

Assessment of non-communicable diseases and injuries among children in selected tertiary level hospitals in Nepal



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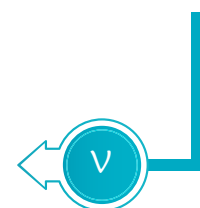
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Dr. Pradip Gyanwali
Member Secretary (Executive Chief)
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Executive summary

Background: The burden of non-communicable diseases (NCDs), including hypertension, cancer, and diabetes mellitus is increasing in people living in low- and middle-income countries (LMICs). As NCDs are emerging into one of the major public health problems, exploring the disease burden among children is key to decision-making and planning processes. There is limited data on causes and trends of admission and mortality among children admitted to pediatric wards in the hospitals of Nepal. This study aimed to identify the most common non-communicable diseases and injuries (NCDI) in children from key pediatric hospitals and tertiary level hospitals in Nepal.

Methods: A health facility-based cross-sectional study was conducted from June to September 2021 using secondary data collected by medical record departments in 15 tertiary level hospitals in Nepal using purposive sampling. Both qualitative and quantitative methods were employed. This retrospective study captured data over five consecutive years (Fiscal Year (FY) 2072/73 to 2076/77). Data are expressed in percentages and proportions. Qualitative data is analyzed using thematic analysis.

Result: Over the FYs 2072/73 to 2076/2077, emergency room and hospital admission records in the study hospitals demonstrated that digestive disease (24.8% in admitted and 29.5% in emergency) neurological disorders (21.4% in admitted and 23.8% in emergency) and chronic respiratory diseases (14.2% in admitted and 12.7% in emergency) were the most prevalent (level 2) types of childhood NCD. Similarly, unintentional injuries (41.9% in admitted and 45.7% in emergency), transport injuries (31.6% in admitted and 21.7% in emergency) and uncategorized injuries (18.5% in admitted and 25.2% in emergency) were the most prevalent injuries among children. Paralytic ileus and intestinal obstruction (20.9% in admitted and 26.6% in emergency), other neurological disorders (21.4% in admitted and 23.8% in emergency) and asthma (14.2% in admitted and 12.7% in emergency) were the leading (level 3) causes of hospital visits. Among injuries (level 3), road injuries (31.6% in admitted and 21.7% in emergency), falls (21.1 % in admitted and 22.8% in emergency) and uncategorized injuries (18.5% in admitted and 25.2% in emergency) were the leading causes of hospital visits. Neurological disorder (13.7%) and other non-communicable disease (46.6%) were the most common cause of NCD related death. Unintentional injuries (47.4%) were the commonest cause of injuries related death.

Conclusion: The present assessment revealed that NCDIs are common among children and adolescents (0-18years) in Nepal. There is an urgent need to strengthen the health system to work towards prevention and management of childhood NCDI. Tertiary level health facilities need to improve and enhance infrastructure and train health care workers to be better prepared for such admissions.

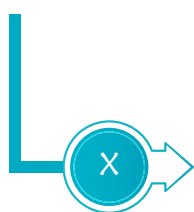
List of abbreviations

ANC	Antenatal Care
CVD	Cardiovascular Disease
DALYs	Disability-Adjusted Life Years
FY	Fiscal Year
GBD	Global Burden of Diseases
HDU	High Dependency Units
ICD	International Classification of Diseases
ICU	Intensive Care Units
IHD	Ischemic Heart Disease
KII	Key Informant Interview
LMICs	Low and Middle Income Countries
MCH	Maternal and Child Health
NCD	Non Communicable Diseases
NCDI	Non Communicable Diseases and Injuries
NHRC	Nepal Health Research Council
OPD	Outpatient Department
PICU	Pediatric Intensive Care Unit
RHD	Rheumatic Heart Disease
TUTH	Tribhuvan University Teaching Hospital

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BACKGROUND

Non-communicable diseases (NCDs) are the leading causes of mortality and ill-health and account for seven out of ten deaths worldwide¹. These diseases have been increasing rapidly in the Low and Middle-Income Countries (LMICs) and the risk of dying prematurely from NCDs in LMICs is almost double than that in a high-income country (HIC)². The burden of NCDs is expected to increase in Nepal in the coming years, owing to an aging population, rapid urbanization, air, soil, and water pollution, and unhealthy lifestyles³⁻⁵.

Children, defined as people belonging to the age group 0-19 years according to the World Health Organization (WHO), are most vulnerable to behaviors such as tobacco use, physical inactivity, and unhealthy diets leading to the emergence of NCDs⁶. On a global scale, NCDs cause 24.8% of disability-adjusted life years and 14.6% of deaths among children and adolescents⁷. Among children aged 5 to 14 years old, the leading causes of years of life lost due to NCDs in 2019 were congenital heart disease, malignant neoplasms, brain cancer, acute lymphoid leukemia, cirrhosis, and other chronic liver diseases, idiopathic epilepsy and sickle cell disease^{7,8}. Children affected by NCDs often face lifelong challenges in managing and treating their conditions. Chronic health conditions in children are multifaceted and involve ongoing care from their families, schools, and communities⁶.

Like any other LMICs, Nepal has a high and rising burden of NCDs. The Nepal burden of diseases 2019 study provides comprehensive data on causes of death, diseases, injuries, and risk factors. Majority (71.1%) of deaths were due to non-communicable diseases (NCDs), 21.1% were due to communicable, maternal, neonatal, and nutritional (CMNN) diseases, and the remaining 7.8% were due to injuries. Cardiovascular diseases (CVDs) were the leading cause of death, with 24% of total deaths being attributable to CVDs⁹.

Over 20 years (1996 to 2016), there has been a dramatic reduction in childhood mortality in Nepal, decreasing from 118 to 39 deaths per 1,000 live births¹⁰. This decline has largely been due to effective infectious disease prevention and control measures, resulting in sharp declines in the incidence of conditions such as childhood pneumonia, diarrhea, measles, and malaria as well as focused efforts to reduce childhood malnutrition¹¹. In this setting, the relative proportion of death and disability due to NCDs has more than doubled from 1990 to 2019¹². Additionally, death and disability due to injuries in Nepal are particularly concentrated in younger age groups, with 26% of DALYs attributable to injuries occurring under the age of 20¹³. Therefore, it's high time we shift our focus to childhood NCDs and injuries so that we can curtail the risks of the NCDs among the adult population and prevent the economic burden of the disease on time.

The Nepal NCDI Poverty Commission which was formed under the auspices of the Global Lancet NCDI Poverty Commission in 2017 launched a national report on “An equity Initiative to Address Non-Communicable Diseases and Injuries” on March 26, 2018. The report entails a situation analysis of NCDIs and socio-economic status in Nepal along with a recommendation of a package of 23 cost-effective health sector interventions budgeted for low-income countries addressing 25 priority NCDI conditions with an

emphasis on conditions affecting the poor in Nepal¹⁴. Post report launch, the commission dedicated a whole year to assessing the burden of NCDIs among children in Nepal and explored the Global Burden of Disease (GBD) database, and various national databases including HMIS, health insurance, and many more. However, the approach did not seem to be sufficient and needed more evidence to support the study. Hence, the commission decided to collect secondary data from the tertiary hospitals providing pediatric care aiming to identify the most severe and prevalent NCDI conditions, particularly affecting children in Nepal. In addition, it aims to emphasize the need for strategies to prevent the emergence of these diseases to ward off the challenges of the global burden of diseases in children.

OBJECTIVES

General objective

- To identify NCDI conditions, particularly affecting children (0-18 years) from key pediatric hospitals and tertiary level hospitals in Nepal

Specific objectives

- To assess the burden of childhood NCDIs in Nepal
- To assess the gap between the magnitude of childhood NCDIs and services available in Nepal
- To explore the required intervention for the prevention and management of childhood NCDIs

METHODOLOGY

Study design

This was a cross-sectional descriptive study using secondary data routinely collected by the medical record department of tertiary level hospitals in Nepal. Both quantitative and qualitative methods were used to identify the most common NCDI conditions, particularly affecting children from key pediatric hospitals and tertiary level hospitals in Nepal.

Study setting

NCDs are currently the leading cause of death according to some hospital-based studies, but a detailed survey on its burden among children is yet to be conducted in Nepal. Two key tertiary level hospitals (including medical colleges) with designated pediatric departments were randomly selected from each of the 7 provinces. Additionally, a tertiary pediatric hospital inside Kathmandu Valley: Kanti Children's hospital was included purposively in the study since it is the key referral hospital with a maximum influx of children with severe diseases and conditions from all over Nepal.

Study population

The source population for the study were all patients that were registered for NCDIs from FY 2072/73 to 2076/77 in the selected hospitals. We carried out secondary data collection by reviewing hospital medical records during June to September 2021, to understand the magnitude of childhood NCDIs in selected key hospitals and health facilities of Nepal. Besides that, we conducted one key-informant interview from each site with the respective hospital incharge/ directors or the pediatric department incharge.

Sample size and sampling technique

The sample size was not predetermined as the study population was all source population whose records were available during the data collection period. The hospital directors/ pediatric incharge/specialists of each selected hospital were interviewed. We purposively selected one tertiary pediatric hospital from Kathmandu Valley- Kanti Children's hospital for the study. Similarly, a list of hospitals from the Ministry of Social Development of each province was obtained, and two tertiary level referral hospitals were purposively selected from each list, as most severe NCDs are referred to and treated at referral hospitals in Nepal.

Data variables, sources of data, and data collection

Socio-demographic data included age, sex, final diagnosis and outcome, availability of human resources and laboratory tests, and other important information available on discharge and OPD records of respective medical record section of the hospitals. Data were collected by trained field researchers who have a bachelor in public health or nursing using semi-structured and pre-tested checklists. The hospital director/pediatrician/incharge of the respective hospitals were interviewed using key informant interview(KII) guidelines to collect the qualitative data.

Data management and quality control

Standard data quality control procedures were implemented for each critical stage of the study design and implementation. Depending on the feedback gained from the pre-test, the questionnaire was further revised and updated. Data were collected by trained field researchers as well as medical recorders of respective hospitals. The field researcher received orientation on the contents of the questionnaire. Orientation was given by core research team members. Intensive monitoring and follow-up during data collection were undertaken by a research officer from the center. During this survey, experienced core research team members assisted the data collectors on technical issues, and closely checked the completeness, accuracy, clarity, and consistency of data.

Quantitative data were taken from the hospital using paper and pencil methods and entered in Microsoft Excel after checking the collected data in the field itself. Once the final dataset with completely and thoroughly cleaned data from all the study sites was ready, a team of investigators analyzed the data. Microsoft Excel was used for analysis. The technical team in the center coded the final diagnosis and cause of death, according to GBD classification for NCDs into different level of GBD classification¹⁵. The trained data entry manager entered the individual patients' details like age, sex, year of admission, etc., and assigned GBD code in each disease category. Where there was doubt in disease classification, there was reconciliation between the medical record that coded the diseases, the study team, and the consultant medical doctors. Descriptive analyses were carried out. Frequencies and percentages of different variables were computed and the results were presented using tables and figures.

Qualitative information was thematically analyzed. Firstly, information gathered through KII in the field was kept in written form in field notes. This was supplemented by the audio record used during the interview process. The use of field notes was followed by the transcription process. Results from the KIIs were recorded in field notes and were transcribed in Nepali using respective audio recordings from the

KIIs. The transcribed data was translated to English for the facilitation of data processing. Then relevant themes, sub-themes, and codes were generated based on the information obtained from qualitative data. Development of the theme was based on putting together the codes with similar meanings under the common theme.

Ethical consideration

The Ethical approval was obtained from an independent Ethical Review Board (ERB) of NHRC. Formal administrative permission was also obtained from respective hospitals. The data collectors of the study introduced themselves and requested selected hospital officials for cooperation by presenting an official letter issued by NHRC. Finally, written informed consent was obtained from the hospital and the confidentiality of the data was maintained.



FINDINGS

Overview of health facilities and study population

A total of 15 health facilities including government hospitals, private and government teaching hospitals were included in this study (Figure 1). These health facilities were selected from seven provinces indicating facilities were geographically representative to the region.

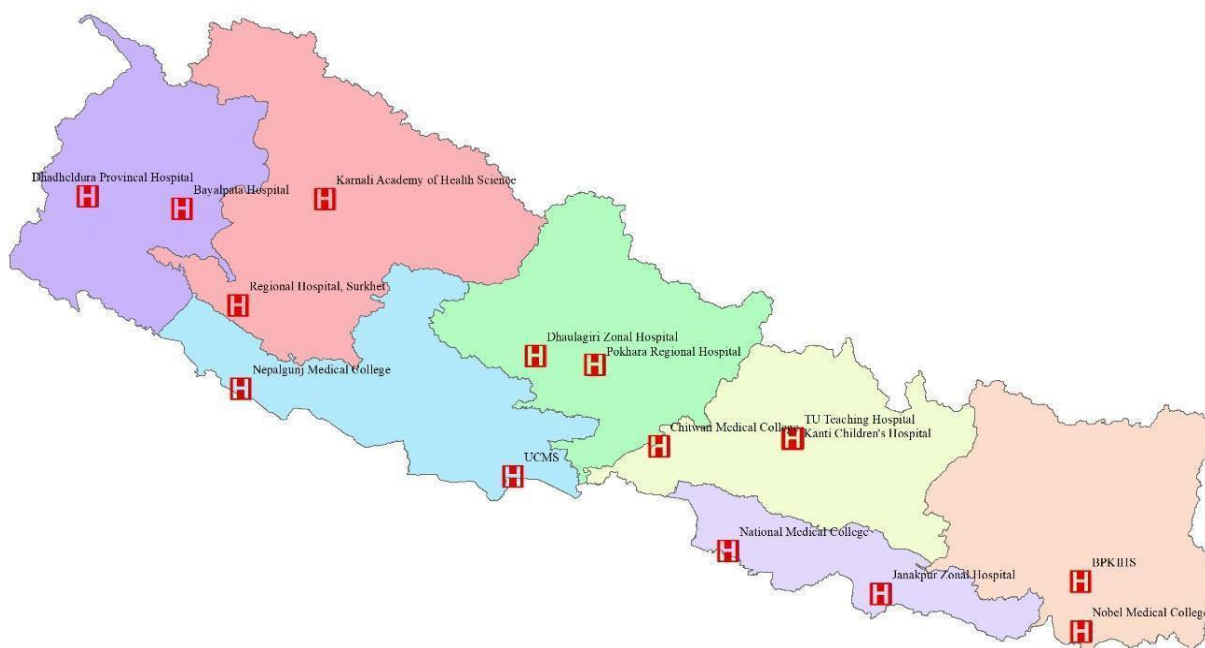


Figure 1 Selected tertiary level hospitals for the study

Pattern of morbidity due to NCDs

Medical records of 150,059 patients (0-18 years) during the FY 2072/73 to 2076/77 were considered and collected. GBD classification was adapted to classify NCDs morbidity in our study. The NCDs included were digestive disease, neurological disorder, chronic respiratory diseases, neoplasms, cardiovascular disorders, mental disorder, diabetes and kidney disease, skin and subcutaneous disease, musculoskeletal disorders, substance use disorder, other non-communicable diseases and injuries (unintentional, transport, self-harm and interpersonal violence, uncategorized).

Table 1 Distribution of childhood NCDs cases from 2072/73 to 2076/77 (Level 2)

NCDI Categories	Admitted (N, %)	Emergency (N, %)
NCDs		
Digestive diseases	8398 (24.8)	10480 (29.5)
Neurological disorders	7246 (21.4)	8460 (23.8)
Chronic respiratory diseases	4810 (14.2)	4523 (12.7)
Neoplasms	2205 (6.5)	1395 (3.9)
Cardiovascular diseases	1680 (5)	1295 (3.6)

Diabetes and kidney diseases	1528 (4.5)	884 (2.5)
Mental disorders	1300 (3.8)	1251 (3.5)
Musculoskeletal disorders	64 (0.2)	334 (0.9)
Skin and subcutaneous diseases	54 (0.2)	1020 (2.9)
Substance use disorders	21 (0.1)	35 (0.1)
Other non-communicable diseases*	6519 (19.3)	5803 (16.4)
NCDs subtotal	33825	35480
Injuries		
Unintentional injuries	12649 (41.9)	23095 (45.7)
Transport injuries	9532 (31.6)	10996 (21.7)
Self-harm and interpersonal violence	2401 (8)	3742 (7.4)
Uncategorized Injuries**	5591 (18.5)	12748 (25.2)
Injuries subtotal	30173	50581
Total	63998	86061

*Endocrine, metabolic, blood, and immune disorders; congenital birth defects; hemoglobinopathies and hemolytic anemias and urinary diseases and male infertility

**Musculoskeletal injury, multiple trauma/injuries, fracture, spinal cord injury, soft tissue injury, eye injury, head injury.

Over the five years period, digestive diseases showed the highest burden among admitted (24.8%) and emergency (29.5%) NCDs followed by neurological disorders (21.4% in admitted and 23.8% in emergency) and chronic respiratory diseases (14.2% in admitted and 12.7% in emergency). Similarly, the majority of injuries were unintentional (41.9% in admitted and 45.7% in emergency), followed by transport injuries (31.6% in admitted and 21.7% in emergency) and self-harm and interpersonal violence (8.0% in admitted and 7.4% in emergency) (Table 1).

Table 2 Distribution of childhood NCDs cases from 2072/73 to 2076/77 (Level 3)

NCDI Categories	Admitted (N, %)	Emergency (N, %)
Non-communicable diseases		
Other neurological disorders	7244 (21.4)	8460 (23.8)
Paralytic ileus and intestinal obstruction	7077 (20.9)	9446 (26.6)
Asthma	4810 (14.2)	4523 (12.7)
Congenital birth defects	3310 (9.8)	2679 (7.6)
Endocrine, metabolic, blood, and immune disorders	1824 (5.4)	1310 (3.7)
Inguinal, femoral, and abdominal hernia	1297 (3.8)	388 (1.1)
Hemoglobinopathies and hemolytic anemias	1180 (3.5)	1357 (3.8)
Non-Hodgkin lymphoma	1167 (3.5)	191 (0.5)
Rheumatic heart disease	1030 (3)	832 (2.3)
Other mental disorders	787 (2.3)	859 (2.4)

Other cardiovascular and circulatory diseases	611 (1.8)	447 (1.3)
Diabetes mellitus	583 (1.7)	489 (1.4)
Chronic kidney disease	575 (1.7)	395 (1.1)
Acute glomerulonephritis	370 (1.1)	(0)
Other neoplasms	319 (0.9)	(0)
Leukemia	297 (0.9)	271 (0.8)
Other NCDs*	1344 (4)	3833 (10.8)
NCDs subtotal	33825	35480
Injuries		
Road injuries	9532 (31.6)	10996 (21.7)
Falls	6355 (21.1)	11520 (22.8)
Fire, heat, and hot substances	3335 (11.1)	3391 (6.7)
Self-harm	1782 (5.9)	1824 (3.6)
Animal contact	1295 (4.3)	3193 (6.3)
Poisonings	1078 (3.6)	2089 (4.1)
Interpersonal violence	619 (2.1)	1918 (3.8)
Foreign body	290 (1)	2418 (4.8)
Drowning	262 (0.9)	341 (0.7)
Exposure to forces of nature	33 (0.1)	134 (0.3)
Environmental heat and cold exposure	1 (0)	(0)
Uncategorized Injuries**	5591 (18.5)	12748 (25.2)
Injuries subtotal	30173	50581
Total	63998	86061

*Other malignant neoplasms, schizophrenia, urinary diseases and male infertility, depressive disorders, hodgkin lymphoma, anxiety disorders, other musculoskeletal disorders, urticaria, stroke, other skin and subcutaneous diseases, drug use disorders, uncategorized, bipolar disorder, appendicitis, non-melanoma skin cancer, brain and nervous system cancer, non-rheumatic valvular heart disease, kidney cancer, cirrhosis and other chronic liver diseases, cervical cancer, upper digestive system diseases, headache disorders, aortic aneurysm, gallbladder and biliary tract cancer, dermatitis, gallbladder and biliary diseases, other digestive diseases, alcohol use disorders, low back pain, bacterial skin diseases

** Head injury, fractures, spinal cord injury, soft tissue injury, lower limb injuries, etc.

Over the five years' period, other neurological disorders such as vertigo, bell's palsy, cerebral palsy, central nervous system diseases, hydrocephalus, seizure disorder, neuropathy, paralysis, GB syndrome, and retts syndrome showed the highest burden amongst the NCDs (21.4 % in admitted and 23.8% in emergency) followed by paralytic ileus and intestinal obstruction (20.9% in admitted and 26.6% in emergency) and asthma (14.2% in emergency and 12.7% in emergency). Similarly, majority of injuries were road injuries (31.6% in admitted and 21.7% in emergency) followed by falls (21.1% in admitted and 22.8% in emergency and fire, heat and hot substances (11.1% in admitted and 6.7% in emergency) (Table 2).

Pattern of mortality due to NCDs

Of the total 715 deaths, 350 deaths due to NCD among children less than 18 years were reported during the 5 years (2072/73–2076/77) in 15 hospitals. Neurological disorders and digestive diseases were most common NCDs leading to the death of children followed by neoplasms. Death due to unintentional injuries was the most common injury followed by transportation injuries and self-harm and interpersonal violence.

Table 3 Distribution of deaths due to NCDI from FY 2072/73 to FY 2076/77

NCDI categories	Boys (N, %)	Girls (N, %)	Total (N, %)
NCDs			
Neurological disorders	33(15.64)	15(10.79)	48(13.71)
Digestive diseases	29(13.74)	10(7.19)	39(11.14)
Neoplasms	25(11.85)	9(6.47)	34(9.71)
Cardiovascular diseases	17(8.06)	15(10.79)	32(9.14)
Chronic respiratory diseases	10(4.74)	12(8.63)	22(6.29)
Diabetes and kidney diseases	3(1.42)	7(5.04)	10(2.86)
Substance use disorders	1(0.47)	(0)	1(0.29)
Musculoskeletal disorders	1(0.47)	0(0)	1(0.29)
Other non-communicable diseases*	92(43.6)	71(51.08)	163(46.57)
NCDs subtotal	211(45.67)	139(38.4)	350(42.48)
Injuries			
Unintentional injuries	91(47.89)	82(46.86)	173(47.4)
Transport injuries	66(34.74)	28(16)	94(25.75)
Self-harm and interpersonal violence	24(12.63)	58(33.14)	82(22.47)
Uncategorized Injuries**	9(4.74)	7(4)	16(4.38)
Injuries subtotal	190(41.13)	175(48.34)	365(44.3)
Total	401	314	715

* Systemic lupus erythematosus (SLE) with organ or system involvement, intravascular coagulation, neonatal aspiration syndrome, thalassemia, anemia, birth asphyxia, sickle cell, congenital heart anomalies, DIC, congenital anomaly

** Unspecified head injuries, head injuries

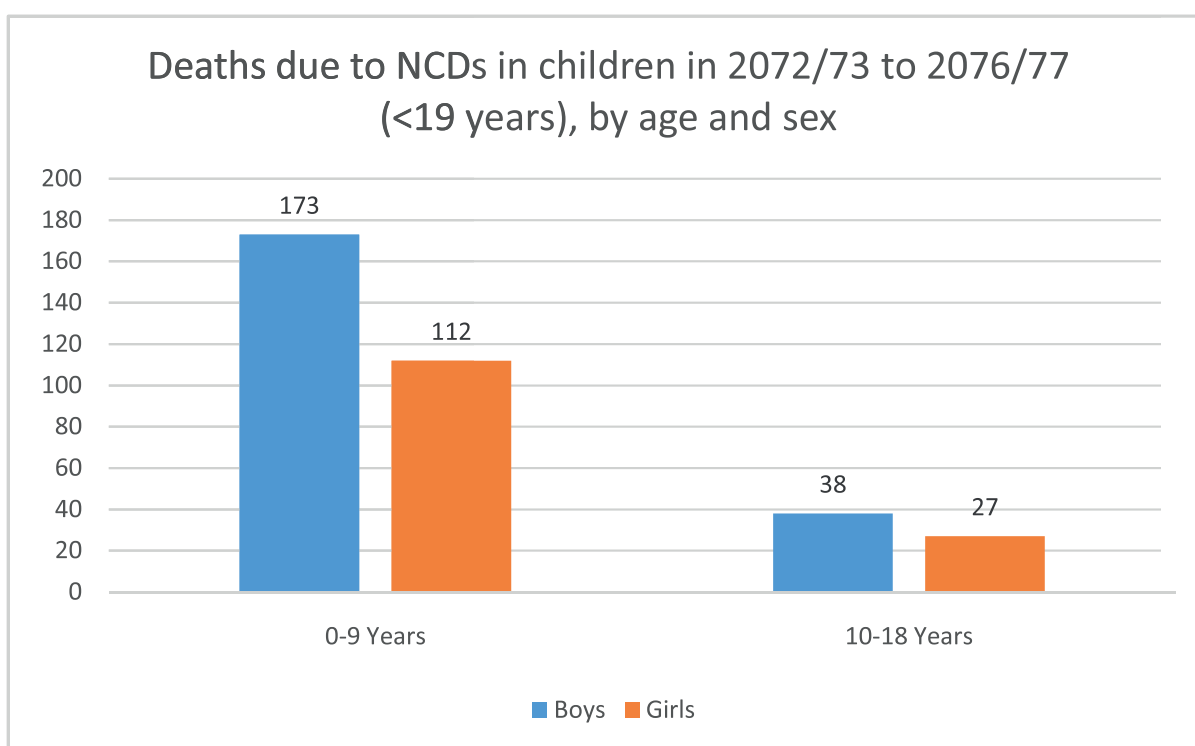


Figure 2 Deaths due to NCDs in children in 2072/73 to 2076/77 (<19 years), by age and sex

Of the total 350 deaths in children due to NCDs (0-18 years), highest death was recorded among age group 0-9 years over the study period. In both the age groups, boys have the higher death rate than girls.

BURDEN OF NCDI IN CHILDREN IN NEPAL

1. Cardiovascular Diseases

Cardiovascular Diseases (CVDs) are group of conditions that affect the heart and blood vessels. CVDs are one of the main causes of death worldwide. CVDs includes coronary artery diseases, stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, abnormal heart rhythms, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis^{16,17}.

The level 3 disease categories under CVDs include aortic aneurysm, ischemic heart disease, non-rheumatic valvular heart disease, stroke, rheumatic heart disease, and other cardiovascular and circulatory diseases. Other cardiovascular and circulatory diseases comprise congestive heart failure, cardiac arrest, heart failure, hypertension, other heart diseases, other vascular diseases, and unspecified heart failure.

Table 4 Distribution of childhood CVD cases from FY 2072/73 to FY 2076/77

Cardiovascular diseases	Admitted (N, %)	Emergency (N, %)
Rheumatic heart disease	1030 (61.3)	832 (64.2)
Stroke	28 (1.7)	16 (1.2)
Non-rheumatic valvular heart disease	9 (0.5)	(0)
Aortic aneurysm	2 (0.1)	(0)
Other cardiovascular and circulatory diseases*	611 (36.4)	447 (34.5)
Total	1680	1295

*Heart failure, hypertension and other vascular disease

Over the study period from FY 2072-2077, the most common cardiovascular conditions were due to rheumatic heart disease, stroke, non-rheumatic valvular heart disease, aortic aneurysms and other cardiovascular disease. Rheumatic heart disease accounts for the highest number of cases of CVD in both admitted (61.3%) and emergency (64.2%) cases (Table 4).

Table 5 Deaths due to cardiovascular diseases in FY 2072/73-FY 2076/77, by sex

Cardiovascular diseases	Boys (N, %)	Girls (N, %)	Total (N, %)
Rheumatic heart disease	6(35.29)	7(46.67)	13(40.63)
Stroke	2(11.76)	3(20)	5(15.63)
Ischemic heart disease	1(5.88)	1(6.67)	2(6.25)
Other cardiovascular and circulatory diseases after disease	8(47.06)	4(26.67)	11(34.38)
Total	17(100)	15(100)	32(100)

*Hypertension and heart failure

Rheumatic heart disease (40.63%) remained one of the most common cause of death among children aged (0-18 Years) over the study period (Table 5).

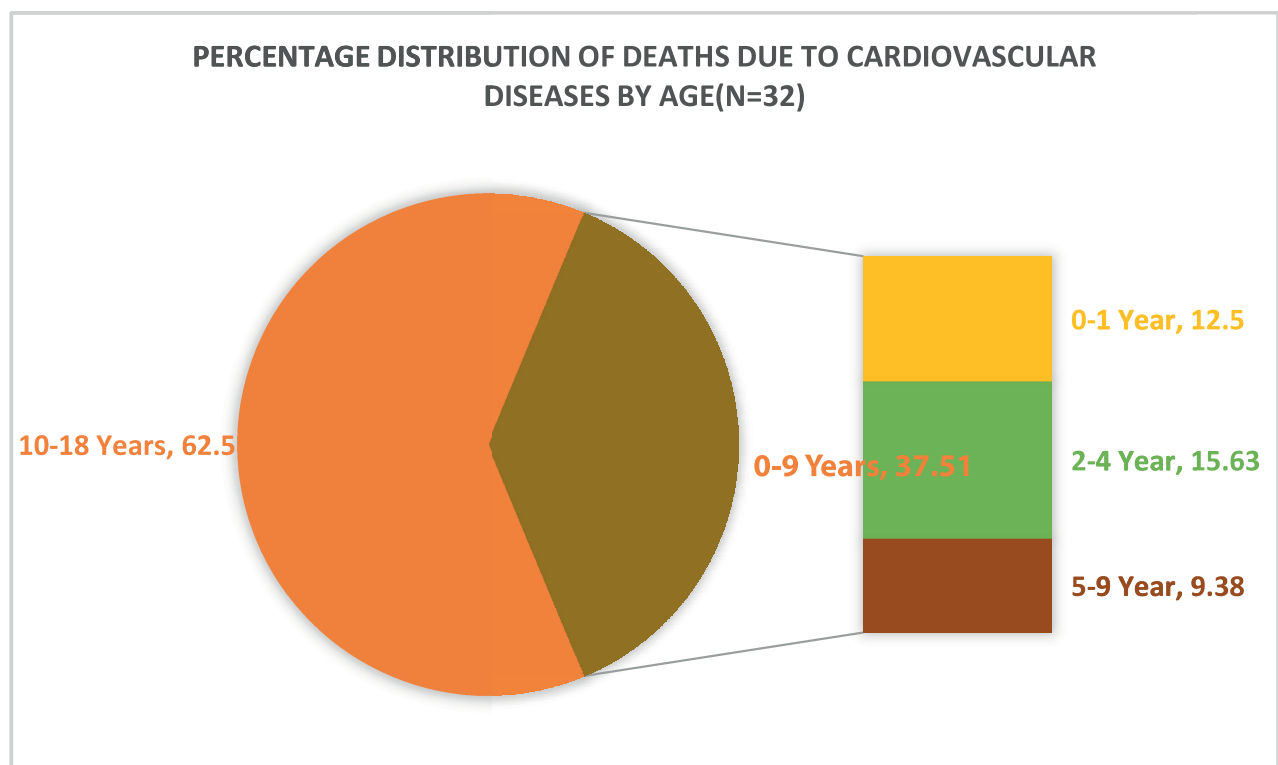


Figure 3 Percentage distribution of deaths due to cardiovascular diseases by age

Out of total deaths due to cardiovascular disease, death among 10-18 years of age group was nearly two third of all cardiovascular deaths. Among the age group 0-9 years, deaths reported was 37.51%.

2. Chronic Respiratory Diseases

Chronic respiratory diseases include diseases like chronic obstructive pulmonary disease, pneumoconiosis, asthma, interstitial lung disease, pulmonary sarcoidosis, and, other chronic respiratory diseases¹⁸. However, this study has only been able to capture the data on asthma in children. Asthma remained the

single most prevalent childhood chronic respiratory diseases with 4810 asthma cases admitted and 4523 cases recorded in emergency over the study period (table 6).

Table 6 chronic respiratory diseases in FY 2072/73-FY 2076/77

Chronic respiratory diseases	Admitted (N, %)	Emergency (N, %)
Asthma	4810 (100)	4523 (100)
Total	4810	4523

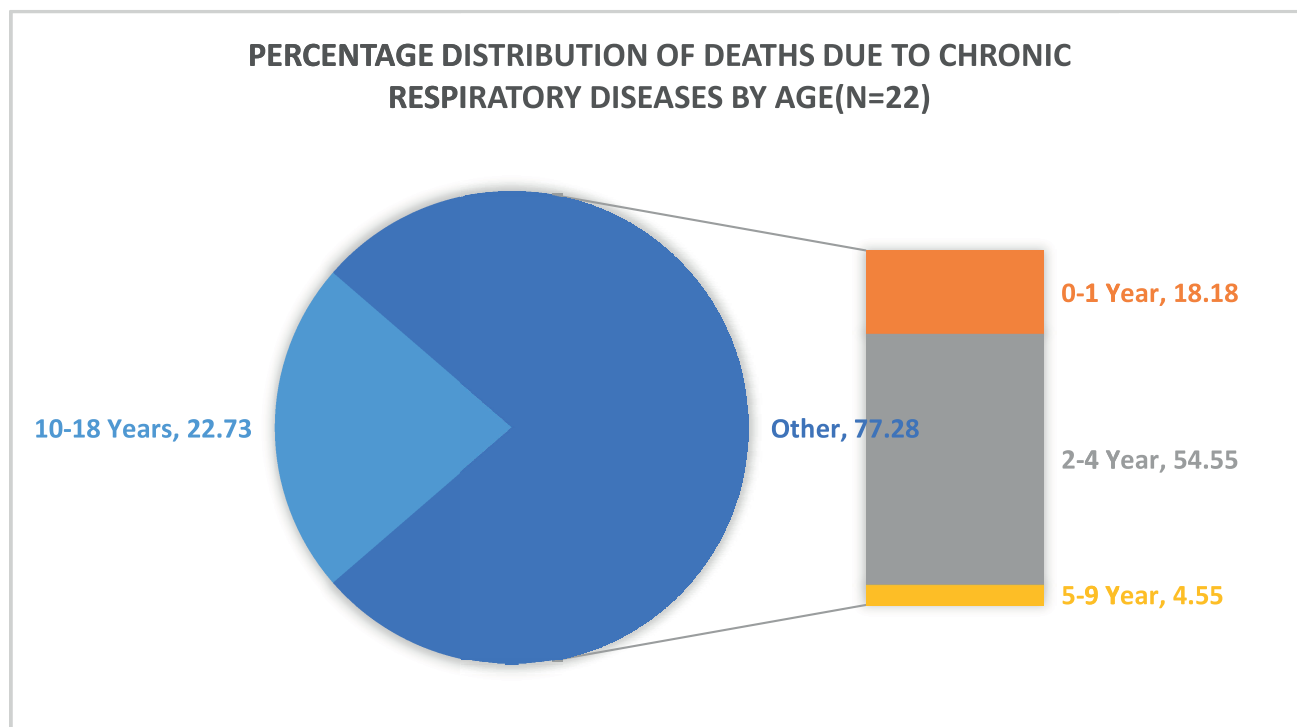


Figure 4 Percentage distribution of deaths due to chronic respiratory diseases by age

Asthma accounted for all the cases of chronic respiratory disease related deaths. Out of total deaths due to chronic respiratory disease, death among 0-9 years of age group was found to be highest (77.28%).

3. Diabetes and kidney Diseases

Diabetes is a chronic metabolic disorder characterized by decreased production of insulin from the pancreas or when the body cannot utilize the insulin effectively¹⁹.

Chronic Kidney Disease (CKD) is a condition characterized by damage to the kidneys leading to gradual loss of kidney function. Damage to the kidneys is caused by various diseases like type 1 or type 2 diabetes, high blood pressure, glomerulonephritis, interstitial nephritis, polycystic kidney disease or other inherited kidney diseases, prolonged obstruction of the urinary tract, from conditions such as, kidney stones and some cancers, vesicoureteral reflux, pyelonephritis²⁰.

Acute glomerulonephritis involves inflammation and subsequent damage of the glomeruli which leads to hematuria, proteinuria, and azotemia. It may be caused by primary renal disease or systemic conditions²¹.

Table 7 Distribution of diabetes and kidney diseases cases from FY 2072/73 to FY 2076/77

Diabetes and kidney diseases	Admitted (N, %)	Emergency (N, %)
Diabetes mellitus	583 (38.2)	489 (55.3)
Chronic kidney disease	575 (37.6)	395 (44.7)
Acute glomerulonephritis	370 (24.2)	(0)
Total	1528	884

Table 7 depicts the most common diabetes and kidney diseases reported over the study period. Diabetes mellitus accounted for 38.2% of admitted cases and 55.3% of emergency cases followed by chronic kidney diseases (37.6% in admitted and 44.7% in emergency)

Table 8 Deaths due to diabetes and kidney diseases in FY 2072/73-FY 2076/77, by sex

Diabetes and kidney diseases	Girls (N, %)	Boys (N, %)	Total (N, %)
Chronic kidney disease	6 (85.7)	2 (66.7)	8 (80)
Acute glomerulonephritis	1 (14.3)	0	1 (10)
Diabetes mellitus	0	1 (33.3)	1 (10)
Total	7	3	10

Majority (80%) of deaths due to diabetes and kidney diseases are attributable to chronic kidney diseases while other causes include acute glomerulonephritis (10%) and diabetes mellitus (10%). (Table 8)

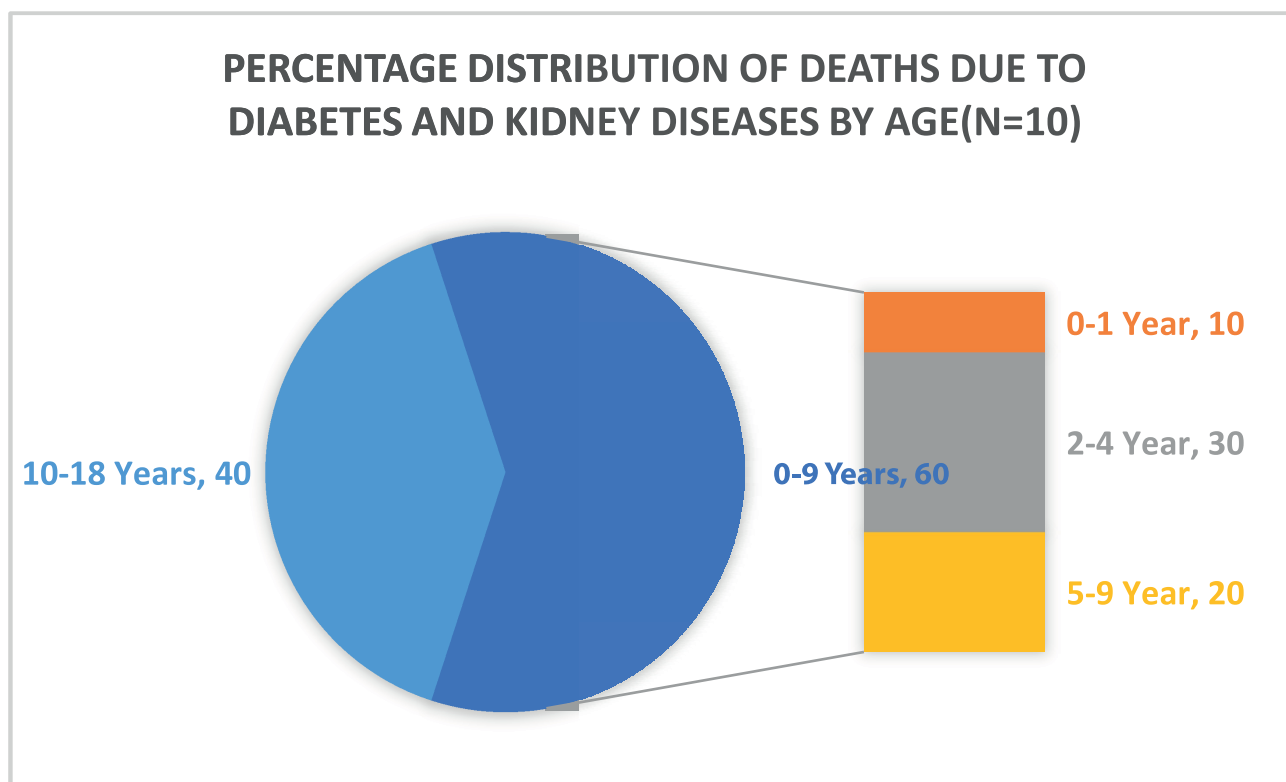


Figure 5 Percentage distribution of deaths due to diabetes and kidney diseases by age

Out of total deaths due to diabetes and kidney disease, death among 0-9 years of age group (60%) was higher than children above 10 years.

4. Digestive diseases

Digestive diseases are health problems that involve the digestive tract which may be mild to severe. This study includes paralytic ileus and intestinal obstruction, inguinal, femoral, and abdominal hernia, upper digestive system diseases, cirrhosis and other chronic liver diseases, appendicitis and gallbladder and biliary diseases²².

Table 9 Distribution of digestive diseases cases from FY 2072/73 to FY 2076/77

Digestive diseases	Admitted (N, %)	Emergency (N, %)
Paralytic ileus and intestinal obstruction	7077 (84.3)	9446 (90.1)
Inguinal, femoral, and abdominal hernia	1297 (15.4)	388 (3.7)
Appendicitis	16 (0.2)	(0)
Cirrhosis and other chronic liver diseases	5 (0.1)	(0)
Upper digestive system diseases	3 (0)	552 (5.3)
Gallbladder and biliary diseases	(0)	10 (0.1)
Other digestive diseases*	(0)	84 (0.8)
Total	8398	10480

* Stomach function disorder

Table 9 shows the digestive diseases reported from FY 2072 to FY 2077 in Nepal. These comprise of paralytic ileus and intestinal obstruction (84.3% among admitted and 90.1% among emergency) followed by inguinal, femoral, and abdominal hernia (15.4% in admitted and 3.7% in emergency).

Paralytic ileus and intestinal obstruction was reported as the only cause of deaths due to digestive disease in the study. Out of all 39 deaths, 29 were reported among boys and 10 among girls.

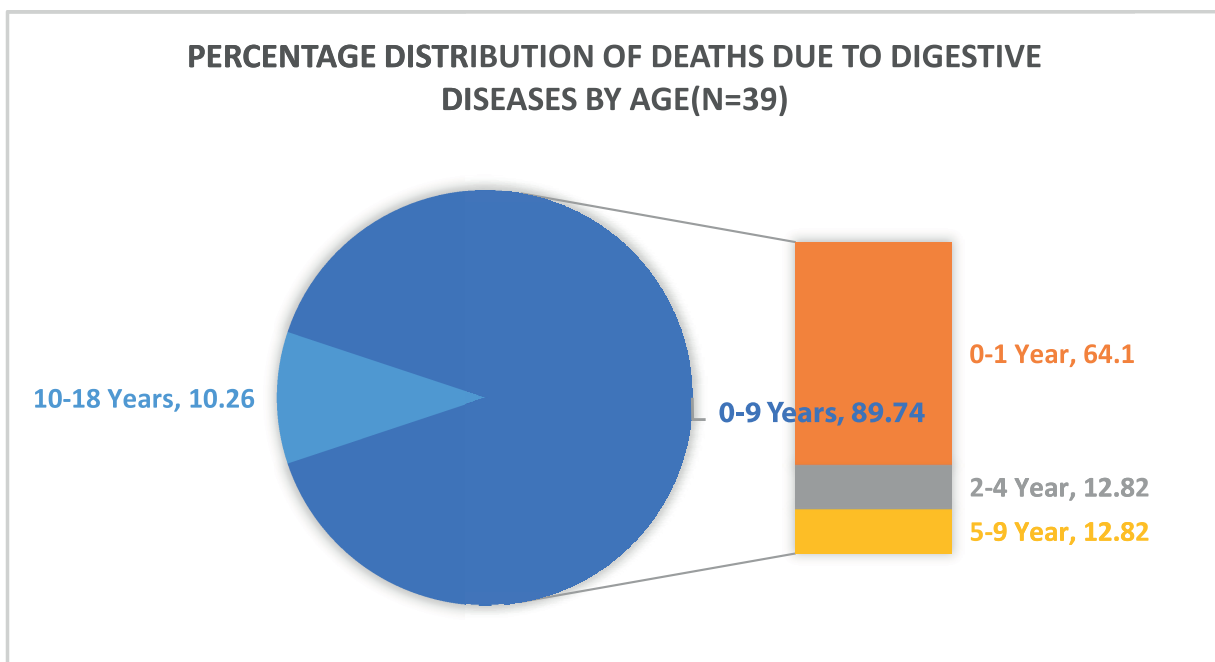


Figure 6 Percentage distribution of deaths due to digestive diseases by age

Out of total deaths due to digestive diseases, death among 0-9 years of age group was higher than children above 10 years.

5. Mental disorders

Mental disorders are conditions that are characterized by the presence of abnormal thinking, perception, mood and behavior²³.

Mental disorders in children were categorized as anxiety disorders, attention-deficit/hyperactivity disorder, autism spectrum disorders, bipolar disorder, conduct disorder, depressive disorders, idiopathic developmental, intellectual disability, other mental disorders and schizophrenia. The distribution of admitted cases of mental disorders in children from FY 2072/73 to FY 2076/77 is given below in table.

Table 10 Distribution of mental disorders cases from FY 2072/73 to FY 2076/77

Mental disorders	Admitted (N, %)	Emergency (N, %)
Schizophrenia	220 (16.9)	54 (4.3)
Depressive disorders	179 (13.8)	91 (7.3)
Anxiety disorders	98 (7.5)	247 (19.7)
Bipolar disorder	16 (1.2)	0 (0)
other mental disorder*	787 (60.5)	859 (68.7)
Total	1300	1251

* Somatization disorder, post-traumatic stress disorder, conversion disorder, mental disorder, psychosis, BPAD, maniac

Other mental disorders such as somatization disorder, post-traumatic stress disorder, conversion disorder, mental disorder, psychosis, BPAD, and maniac were the most common cause of mental disorders (60.5% in admitted and 68.7% in emergency) followed by schizophrenia(16.9% in admitted and 4.3% in emergency), depressive disorder(13.8% in admitted and 7.3% in emergency) , anxiety disorder (7.5% in admitted and 19.7% in emergency), and bipolar disorders (1.2% in admitted) (Table 10).

6. Musculoskeletal Disorders

Musculoskeletal disorders (MSD) are disorders involving the muscles, nerves, tendons, joints, cartilage, and spinal discs. Example include rheumatoid arthritis, osteoarthritis, low back pain, neck pain, gout, developmental dysplasia of hip and duchenne muscular dystrophy²⁴. The musculoskeletal disorders in children included rheumatoid arthritis, low back pain, neck pain, and other musculoskeletal disorders.

Table 11 Distribution of musculoskeletal disorders cases from FY 2072/73 to FY 2076/77

Musculoskeletal disorders	Admitted (N, %)	Emergency (N, %)
Low back pain	0 (0)	331 (99.1)
Other musculoskeletal disorders*	48 (75)	3 (0.9)
Uncategorized**	16 (25)	0 (0)
Total	64	334

*Duchenne muscular dystrophy, developmental dysplasia of hip

** Muscular disorder

Table 11 shows the distribution of musculoskeletal disorders over the study period. Overall, low back pain (99.1%) was the single most common cause of musculoskeletal disorders in emergency followed by other musculoskeletal disorders (75%) among admitted cases. Other musculoskeletal disorders comprise developmental dysplasia of hip and duchenne muscular dystrophy.

7. Neoplasm

Neoplasm is mass of tissue formed due to abnormal and excessive growth of cells. They can be benign or malignant. The neoplasms included in this study are non-hodgkin lymphoma, leukemia, hodgkin lymphoma, brain and nervous system cancer, nasopharynx cancer, non-melanoma skin cancer, melanoma, cervical cancer, gallbladder and biliary tract cancer²⁵.

Table 12 Distribution of neoplasms cases from FY 2072/73 to FY 2076/77

Neoplasms	Admitted (N, %)	Emergency (N, %)
Non-Hodgkin lymphoma	1167 (52.9)	191 (13.7)
Leukemia	297 (13.5)	271 (19.4)
Hodgkin lymphoma	150 (6.8)	105 (7.5)
Non-melanoma skin cancer	13 (0.6)	(0)
Brain and nervous system cancer	12 (0.5)	18 (1.3)
Kidney cancer	9 (0.4)	19 (1.4)
Cervical cancer	4 (0.2)	0 (0)
Gallbladder and biliary tract cancer	1 (0)	0 (0)
Other malignant neoplasms*	233 (10.6)	791 (56.7)
Other neoplasms**	319 (14.5)	(0)
Total	2205	1395

* Malignant cancer, malignant neoplasm

** Benign tumors, other cancer

The commonest neoplasm reported in children was Non-Hodgkin's lymphoma (52.9% in admitted and 13.7% in emergency), followed by other neoplasm such as benign tumors and other cancers (14.5% in admitted), leukemia (13.5% in admitted and 19.4% in emergency) (Table 12).

Table 13 Deaths due to neoplasms in FY 2072/73-FY 2076/77, by sex

Neoplasms	Boys (N, %)	Girls (N, %)	Total (N, %)
Leukemia	21(84)	8(88.89)	29(85.29)
Liver cancer	1(4)	(0)	1(2.94)
Hodgkin lymphoma	1(4)	0(0)	1(2.94)
Brain and nervous system cancer	1(4)	(0)	1(2.94)
Kidney cancer	(0)	1(11.11)	1(2.94)
Other malignant neoplasms	1(4)	(0)	1(2.94)
Total	25	9	34

Leukemia (85.3%) was the commonest cause of death due to neoplasm during the study period. (Table 13).

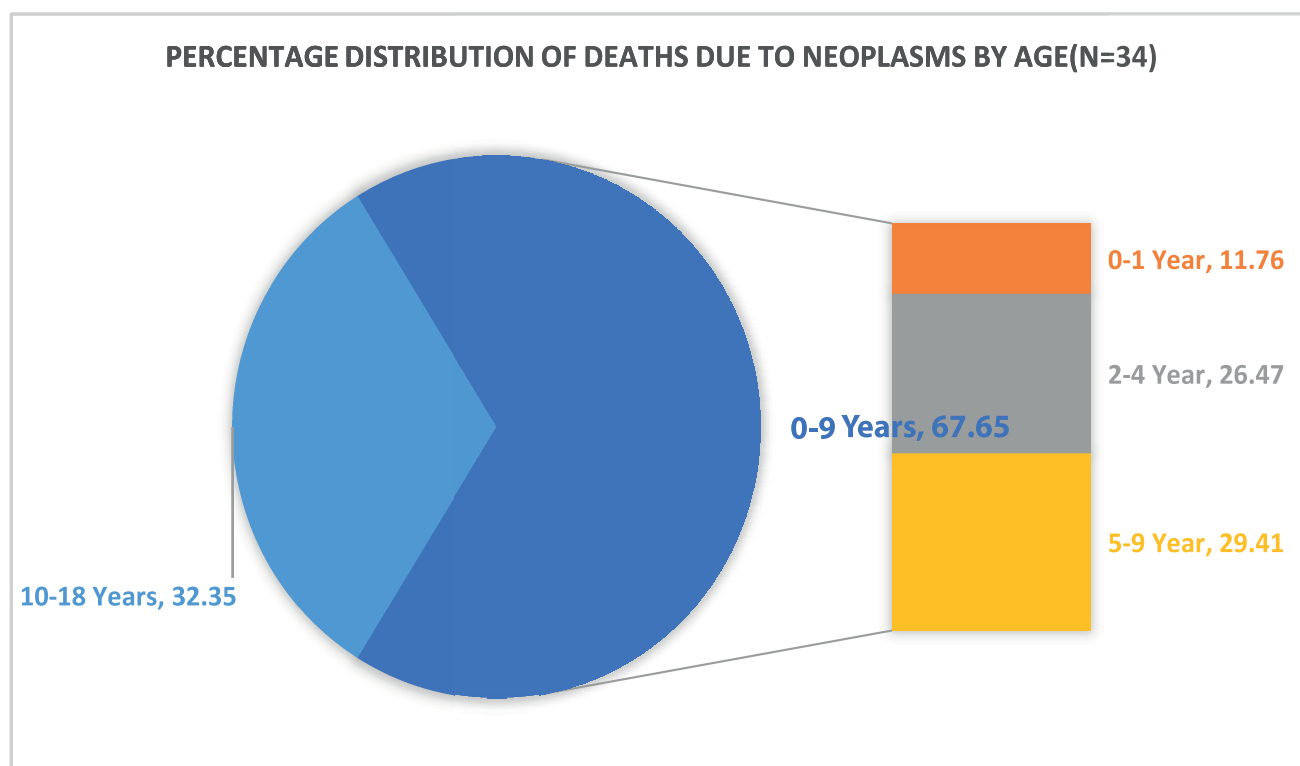


Figure 7 Percentage distribution of deaths due to neoplasms diseases by age

Out of total deaths due to neoplasm disease, death among 0-9 years of age group was more than double than that in children above 10 years. Among the age group 0-9 years, deaths reported in infants was 11.76%. Age group 2-4 years and 5-9 years were responsible for 26% and 29% of death, respectively.

8. Neurological disorders

Neurological disorders are disorders involving the nervous system (brain, spinal cord, and nerves)²⁶. The neurological disorders included in this study are headache disorders and other neurological disorders (vertigo, bells palsy, cerebral palsy, CNS disease, hydrocephalus, seizure disorder, neuropathy, paralysis, GB syndrome, retts syndrome). The distribution of neurological disorders is given below:

Table 14 Distribution of neurological disorders from FY 2072/73 to FY 2076/77

Neurological disorders	Admitted (N, %)	Emergency (N, %)
Headache disorders	2 (0)	(0)
Other neurological disorders *	7244 (100)	8460 (100)
Total	7246	8460

* Vertigo, bells palsy, cerebral palsy, CNS disease, hydrocephalus, seizure disorder, neuropathy, paralysis, GB syndrome, retts syndrome

During the study period, other neurological disorders were found to be the most common cause of neurological disorder followed by headache among both admitted and emergency cases (Table 14).

Table 15 Deaths due to Neurological disorders in FY 2072/73-FY 2076/77, by sex

Neurological disorders	Girls (N, %)	Boys (N, %)	Total (N, %)
Epilepsy	12 (80)	29 (87.9)	41 (85.4)
Other neurological disorders*	3 (20)	4 (12.1)	7 (14.6)
Total	15	33	48

*hydrocephalus, retts syndrome, cerebral palsy, paralysis, bell’s palsy, neuropathy, vertigo/dizziness, CNS diseases

Majority (85.4%) of deaths due to epilepsy are attributable to neurological disorder while other causes include other neurological disorders (14.6%). (Table 15).

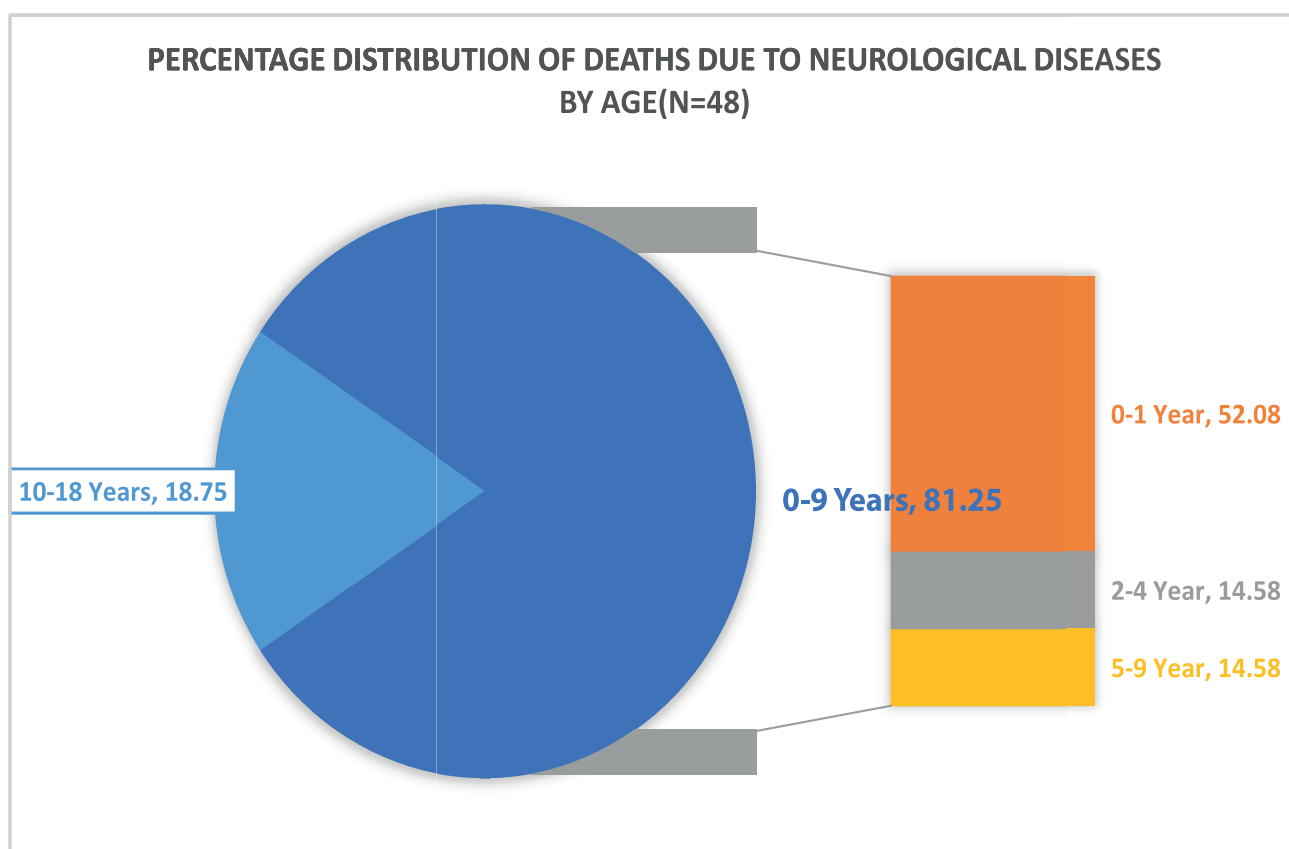


Figure 8 Percentage distribution of deaths due to neurological diseases by age

Out of total deaths due to neurological disease, death among 0-9 years of age group was more than four fold higher than the same in children above 10 years. Among the age group 0-9 years, deaths reported in infants was 52%. Similarly age group 2-4 years and 5-9 years contributes equal percent i.e. 14.58% in death count.

9. Other non-communicable diseases

Other non-communicable disease of children comprises of congenital birth defects, endocrine, metabolic, blood, and immune disorders, hemoglobinopathies and hemolytic anemia. The distribution of other non-communicable diseases in children is shown in the table below:

Table 16 Distribution of other non-communicable diseases from FY 2072/73 to FY 2076/77

Other non-communicable diseases	Admitted (N, %)	Emergency (N, %)
Congenital birth defects	3310 (50.8)	2679 (46.2)
Endocrine, metabolic, blood, and immune disorders	1824 (28)	1310 (22.6)
Hemoglobinopathies and hemolytic anemias	1180 (18.1)	1357 (23.4)
Urinary diseases	205 (3.1)	457 (7.9)
Total	6519	5803

Majority of the other non-communicable diseases were caused by congenital birth defects (admitted 50.8% and emergency 46.2%) followed by endocrine, metabolic, blood and immune disorders, hemoglobinopathies and hemolytic anemia's and urinary diseases. Congenital birth defects included congenital heart anomalies, down syndrome, tracheoesophageal fistula, hypospadias, undescended testes, hirschsprung disease, anorectal malformation, cleft lip and palate, spina bifida, etc. Endocrine, metabolic, blood and immune disorders included idiopathic thrombocyticpurpura, coagulation disorders, disseminated intravascular coagulation, iron deficiency anemia, hypothyroidism, diabetic ketoacidosis, allergy, hench-schonlein purpura, systemic lupus erythematosus, etc. Hemoglobinopathies and hemolytic anemias included sickle cell disease, thalassemia, hemophilia, factor XIII deficiency, etc. Urinary diseases include phimosis, urinary calculus, hydronephrosis, uropathy, and urinary calculus (Table 16).

Table 17 Distribution of congenital birth defects from FY 2072/73 to FY 2076/77

Congenital birth defects	Admitted (N, %)	Emergency (N, %)
Congenital heart anomalies	3050 (92.1)	2113 (78.9)
Digestive congenital anomalies	83 (2.5)	423 (15.8)
Down syndrome	81 (2.4)	122 (4.6)
Neural tube defects	0 (0)	2 (0.1)
Orofacial clefts	9 (0.3)	8 (0.3)
Urogenital congenital anomalies	67 (2)	10 (0.4)
Other congenital birth defects*	20 (0.7)	1 (0)
Total	3310	2679

* Hemangioma, hypospadias, other birth injuries

Congenital heart anomalies (92.1% in admitted and 78.9% in emergency) was the commonest congenital birth defects reported in children followed by digestive congenital anomalies (2.5% in admitted and 15.8% in emergency), down syndrome (2.4% in admitted and 4.6% in emergency) (table 17).

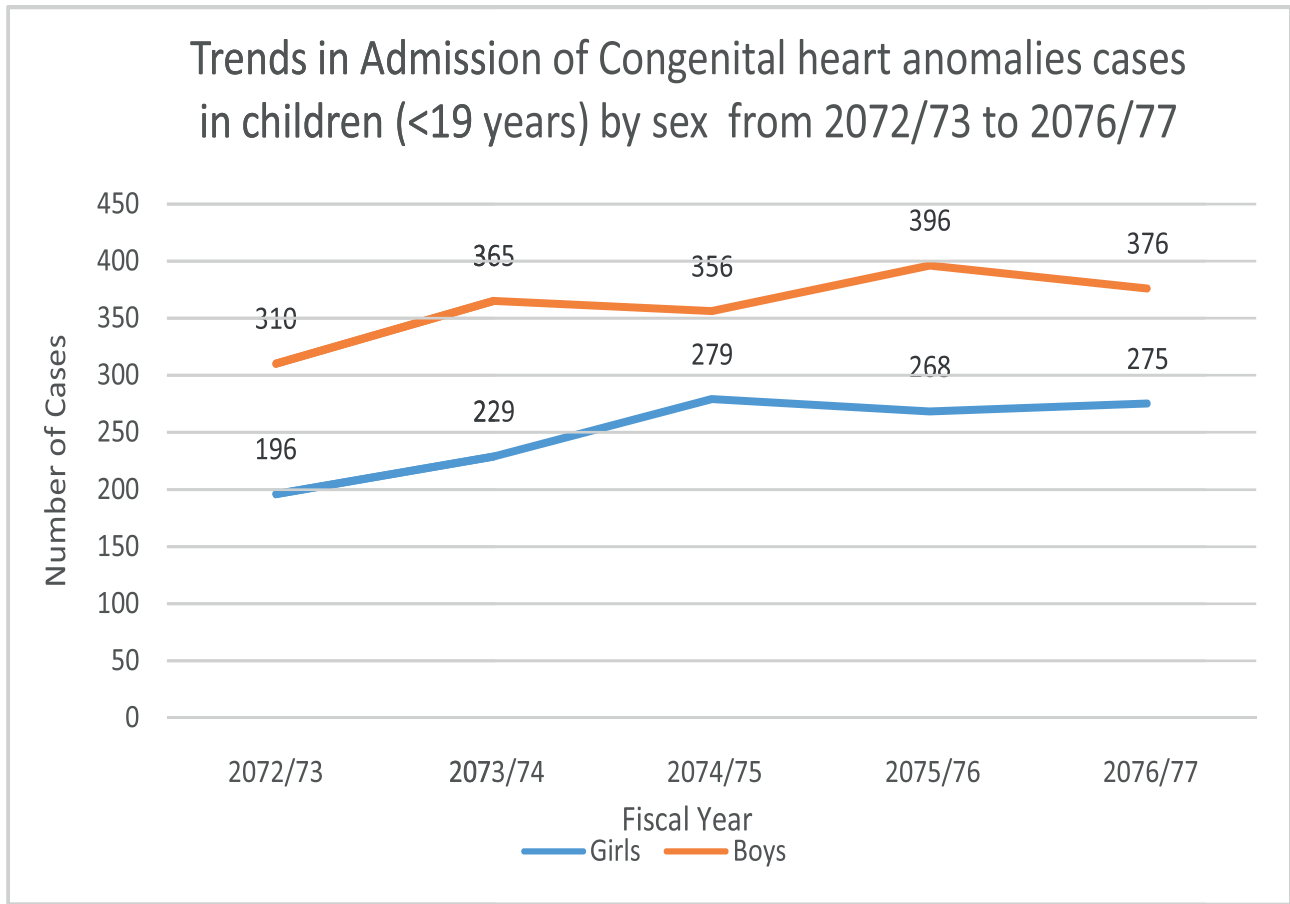


Figure 9 Trends in prevalence of congenital heart anomalies in children (0-18 years) by sex

Figure 9 demonstrates a higher number of cases of congenital heart anomalies in boys than in girls (0-18 years) years during the study period.

Table 18 Deaths due to other Non-communicable diseases in FY 2072/73-FY 2076/77, by sex

Other non-communicable diseases	Boys (N, %)	Girls (N, %)	Total (N, %)
Congenital birth defects	81(88.04)	65(91.55)	146(89.57)
Endocrine, metabolic, blood, and immune disorders	4(4.35)	2(2.82)	6(3.68)
Hemoglobinopathies and hemolytic anemias	7(7.61)	4(5.63)	11(6.75)
Total	92	71	163

Congenital birth defects (89.6%) accounted for the majority of other non-communicable disease related deaths followed by Hemoglobinopathies and hemolytic anemia (6.75%) and Endocrine, metabolic, blood, and immune disorders (3.68%).

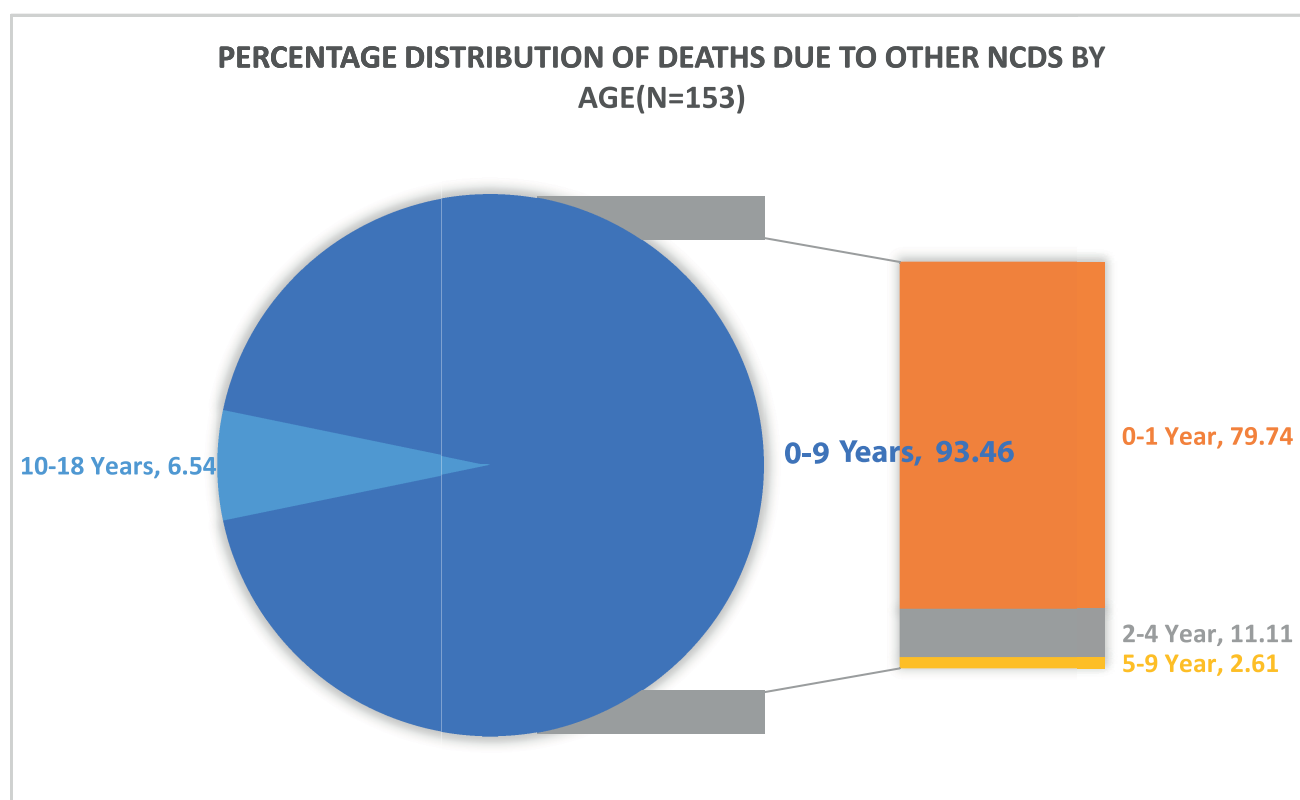


Figure 10 Percentage distribution of deaths due to other NCDs by age

Out of total deaths due to other NCDs, death among 0-9 years of age group was higher than children above 10 years. Among the age group 0-9 years, deaths reported in infants was 79.74%. Similarly, age group 2-4 years and 5-9 years contributes 11.11% and 2.61% respectively.

10. Skin and subcutaneous diseases

Skin and subcutaneous diseases includes dermatitis, psoriasis, bacterial skin disorders, scabies, fungal skin diseases, viral skin, diseases, acne vulgaris, alopecia areata, pruritis, urticarial, decubitus ulcer and other skin and subcutaneous diseases according to the global burden of disease classification for NCDI. In this study, the skin and subcutaneous diseases consisted of dermatitis and other skin and subcutaneous diseases, which included boil, carbuncle and allergic purpura in this study.

Table 19 Distribution of skin and subcutaneous diseases from FY 2072/73 to FY 2076/77

Skin and subcutaneous diseases	Admitted (N, %)	Emergency (N, %)
Dermatitis	31 (57.4)	501 (49.1)
Bacterial skin diseases	(0)	155 (15.2)
Other skin and subcutaneous diseases*	23 (42.6)	364 (35.7)
Total	54	1020

*Allergic purpura, boil/carbuncle

Dermatitis accounted for majority (57.4% in admitted and 49.1% in emergency) of the skin and subcutaneous cases followed by other skin and subcutaneous diseases (42.6% in admitted and 35.7% in emergency) and bacterial skin disease (15.2% in emergency) (Table 19).

11. Substance use disorders

Substance use disorder is a disorder which is characterized by uncontrolled use of a substance by a person despite knowing about its harmful consequences. The disorder categories under substance use disorders include drug use disorders and alcohol use disorders

Table 20 Distribution of substance use disorders from FY 2072/73 to FY 2076/77

Substance use disorders	Admitted (N, %)	Emergency (N, %)
Drug use disorders	21 (100)	9 (25.7)
Alcohol use disorders	(0)	26 (74.3)
Total	21	35

Table 20 shows common substance use disorders among children reported during the study duration. In this study, admitted cases of the substances use disorder were attributable to drug use disorders while in emergency about three fourths of cases were due to alcohol use disorder and the remaining were due to drug use.

12. Injuries

Injuries are bodily damage caused by accidents, falls, hits, weapons, self-harm, interpersonal violence, road injuries, animal contact, drowning, environmental heat and cold exposure, falls, fire, heat and hot substances, foreign body and poisonings and other causes. The causes can be intentional or unintentional²⁷.

The unintentional injuries categories included animal contact, drowning, environmental heat and cold exposure, falls, fire, heat and hot substances, foreign body and poisonings

Table 21 Distribution of injuries from FY 2072/73 to FY 2076/77

Injuries	Admitted (N, %)	Emergency (N, %)
Unintentional injuries	12649 (41.9)	23095 (45.7)
Falls	6355 (50.2)	11520 (49.9)
Fire, heat, and hot substances	3335 (26.4)	3391 (14.7)
Animal contact	1295 (10.2)	3193 (13.8)
Poisonings	1078 (8.5)	2089 (9)
Foreign body	290 (2.3)	2418 (10.5)
Drowning	262 (2.1)	341 (1.5)
Exposure to forces of nature	33 (0.3)	134 (0.6)
Environmental heat and cold exposure	1 (0)	(0)
Adverse effects of medical treatment	(0)	9 (0)
Transport injuries	9532 (31.6)	10996 (21.7)
Road injuries	9532 (100)	10996 (100)
Self-harm and interpersonal violence	2401 (8)	3742 (7.4)

Self-harm	1782 (74.2)	1824 (48.7)
Interpersonal violence	619 (25.8)	1918 (51.3)
Unspecified injuries	5591 (18.5)	12748 (25.2)
Unspecified injuries*	5591 (100)	12748 (100)
Total	30173 (47.1)	50581 (58.8)

*Cut injuries, eye injury, head injuries, fracture of upper and lower limb, birth injuries, spinal cord injuries.

Injuries in the under 18 population reported during the study period included self-harm and interpersonal violence, transport injuries and unintentional injuries. In case of unintentional injuries, the most common cause included falls (50.2% in admitted and 49.9% in emergency), fire, heat and hot substances (26.4% in admitted and 14.7% in emergency) followed by animal contact (10.2% in admitted and 13.8% in emergency). The unintentional injuries reported in the study comprise of drowning, burn, falls, flooding, venomous animal bite, foreign body eye, nose, larynx and bronchus, frostbite, and poisoning. Three fourth admitted cases of self-harm and interpersonal violence were due to self-harm while rest was due to interpersonal physical assault, rape, etc. However, in case of the emergency the ratio is similar between the two. All of the transport injuries were resultant to road traffic accidents. The unspecified injuries reported in this study included cut injuries, eye injury, head injuries, fracture of upper and lower limb, birth injuries, spinal cord injuries, etc. (Table 21).

Table 22 Deaths due to injuries in FY 2072/73-FY 2076/77, by sex

Injuries	Boys (N, %)	Girls (N, %)	Total (N, %)
Self-harm and interpersonal violence	24	58	82
Self-harm	24 (100)	58 (100)	82 (100)
Transport injuries	66	28	94
Road injuries	66 (100)	28 (100)	94 (100)
Unintentional injuries	91	82	173
Animal contact	26(28.57)	18(21.95)	44(25.43)
Falls	25(27.47)	20(24.39)	45(26.01)
Fire, heat, and hot substances	20(21.98)	16(19.51)	36(20.81)
Poisonings	11(12.09)	18(21.95)	29(16.76)
Drowning	9(9.89)	8(9.76)	17(9.83)
Exposure to forces of nature	0(0)	2(2.44)	2(1.16)
Uncategorized injuries	9	7	16
Uncategorized injuries	9 (100)	7 (100)	16 (100)
Total	190	175	365

In this study, causes of death due to injuries in the under 18 population reported during the study period included self-harm and interpersonal violence, transport injuries and unintentional injuries. Majority of the deaths due to injuries were caused by unintentional injuries such as animal contact, falls, fire, heat and hot substances, poisoning, etc., followed by transport injuries and self-harm and interpersonal violence (Table 22).

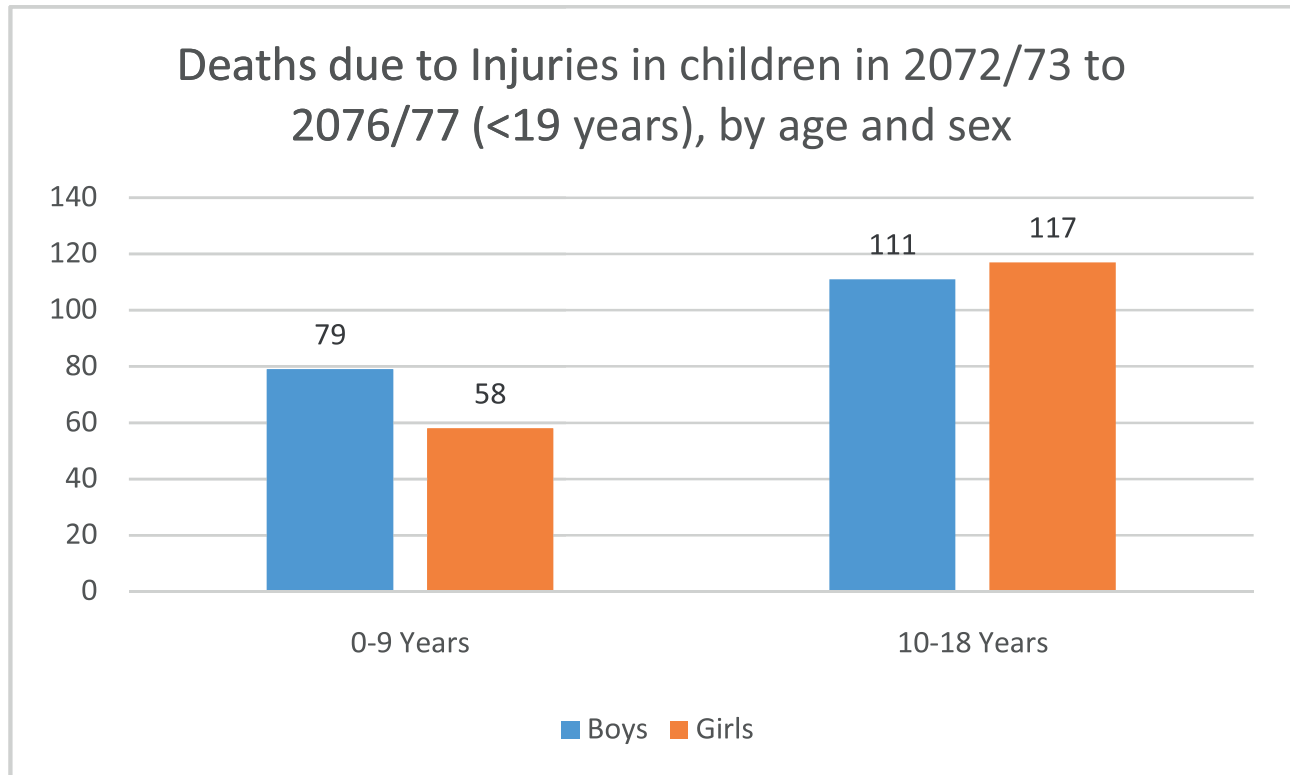


Figure 11 Distribution of deaths due to injuries by age and sex

Of the total 376 deaths in children (0-18 years) due to injuries over the study period, higher number of death was recorded among age group 10-18 years. Among 0-9 years of age group, boys accounted for higher number of death, similarly for 10-18 years, death was observed nearly equal for both sex.

FINDINGS FROM QUALITATIVE STUDY – KEY INFORMANT INTERVIEW

Key informant interviews (KIIs) were conducted among hospital directors/pediatric in-charge/specialists of all selected hospitals. Altogether 15 KIIs were conducted under the guiding question regarding burden and facilities of childhood NCDIs in Nepal. Six major themes emerged regarding participants in regards to childhood NCDI in Nepal: (1) Burden of disease; (2) Hospital Services; (3) Facilitators and Barriers; (4) Gap in assessing and addressing for NCDIs; (5) Strategy and Intervention; and (6) Community response toward hospital services.

Burden of disease

According to our key participant, road traffic accidents, heart disease, respiratory diseases, cancer, diabetes and congenital health problems were the leading cause of hospital visits. Among them, the majority of participants perceived that there was a high flow of injury-related cases at tertiary level hospitals of Nepal, followed by heart disease and diabetes among children less than 18 years old.

One of the participant stated about the burden of injuries in their hospital as:

“In villages and rural settings, the most common health issue is trauma and if the patients do not receive proper health care services on time and appropriate health services, they could end up with long-term disability which in turn affects the country as a whole.” KII_1

Another participant informed about the major burden among children to be CVDs as: *“Many children arrive here with cardiac problems such as congenital heart disease which is common under 5 years and also Rheumatic Heart Disease used to be common among these groups” KII_2*

However, cancer, blood-related disorder and animal bite were found to be major non-communicable diseases among children less than 18 years of age group in one of the hospitals as the informant quotes: *“Blood disorders, e.g., patients of blood cancer, patients of thalassemia, and patients of hemophilia also visited the pediatric OPD of this hospital.” KII_9*

The burden of other non-communicable diseases perceived by one of the informants at the tertiary level hospital were malnutrition-related diseases, mental disorders, neurological diseases, and poisoning/ suicide who also mentions the concern about over-nutrition problem among children: *“Regarding malnutrition, only under-5 nutrition is a topic of concern and besides 5 major killer diseases; other nutrition-related diseases are neglected. Similarly, only undernutrition has been the topic of concern for us, and over-nutrition is hardly talked about.” KII_1*

Other participants also show deep concern on the mental health issues saying *“... among mental health problems, anxiety disorders were found to be the most common problems. ... Also few of suicidal tendency cases arrived. However, committing self-harm like ingestion of poison is most common act of self-harm among the adolescent girls” KII_12*

“Patients with cerebral palsy, epilepsy and muscular dystrophy and others genetic disorders like down’s syndrome also visit our hospital” KII_2

Hospital services

Since the hospitals which were selected for this study were tertiary level hospitals, it was found that all hospitals provided basic healthcare service and they had sufficient infrastructure to care for ill children who visited there. All hospitals were providing OPD, emergency services and IPD services. However, all hospitals did not have well-equipped NICU, PICU and HDU units. Two of the key informants stated the situation about their hospital as:

“We claim that there is no qualified manpower and modern ICU in Madhesh province except National Medical College. We have twenty-five NICU beds in our hospital. We have qualified doctors for NICU but there are not enough well-facilitated ventilators in Madhesh province except National Medical College.” KII_9

“We have only 6 PICU beds and soon we have a plan to increase up to 15 beds.” KII_12

All hospitals have basic diagnostic facilities for NCDs for children less than 18 years of age. However, some special tests were not performed at all hospitals and they send the sample to another diagnostic center.

“We have all the basic lab facilities like complete blood count, renal function test, stool test, etc. But we don't have advanced facilities. We also have digital X-ray facilities which help us to assess trauma.” KII_1

Some tertiary level hospitals have a community program to care for children which is mainly focused on nutrition and communicable diseases. The key informants talk about the community program as: *“We are conducting programs like health camps during disasters at the community level either in coordination with other organizations or alone. We are also conducting programs like deworming, health education, and nutrition programs.”* KII_10

Few hospitals were providing counseling to mothers and other caretakers to improve the nutritional status of children.

“As a pediatrician in a pediatric hospital, we have the opportunity to counsel mothers about the importance of exclusive breastfeeding and raising awareness about non-communicable diseases through discussion and education.” KII_11

Some hospitals have started an initiative of rehabilitation homes for children's care informant states:

“Hospitals are providing the basic level services like for malnutrition. We have a nutrition rehabilitation home for malnourished children.” KII_4

Most of the hospitals have child specialist service. However, some hospitals have only general pediatricians. So, the clinical services were not the same in all hospitals. Some of the responses we got are:

“We don't have a pediatric cardiologist in our center. That's why we just do ECHO screening if we suspect cardiac disease.” KII_8

“We have a pediatric endocrine clinic which provides endocrine-related services like thyroid, diabetes along with other super specialty care related to endocrine.” KII_2

Facilitators and barriers

There are certain positive influencing factors that facilitate the provision of health services by tertiary hospitals. In tertiary hospitals, the availability of specialized doctors and nurses with appropriate training and capacity facilitates childhood NCDI service. However, some hospitals had different barriers to providing healthcare. However, they were also serving the needy patients at their hospital.

Certain hospitals have well-trained staff. Therefore, they feel it is easy to provide good health services for children. One informant stated:

“We have a nurse with specialization in pediatrics who is in charge in the Maternal and child health (MCH) and immunization. Besides that, we have nursing sisters from the pediatric background. I don't know the exact data but here are some sisters with a pediatric background.” KII_12

Lack of specialized human resources and frequent transfer of staff were considered as important challenges in delivering NCDs and other healthcare services at tertiary level hospitals.

“Most of the health workers are basic; you can take an example of mine. I will be working here for two more years and leave once my contract is over.” KII_5

Some hospitals did not have well-trained staff. Therefore, they felt it was difficult to provide good childcare at their hospitals who said, *“We don’t have trained manpower. For example, we are planning to add an ICU and PICU so trained nursing staff and medical officers are required.”* KII_5

“The third and the most important limitation is that sub-specialty services like pediatric ENT, cardiology, ophthalmology, surgery are available at different locations so they have to be referred to different places.” KII_14

Gap in assessing and addressing for NCDIs

Despite the increasing burden of childhood NCDI in Nepal, the readiness in terms of access to and utilization of NCD services has remained one of the major challenges. Informants stressed the importance of coordination and reviewing of hospital data that could guide and provide information for future NCD services more effectively. One informant stated: *“Although we generate data, it is not reviewed so thorough data review and discussion, we can assess how impactful our services are regarding child care and also identify the areas for improvement.”* KII_1

The majority of participants felt that there was no coordination between the federal government, provincial government and local government to run health institutions properly. Most of them perceived that this was one of the major causes due to which health services were not improving. One of the informants speaks out as:

“There is no coordination for child health policy in Madhesh province. There are few health policies related to child health in Madhesh province. I have already been told that there is no coordination between Local level, Provincial level and Federal level.” KII_9

Few informants had felt that there was a need to assess policy related to child health and disease and some also perceived that there was no proper planning for resource allocation. One of them states: *“We have many issues that are to be responded to; we have a gap in policy like recently NCDI in adults has been included in our policy but as I said before, we still lack behind in NCDI among children.”* KII_4

Strategy and Intervention

There are limited health promotion activities at the population level that focus on detecting childhood NCDI. However, some tertiary hospitals of Nepal have their strategy and intervention to manage non-communicable diseases among under 18 years old children.

Few hospitals have a strategy to build new buildings to manage the burden of non-communicable diseases. As well as, a few hospitals were thinking of increasing the number of ICU and PICU to manage NCDI cases in tertiary care centers. One informant expressed that: *“Recently we have 6 PICU beds and in the near future, we are planning to have a minimum 12 beds or 15 beds PICU or HDU unit.”* KII_12

Only a few participants suggested that guardians should do regular checkups of their children. It will help to know about the status of the non-communicable disease at an essential phase of disease development. One of the participants suggested saying: *“Similarly, one thing is that regular check-ups must be done and the public should know that children may also have non-communicable diseases like diabetes as diabetes not only affects the adult but may also occur among children.”* KII_5

Few hospitals have arranged screening programs for non-communicable diseases for children under 18 years of age. Informant briefs the program as:

“We can run specialized clinics for non-communicable diseases, we can also allocate a special day for non-communicable diseases and if the government of Nepal, Ministry of Health and Population will support us we can run those clinics non-communicable diseases in our department by giving a specific day of a week. Like the first day of the week and run a Rheumatic heart disease clinic.” KII_11

Some of the hospitals have prepared treatment protocols to manage the cases of non-communicable diseases. They highlight the importance of the treatment protocol for each childhood illness saying:

“For each topic, we need to create a protocol. We developed a pediatric treatment protocol that is used in all facilities, from emergency to beyond, and that should be improved on a daily basis. We have all of the pediatric treatments in that protocol, with various protocols for communicable and non-communicable diseases.” KII_13

Child education has an important role to intervene in the NCDIs, which is also highlighted by one of the participants who quotes:

“There should be educational program in school to teach about the traffic rules and road safety. The school should teach the students that they have to cross the road from the allocated area, how to walk, how to reach home because everyone does not travel in a school bus.” KII_9

Other participants highlight about the role of community ANC visits to intervene in non-communicable and congenital diseases: *“In addition to this, the ANC program helps to provide neonatal care as well as reduces the risk of other childhood illnesses that might occur in the future.” KII_1*

Community response toward hospital services

In general, the response of the public towards healthcare delivery is satisfactory. However, they have felt that patients need to pay a lot of money to treat their condition. One informant speaks about the health care cost as: *“People also complain about the high cost of services in TUTH despite being a public or general government hospital but overall patients are satisfied.” KII_14*

Few informants had not perceived that the community people to be entirely satisfied with hospital services and pointed out that there are rooms for improvement: *“We had a mixed perception from the guardians towards the treatment provided from this hospital. I cannot say that 100% were satisfied with our services however the percentage of satisfied people is high.” KII_10*

CONCLUSION & RECOMMENDATION

This study suggests that NCDIs are common among children and adolescent (0-18years) and its emergence as public health problems in Nepal. Digestive disease, neurological disorders and chronic respiratory diseases were the most prevalent (level 2) types of childhood NCD. Similarly, unintentional injuries, transport injuries and uncategorized injuries were the most prevalent injuries among children. Paralytic ileus and intestinal obstruction, other neurological disorders and asthma were the leading (level 3) causes of hospital visits. Among injuries (level 3), road injuries, falls and uncategorized injuries were the leading causes of hospital visits. Neurological disorder and other non-communicable disease were the most common cause of NCD related death. Unintentional injuries were the commonest cause of injuries related death. Therefore; there is a need to strengthen the health system to work towards childhood NCDI and capacitate the tertiary health facilities to enhance their infrastructure and health care workers to cater to the increasing NCDI cases. Problems associated with incomplete medical record-keeping, garbage code, missing data and under-reporting were observed in the current study. Hence, the healthcare workers should be trained regarding ICD-10 coding of inpatient admissions at health facilities for the better reporting and surveillance of NCDI in the long term. Furthermore, electronic health record (EHR) should be established with a unique identifier assigned to each patient to strengthen the recording and reporting system in NCDI care. This study recommends for a nationwide population based study to quantify the actual burden with risk factors of Childhood NCDI for policy formulation and design intervention.

LIMITATION OF THE STUDY

Even though this study has come up with important findings regarding the burden of childhood NCDI in Nepal, there are a number of limitations with our study warrant cautious interpretation of its findings. Firstly, due to the lack of standardized GBD classification for NCDIs in children and adolescents, we finally adopted GBD classification for adults which may not be well suited for children and adolescents, further limiting the true magnitude of our findings. Secondly, our study did not seek to validate clinical diagnoses resulting in misclassification bias during disease classification. As the study does not include detailed socio-demographic characteristics, the analysis of other important inferential statistics was not possible.

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Annex 1 Province wise distribution of infrastructure in selected tertiary hospital (June to September, 2021)

Province/ Hospital	Total Bed number	Paedatri bed	ICU bed	ICU bed paediatric	Ventilators	Pediatric Venti-lator	HDU bed	HDU ventilator	NICU Beds	NICU Ventilator	PICU beds	PICU ventilator
Province 1	1563	152	147	37	96	28	3	0	24	18	13	14
BPKHIS	813	100	35	7	41	8	3	0	7	8	3	4
Nobel Medical College	750	52	112	30	55	20	0	0	17	10	10	10
Province 2	767	89	65	25	19	0	87	23	18	4	0	0
Janakpur Hospital	260	17	14	0	0	0	50	4	8	4	0	0
National Medical College	507	72	51	25	19	0	37	19	10	0	0	0
Province 3	1737	447	210	83	144	34	100	6	59	15	43	27
CMC	750	95	141	37	68	11	54	0	20	4	17	7
Kanti Hospital	325	292	57	24	16	16	40	6	25	8	18	16
TUTH	662	60	12	22	60	7	6	0	14	3	8	4
Province 4	588	53	13	0	18	2	27	20	20	2	6	0
Dhaulagiri Hospital	88	10	4	0	9	2	27	4	0	0	0	0
PAHS	500	43	9	0	9	0	0	16	20	2	6	0
Province 5	1230	106	84	4	46	5	156	4	47	6	12	3
Nepaljung Hospital	500	36	32	0	10	3	0	0	22	2	7	1
UCMS	730	70	52	4	36	2	156	4	25	4	5	2
Province 6	400	52	35	10	30	0	75	6	13	4	2	0
Karnali Academy of Health Science	350	40	10	0	15	0	25	6	5	0	0	0
Province Hospital Surkhet	50	12	25	10	15	0	50	0	8	4	2	0
Province 7	167	4	5	0	6	0	4	6	2	0	0	0
Bayalpata Hospital	65	4	0	0	0	0	0	0	2	0	0	0
Dadeldhura Hospital	102	0	5	0	6	0	4	6	0	0	0	0
Grand Total	6452	903	559	159	359	69	452	65	183	49	76	44

Annex 2 Pediatric service infrastructure in Tertiary level hospital (June to September, 2021)

Province/ Hospital	Total Beds	Pediatric ward beds	% of Pediatric beds	Total ICU bed	ICU bed for pediatric	Percentage of Pediatric ICUs	Ventilator	Ventilator for pediatric	Percentage of Pediatric Ventilators	Number of Pediatrician
Province 1	1563	152	9.72	147	37	25.17	96	28	29.17	23
BPKHIS,Dharan	813	100	12.30	35	7	20.00	41	8	19.51	15
Nobel Medical College	750	52	6.93	112	30	26.79	55	20	36.36	8
Province 2	767	89	11.60	65	25	38.46	19	0	0.00	8
Janakpur Hospital	260	17	6.54	14	0	0.00	0	0		NA
National Medical College	507	72	14.20	51	25	49.02	19	0	0.00	8
Province 3	1737	447	25.73	210	83	39.52	144	34	23.61	6
CMC	750	95	12.67	141	37	26.24	68	11	16.18	6
Kanti Hospital	325	292	89.85	57	24	42.11	16	16	100.00	NA
TUTH	662	60	9.06	12	22	183.33	60	7	11.67	NA
Province 4	588	53	9.01	13	0	0.00	18	2	11.11	7
Dhaulagiri Hospital	88	10	11.36	4	0	0.00	9	2	22.22	0
PAHS	500	43	8.60	9	0	0.00	9	0	0.00	7
Province 5	1230	106	8.62	84	4	4.76	46	5	10.87	5
Nepaljung Hospital	500	36	7.20	32	0	0.00	10	3	30.00	4
UCMS	730	70	9.59	52	4	7.69	36	2	5.56	1
Province 6	400	52	13.00	35	10	28.57	30	0	0.00	8
Karnai Academy of Health Science	350	40	11.43	10	0	0.00	15	0	0.00	5
Province Hospital Surkhet	50	12	24.00	25	10	40.00	15	0	0.00	3
Province 7	167	4	2.40	5	0	0.00	6	0	0.00	0
Bayalpata Hospital	65	4	6.15	0	0		0	0		0
Dadeldhura Hospital	102	0	0.00	5	0	0.00	6	0	0.00	0
Grand Total	6452	903	14.00	559	159	28.44	359	69	19.22	57

Annex 3 Proforma of participants of the qualitative study

SN	KII code	Sex	Age	Marital status	Hospital Name
1	KII_1	Male	30	Unmarried	Bayalpata Hospital-Achham
2	KII_2	Male	48	Married	B.P. Koirala Institute of Health Sciences-Dharan
3	KII_3	Male	30	Married	Chitwan Medical College-Chitwan
4	KII_4	Male	Na	Na	Dadeldhura Provincial Hospital-Dadeldhura
5	KII_5	Male	36	Married	Dhaulagiri Zonal Hospital-Baglung
6	KII_6	Male	39	Married	Janakpur Zonal hospital-Janakpur
7	KII_7	Male	49	Married	Kanti Children's Hospital-Kathmandu
8	KII_8	Male	50	Married	Karnali Academy of Health Science- Jumla
9	KII_9	Male	52	Married	National Medical College, Birganj
10	KII_10	Male	38	Married	Nepalgunj medical College-Nepalgunj
11	KII_11	Male	35	Married	Novel Medical College-Biratnagar
12	KII_12	Male	45	Married	Pokhara Academy of Health Science-Pokhara
13	KII_13	Male	45	Married	Regional Hospital Surkhet, Surkhet
14	KII_14	Male	46	Married	Tribhuvan University Teaching Hospital, TUTH, Kathmandu
15	KII_15	Male	42	Married	Universal College of Medical Sciences-Rupandehi

Annex 4 Laboratory information (June to September, 2021)

Tests	Bayalpata Hospital	BPKHIS, Dharan	CMC	Dadeldhura Hospital	Dhaulagiri Hospital	Janakpur Hospital	Kanti Hospital	KAHS	National Medical College	Nepalgunj Medical College	Nobel Medical College	PAHS	Province Hospital Surkhet	TUTH	UCMS
ABG	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AFP	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes
ALP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
aPTT	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	-	Yes
BloodC/s	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BMA	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
c3, c4	No	Yes	No	No	No	No	No	No	Yes	No		No	No	No	No
CBC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEA	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes
CEA-Yes25	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes
CEAYes9-9	No	Yes	No	No	No	No	No	No	No	No		No	No	Yes	No
CK-NAC	No	Yes	No	No	No	No	No	No	No	No		No	No	No	No
Conjugated bilirubin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
CPK_MB	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
creatinine	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CSF examination	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
CT Scan	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Doppler	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
EKG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECHO	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
EEG	No	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes	No

Tests	Bayalpata Hospital	BPKHIS, Dharan	CMC	Dadeldhura Hospital	Dhaulagiri Hospital	Janakpur Hospital	Kanti Hospital	KAHS	National Medical College	Nepalgunj Medical College	Nobel Medical College	PAHS	Province Hospital Surkhet	TUTH	UCMS
SGPT/ALT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spirometer	Yes	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No
Sputum examination	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
T3	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
T4	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
total bilirubin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TropI	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TSH	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UREA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urine C/S	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urine for ketone	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urine for microalbumin	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Urine protein	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urine R/E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
USG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VDRL test	No	Yes	No	No	No	No	No	No	Yes	No		No	No	Yes	No
X-ray	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes



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