. Farmer 2. Merchant 3. Government employee
    4. Non-governmental (NGO) employee 5. Others (specify)_____
12. What is Father's/caregiver's occupation?
    1. Farmer 2. Merchant 3. Government employee
    4. Non-governmental (NGO) employee 5. Others (specify)_____
13. What is the approximate monthly income of the family?_____
14. What is the vaccination status of this child?
    1. Fully vaccinated 2. On vaccination (vaccinated for age)
    3. Partially vaccinated 4. Not vaccinated at all 5. Not sure
15. If partially/ not vaccinated what was the reason?_____

Part II Nutritional assessment

16. At what age was the complementary feeding started?
    1. Before 6months 2. After 6months 3. not started yet
17. For less than 1 year of age what was the content of complementary feeding started?
    1. Formula milk buying from market 2. Cow`s milk
    3. Other feeding (mention)_____

Part III. Patient Anthropometric assessment on admission

18.

Parameter	Admission
Weight	
Height/Length	
MUAC	
WFA	
WFL/WFH	
LFA/HFA	
BMI	
BMI for age	

Part III. Patient Cardiac disorder Information on admission

19. Did she/he previously diagnose Cardiac disease before current admission?
    1. Yes 2. No
20. If **a question on number 19 is Yes,** how long since the cardiac disease was diagnosed? _____
21. Was he/she taking on medication for her/his Cardiac disease?
    1. Yes 2. No
22. If **question number 21 is Yes**, for how long since those medications started?_____
23. What medication he/she was taking for his/her cardiac disease? (specify)
    1._____ 2._____ 3._____ 4. _____
24. Does she/he in **Acute heart failure** currently? 1. Yes, 2. No
25. If a question on **number 24 is Yes,** for how long he/she was symptomatic before admission?_____
26. What symptoms do he/she has currently at admission? (Answer can be > 2)
    1. Cough 2. Shortness of breathing or fast breathing
    3. Diaphoresis or breastfeeding interruption
    4. Body swelling 5. Orthopnea 6. No symptoms related to cardiac illness
27. If he/she had **diaphoresis,** were of his/her body and when he/she had diaphoresis?
    1. Head only 2. Head and body at exertion
    3. Head and body at rest 4. Didn't have this symptom at all
28. If he/she had tachypnea (fast breathing) or shortness of breathing, how frequent she/he was having this symptom?
    1. Rare 2. Several times 3. Frequent 4. Didn't have this symptom at all
29. What was the breathing pattern of him/her at admission?
    1. Normal 2. Retraction 3. dyspneic
29. What are the following parameters at admission?
    1. Pulse rate_____ 2. Respiratory rate_____
31. S3 gallop 1. Absent 2. Present

32. Does he/she has tender Hepatomegaly at admission 1. Yes, 2. No

33. What is the size of the liver below the right costal margin at admission?

A. less than 2 cm B. 2- 3 cm C. Greater than 3 cm

34. What were identified precipitating factors if he/she had acute heart failure for current admission?

1. Chest Infection 2. Anemia 3. Rheumatic Recurrence 4. Hypertension

5. Infective Endocarditis 6. Drug discontinuation 7. Not identified

35. What medication she/he is taking for current acute Heart failure admission?

1._____ 2._____ 3._____ 4._____

36. What cardiac lesion was identified by Echocardiography?

1. Congenital (mention lesion_____)

2. Acquired (Mention Lesion_____)

37. What is the severity of congestive heart failure (CHF) he/she has? (Depending Modified Ross score for Heart failure in children)

1. No (0-2) 2. Mild (3-6) 3. Moderate (7-9) 4. Severe (10-12)

Part V- Hematologic parameters information on admission

38. Did he/she take a blood transfusion before current admission? 1. Yes, 2. No

39. If **he/she** took blood transfusion before current admission, what was the reason?

1. Blood loss 2. Told for cardiac illness 3. Told to have anemia 4. I don't know

40. Did he/she take Iron therapy before current admission? 1. Yes, 2. No

41. If question **number 40 is yes** when he/she took that Iron therapy? _____

42. If she/he took Iron therapy, for how long has she/he had taken it? _____

43. Does she/he take Iron syrup/tablet currently? 1. Yes, 2. No

44. If he/she currently taking Iron syrup, when it was started?

1. before current admission (specify_____) 2. After current admission

Part VI – Full blood count information

45. Full blood count profile

CBC parameters	At admission
WBC	
HGB	
HCT	
PLT	
MCV	
MCH	
MCHC	
Neutrophil %	
Lymphocyte %	

Part VII- Information on the admission of the patient (from chart of patient and caregiver**)**

46. Is this his/her first admission? 1. Yes, 2. No
47. If not his/her first admission, how many times he/she was admitted during the study period?
    1. Once 2. Twice 3. Three times 4. Four times
48. What was the reason for readmission? (Answer may be more than one)
    1. Acute heart failure 2. Chest infection
    3. For blood transfusion 4. Other (specify_____)
49. What is the total length of stay in the hospital? (for initial admission _____)
50. Outcome of the patient for initial admission_____
    1. discharged 2. death 3. Referred 4. Left against medical advice 5. Disappeared

® This is the end of our questionnaire. Thank you very much for taking the time to answer my questions. We appreciate your help. Please re-check that you have filled in all the questions.

Name of data Collector _____

Signature _____

Date _____