International Journal of Medical and Health Research
ISSN: 2454-9142, Impact Factor: RJIF 5.54
www.medicalsciencejournal.com
Volume 2; Issue 11; November 2016; Page No. 06-14

An epidemiological study on morbidity patterns amongst hospitalized children in a new tertiary care hospital of Gurgaon, India

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Abstract
Background & objectives: Children illness require more frequent hospital care and younger children (<15 yr of age) are more vulnerable to mortality. This study was, therefore, undertaken to evaluate the morbidity pattern in hospitalized under fifteen children (0-14 yr of age) with all disease in a tertiary care hospital in Gurgaon, India.
Methods: This was a retrospective (record based) observational study carried out from January 2014 to December 2014. Hospitalized children were enrolled for the study and evaluated for morbid events leading to hospitalization.
Results: A total of 19,609 new patients were seen in the FMRI within the period under review. Out of these, 3572 (18.2%) children were admitted (aged 0-14 years). Boys constituted 60.7% (n=2167) boys and 39.3% (n=1404) girls with boys to girls preponderance ratio of 1.54:1. Out of the total; 2736 (76.6%) children who came from 22Indian states, boys were 1642 (60.0 %) and girls were 1094 (40.0%) with a sex ratio of 666 girls to 1,000 to boys. Of the remaining 836 (23.4%) children, who were foreign nationals coming from 43 different countries, boys were 526 (62.9%) and girls were 310 (37.1%) with a sex ratio of 589 girls to 1,000 males. A statistically significant association was found between boys and girls among the Indian, other countries and total children. The major causes of admission such as problem in live born infants according to place of birth/birth related issues, childhood malignancy and blood disorders, aplastic anaemia, congenital malformations of heart, cerebral palsy, short gestation and low birth weight, chronic disease of tonsils and adenoids, convulsions, gastroenteritis and colitis occur more frequently during the wet season than during the dry season. Besides common pediatrics diseases, congenital malformations of heart, childhood malignancy and blood disorders and aplastic anaemia are the common causes of morbidities among the boys and girls of Indian population and foreign nationals.**Conclusion:** Research on morbidity is rather scanty. Yet it is very important and useful indicator of the health status of the people. The concept morbidity has more than one meaning. It is complex, multi-dimensional and difficult to define and measure because it has strong cultural character, which permits it's meaning to change over time and space. This study was a hospital based study and hence, does not represent the true rate of events for morbidity children in the general population. The ideal study should be a community-based cohort study or a birth cohort study.

Keywords: Children, morbidity, condition at discharge

1. Introduction
India is a large country with huge variations in health indicators across states and districts of the country [1]. Unlike other big nations, for instance Russia, China and the USA, the Indian population consists of many communities with different cultures and habits and widely varying literacy rates. The morbidity and mortality pattern across India varies significantly as would be expected from the wide health and health determinant disparity spread across length and breadth of India [2, 3].
The Gurgaon district of Haryana state is surrounded by Delhi and Rajasthan. Over the past 25 years the city has undergone rapid development and construction. It is one of Delhi's four major satellite cities and is part of the National Capital Region. It is within commuting distance of Delhi via an expressway and Delhi Metro. Gurgaon is the second largest city in the Indian State of Haryana and is the industrial and financial center of Haryana. It has the 3rd highest per capita income in India after Chandigarh and Mumbai.
In 2011, Gurgaon had population of 1,514,432 of which male and female were 816,690 and 697,742 respectively with a sex ratio of 854 females per 1000 males. There was an upward change of 73.96 percent in the population compared to population as per 2001 [5].
Fortis Memorial Research Institute, Gurgaon (FMRI) started clinical services on July 2012 and was officially inaugurated on 1st May 2013. With the goal to dispense modern tertiary health care to the community in a compassionate, professional and distinctive way.

2. Methods
2.1. Study Population: An in-patient is a patient who is formally admitted (or 'hospitalized') for diagnosis, treatment and/or care and stays for a minimum of one night or more than 24 hours in the hospital providing in-patient care. A retrospective study was conducted amongst admitted children 0-14 years of age from January 2014 to December 2014 at FMRI. The data entry on morbidity and mortality of all

patients is routinely done by the medical records section. This data has information on socio demographic, age, sex, diagnosis, treatment, prognosis of the disease condition at discharge and cause of death etc. as recorded in the case records by the clinicians. Records of patients with missing information of demographic data and diagnosis were excluded from the study. For multiple diagnoses, morbidity with the longest duration or the final diagnosis (supported by relevant laboratory investigations) was recorded as primary illness for the patient. All the information collected was cross-checked for completeness of the data from the records available at hospital (viz- patient's admission file, reports and ward registers, etc.). The World Health Organization (WHO) standards were used for analyzing and comparing the data. The abstracted data is coded by using manual of International Statistical Classification of Disease and Related Health Problems, 10th Revision, Volume 1, 2 & 3, published by the World Health Organisation, Geneva, 2010 Edition [6-8]. Quality control of information is maintained through the use of data processing, editing techniques, case finding audits and reviews of coded and abstracted data. Validity checks were carried out on all the variables and records with missing values and impossible codes were checked against the original files and corrected. Finally a series of checks of diagnosis versus sex and age etc. were carried out to detect the coding or typing errors. The hospital has a pediatric capacity of 15 beds. The present study only highlights the status of different types of morbidities in a tertiary care hospital. This is the first study in this hospital amongst children 0-14 years of age with all causes of morbidity to highlights the morbidity pattern.

2.2. Statistical analysis

Collected data were entered in Microsoft Excel and the results generated were analyzed using software Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistical measures such as percentage, mean, and standard deviation were applied. Inferential statistical tests such as Z-test, bivariate correlations and Chi-square test were applied to identify important relationships between variables to determine the level of significance. A p-value of < 0.05 was considered statistically significant.

3. Results

3.1 Geographical area of children admitted

A total of 19,609 new patients were seen in the FMRI within the period under review. Out of these, 3572 (18.2%) children were admitted (aged 0-14 years). Boys constituted 60.7% (n=2167) boys and 39.3% (n=1404) girls with boys to girls preponderance ratio of 1.54:1. Out of the total; 2736 (76.6%) children who came from 22 Indian states, boys were 1642 (60.0 %) and girls were 1094 (40.0%) with a sex ratio of 666 girls to 1,000 to boys. Of the remaining 836 (23.4%) children, who were foreign nationals coming from 43 different countries, boys were 526 (62.9%) and girls were 310 (37.1%) with a sex ratio of 589 girls to 1,000 males. A statistically significant association was found between boys and girls among the Indian, other countries and total children. (Table 1, Fig.1).

Table 1: Distribution of geographical area of children admitted

Geographical area	Boys (%)	Girls (%)	Total (%)	Z-statistic (p value)
India (No. of states-22)	1642 (60.0)	1094 (40.0)	2736 (76.6)	10.2576, Significant (p <0.05)
Other countries (No. of countries- 43)	526 (62.9)	310 (37.1)	836 (23.4)	7.2225, Significant (p <0.05)
Total	2168 (60.7)	1404 (39.3)	3572 (100.0)	12.5071. Significant (p <0.05)

Fig. 1: Percentage of patients admitted among India and other countries by sex

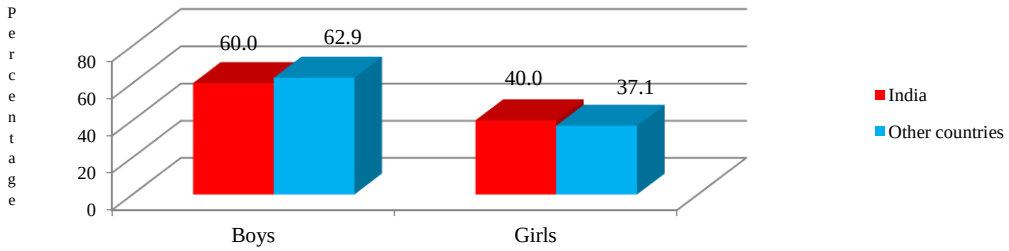

Fig 1: Percentage of patients admitted among India and other countries by sex

Table 2 give the break-up of leading number of children admitted at FMRI by place of residence from Indian states and other countries. Majority of Indian patients came from nearby states Haryana (58.5%) followed by Delhi (16.8%), Rajasthan (10.7%), Uttar Pradesh (7.9%), Punjab (1.6%), Assam (1.1%), Jammu & Kashmir (1.0%), Bihar (0.6%) Madhya Pradesh (0.5%), and Uttarakhand (0.5%) (Fig.2).

Maximum number of children that came to Fortis hospital for taking treatment were from Iraq (38.3%) followed by Afghanistan (21.5%), Kazakhstan (15.9%), Kenya (6.3%), Nigeria (5.0%), Russia (2.5%), Ukraine (1.4%), Uzbekistan (1.3%), Nauru (0.6%) and Sudan (0.6%) respectively (Fig.3).

Table 2: Leading number of children by place of residence from Indian and other countries

Rank	India			Other Countries		
	States	No.	%	Country	Nos.	%
1	Haryana	1601	58.5	Iraq	320	38.3
2	Delhi	461	16.8	Afghanistan	180	21.5
3	Rajasthan	277	10.7	Kazakhstan	133	15.9
4	Uttar Pradesh	216	7.9	Kenya	53	6.3
5	Punjab	44	1.6	Nigeria	42	5.0
6	Assam	29	1.1	Russia	21	2.5
7	Jammu &Kashmir	28	1.0	Ukraine	12	1.4
8	Bihar	17	0.6	Uzbekistan	11	1.3
9	Madhya Pradesh	14	0.5	Nauru	5	0.6
10	Uttaranchal	13	0.5	Sudan	5	0.6

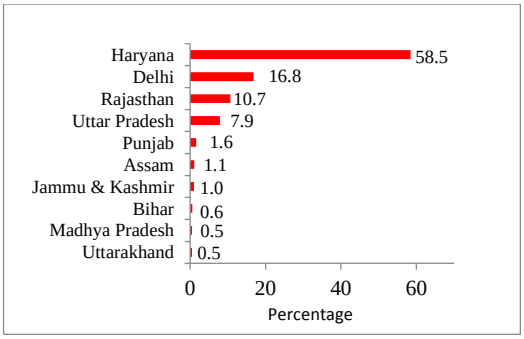

Fig 2: Leading number of children from Indian states

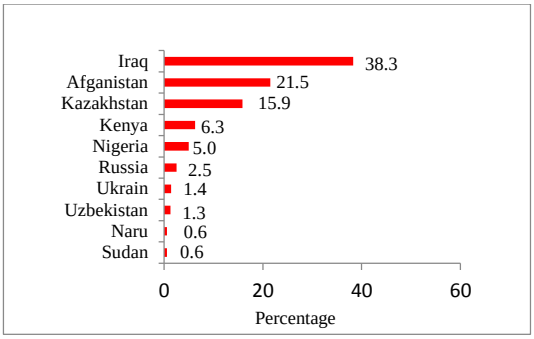

Fig 3: Leading number of children from other countries

3.2 Sex and age group of children admitted

Among the 3,572 children who were admitted, 2,168 (60.7%) were boys while 1,404 (39.3%) were girls (Z-statistic = 12.5071, $p < 0.05$). Male to female ratio was 1.5:1, while the average patient age for boys was 4.8 years (Standard Deviation= 3.536, Variance= 12.503) and for girls was 4.5 years (Standard Deviation= 3.529, variance= 12.455). Sixty per cent of the children were less than five years old and 33.5% were aged less than one year. 28.0% of the children were in the age group of 5-9 years and 12.5% children were in the age group of 10-14 years. A statistically significant association was found between boys and girls among all age groups A statistically significant correlation (0.056, $p<0.01$ level) was found between the age and sex (Table 3, Fig. 4)

Table 3: Age and sex distribution of children admitted

Age group (years)	Boys (%)	Girls (%)	Total (%)	Z-statistic (p value)
<1	681 (56.8)	517 (43.2)	1198 (33.5)	4.6637 Significant (<0.05)
1-4	561 (60.5)	366 (39.5)	927 (26.0)	6.2568, Significant (<0.05)
5-9	652 (65.3)	347 (34.7)	999 (28.0)	9.2504, Significant (p <0.05)
10-14	274 (61.2)	174 (38.8)	448 (12.5)	4.6274, Significant (p <0.05)
Total (%)	2168 (60.7)	1404 (39.3)	3572 (100.0)	12.5071, Significant (p <0.05)

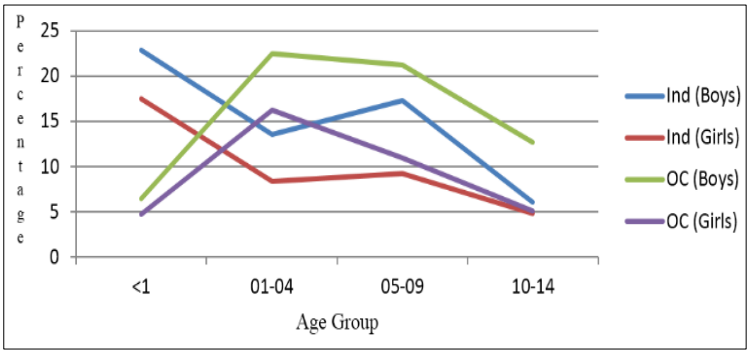

Fig 4: Ag-specific proportions in children among Indian states and other countries by sex

3.3 Major morbidities identified by geographical area of children admitted in boys

Table 4 provides the distribution of major morbidities identified in boys among Indian & other countries respectively. In Indian boys, diseases of live born infants/birth related issues **(**n=387, 23.6%) was the leading cause followed by lymphoid leukemia (n=102, 6.2%), aplastic anemia (n=73, 4.4%), congenital malformations of heart (n=53, 3.2%), malignant neoplasm of brain (n=51, 3.1%), congenital malformations of cardiac septa (n=50, 3.0%), chronic diseases of tonsils and adenoids (n=36, 2.2%), malignant neoplasm of other connective and soft tissue (n=30, 1.8%), convulsions, not elsewhere classified (n=30, 1.8%) and diseases of gastroenteritis and colitis (n=29, 1.5%) (Fig. 5) respectively.

Among the other countries boys, diseases of congenital malformations of heart (n=44, 8.4%) was the leading cause followed by malignant neoplasm of bone and articular cartilage of other and unspecified (n=18, 3.4%), malignant neoplasm of brain (n=14, 2.7%), malignant neoplasm of bone and articular cartilage of limbs (n=13, 2.5%), malignant neoplasm of eye and adnexa (n=12, 2.3%), chronic diseases of tonsils and adenoids (n=11, 2.1%), Hodgkin's lymphoma (n=8, 1.5%), cerebral palsy (n=8, 1.5%) and congenital deformities of hip (n=8, 1.5%) Fig. 6 respectively

Diseases of congenital malformations of heart, childhood malignancy and blood disorders, chronic diseases of tonsils and adenoids are the common causes of morbidities among the male child of Indian population and foreign nationals.

Table 4: Distribution of major morbidities identified in boys among Indian & other countries

Rank	India				Other countries			
	ICD.10	System involved	No.	%	ICD.10	System involved	No.	%
1	Z38	Live born infants/birth related issues	387	23.6	Q24	Other congenital malformations of heart	44	8.4
2	C91	Lymphoid leukemia	102	6.2	C41	Malignant neoplasm of bone and articular cartilage of other and unspecified	18	3.4
3	D61	Other aplastic anemia	73	4.4	C71	Malignant neoplasm of brain	14	2.7
4	Q24	Other congenital malformations of heart	53	3.2	C40	Malignant neoplasm of bone and articular cartilage of limbs	13	2.5
5	C71	Malignant neoplasm of brain	51	3.1	C69	Malignant neoplasm of eye and adnexa	12	2.3
6	Q21	Congenital malformations of cardiac septa	50	3.0	J35	Chronic diseases of tonsils and adenoids	11	2.1
7	J35	Chronic diseases of tonsils and adenoids	36	2.2	Z48	Other surgical follow-up care	11	2.1
8	C49	Malignant neoplasm of other connective and soft tissue	30	1.8	C81	Hodgkin lymphoma	8	1.5
9	R56	Convulsions, not elsewhere classified	30	1.8	G80	Cerebral palsy	8	1.5
10	A09	Gastroenteritis and colitis	29	1.5	Q65	Congenital deformities of hip	8	1.5

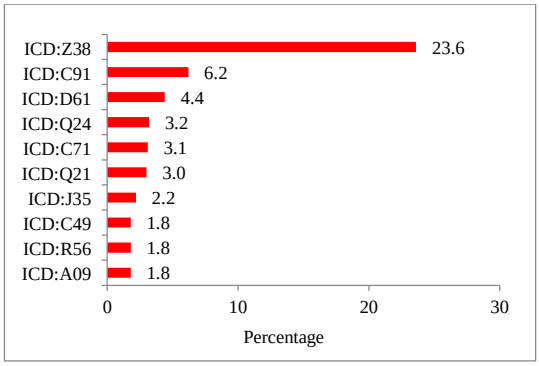

Fig 5: Major morbidities identified in Indian boys

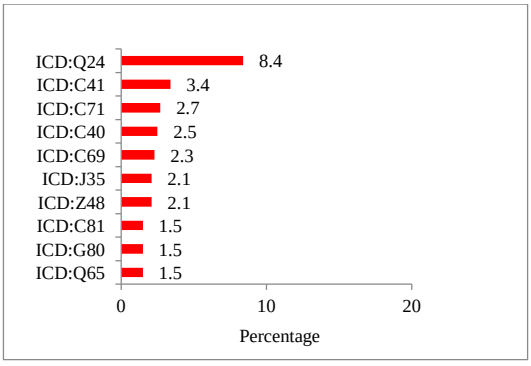

Fig 6: Major morbidities identified in other countries boys

3.4 Major morbidities identified by geographical area of children admitted in girls

Table 5 depicts the distribution of major morbidities identified in girls among Indian & other countries respectively. In Indian girls, diseases of Live born infants/birth related issues **(**n=343, 31.4%) was the leading cause followed by lymphoid leukemia (n=153, 14.0%), congenital malformations of heart (n=38, 3.5%), short gestation and low birth weight (n=25, 2.3%), convulsions, not elsewhere classified (n=25, 2.3%), leukemia of unspecified (n=24, 2.2%), neonatal jaundice (n=21, 1.9%), gastroenteritis and colitis (n=20, 1.8%), malignant neoplasm of peripheral nerves and autonomic nervous system (n=19 1.7%) and diseases of malignant neoplasm of brain (n=18, 1.6%) Fig. 7 respectively.

Among the other countries girls, diseases of congenital malformations of heart (n=32, 10.3%) was the leading cause followed by aplastic anemia (n=20, 6.5%), malignant neoplasm of adrenal gland (n=19, 6.1%), malignant neoplasm of eye and adnexa (n=16, 5.2%), chronic viral hepatitis (n=14, 4.5%), malignant neoplasm of bone and articular cartilage of limbs (n=8, 2.6%), cerebral palsy (n=6,

1.9%), malignant neoplasm of liver and intrahepatic bile ducts (n=4, 1.3%), malignant neoplasm of other connective and soft tissue (n=4, 1.3%) and diseases of hemangioma and lymphangioma (n=4, 1.3%) Fig. 8 respectively

Diseases of congenital malformations of heart, childhood malignancy and blood disorders and neonatal jaundice/ aplastic anemia are the common causes of morbidities among the female child of Indian population and foreign nationals.

Table 5: Ten leading causes of morbidities/system involved in girls among Indian & other countries

Rank	India				Other countries			
	ICD.10	System involved	No.	%	ICD.10	System involved	No.	%
1	Z38	Live born infants/birth related issues	343	31.4	Q24	Other congenital malformations of heart	32	10.3
2	C91	Lymphoid leukemia	153	14.0	D61	Aplastic anaemia	20	6.5
3	Q24	Other congenital malformations of heart	38	3.5	C74	Malignant neoplasm of adrenal gland	19	6.1
4	P07	short gestation and low birth weight	25	2.3	C69	Malignant neoplasm of eye and adnexa	16	5.2
5	R56	Convulsions, not elsewhere classified	25	2.3	B18	Chronic viral hepatitis	14	4.5
6	C95	Leukaemia of unspecified	24	2.2	C40	Malignant neoplasm of bone and articular cartilage of limbs	8	2.6
7	P59	Neonatal jaundice	21	1.9	G80	Cerebral palsy	6	1.9
8	A09	Gastroenteritis and colitis	20	1.8	C22	Malignant neoplasm of liver and intrahepatic bile ducts	4	1.3
9	C47	Malignant neoplasm of peripheral nerves and autonomic nervous system	19	1.7	C49	Malignant neoplasm of other connective and soft tissue	4	1.3
10	C71	Malignant neoplasm of brain	18	1.6	D18	Hemangioma and lymphangioma	4	1.3

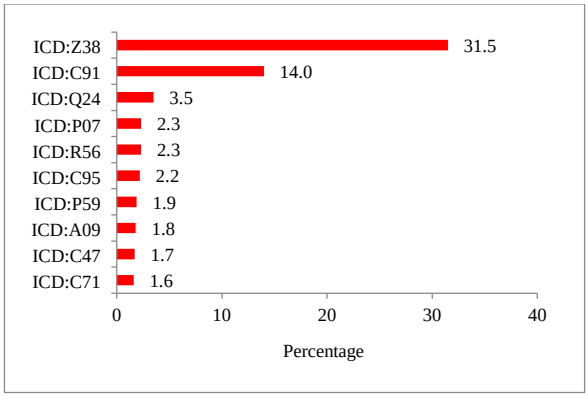

Fig 7: Ten leading causes of morbidity among Indian, Girls

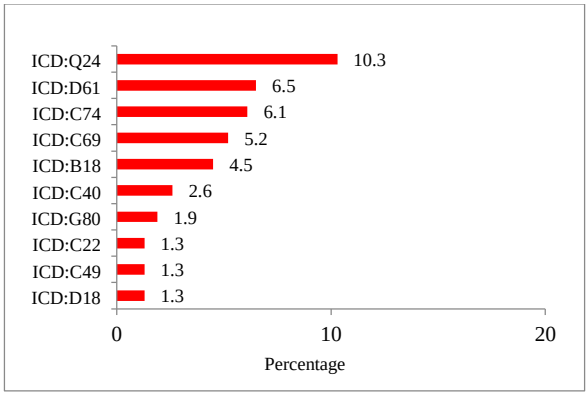

Fig 8: Ten leading causes of morbidity among other countries, Girls

3.5 Children according to condition at discharge by sex

Table 6 shows the distribution of children according to condition at discharge for Indian cases and other countries. It was found that out of the total (n=3572) admitted children in hospital, 3520 children (98.5%) were discharged/relieved as cured, 28 (0.8%) expired, 17 (0.5%) left against medical advice (LAMA) and 4 (0.1%) children left the hospital on own risk (Fig.9). A statistically significant association was found between the conditions of discharge/relieved, expired and total cases of India and other countries boys and girls.

Table 6: Distribution of children according to condition at discharge among Indian and other countries

Condition at discharge	Indian			Other Countries			Total			Z-statistic (p value)
	Boys (%)	Girls (%)	Total (%)	Boys (%)	Girls (%)	Total (%)	Boys (%)	Girls (%)	Total (%)	
Discharge/ Relieved	1621 (60.0)	1079 (40.0)	2700 (98.7)	517 (62.8)	306 (37.2)	823 (98.4)	2138 (60.7)	1382 (39.3)	3520 (98.5)	12.4134, Significant (p <0.05)
Expired	13 (76.4)	4 (23.6)	17 (0.6)	8 (72.7)	3 (27.3)	11 (1.3)	21 (75.0)	7 (25.0)	28 (0.8)	2.3664, Significant (p <0.05)
LAMA*	7 (46.7)	8 (53.3)	15 (0.5)	1 50.0)	1 50.0)	2 (0.2)	8 (47.1)	9 (52.9)	17 (0.5)	-0.2387, Not Significant (p <0.05)
Left on own risk	1 (25.0)	3 (75.0)	4 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (25.0)	3 (75.0)	4 (0.1)	-0.8944, Not Significant (p <0.05)
Total	1642 (60.0)	1094 (40.0)	2736 (100.0)	526 (62.9)	310 (37.1)	836 (100.0)	2168 (60.7)	1404 (39.3)	3572 (100.0)	12.5071, Significant (p <0.05)

*Left Against Medical Advice

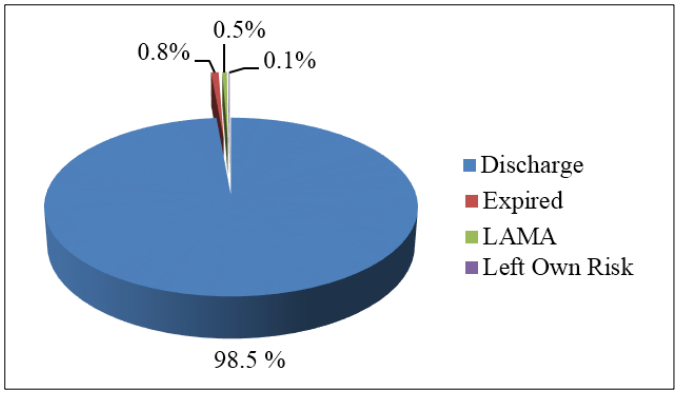

Fig 9: Children according to condition at discharge for total cases

3.5 Seasonal variations of children according to condition at discharge by sex

Table 7 provides the distribution of seasonal variations of children admitted at FMRI. The climate of Gurgaon area cannot be differentiated into the conventional four seasons. A more practical demarcation is the winter months (December, January and February), the spring season months (March and April), the hot-dry period (May and June), the hot-wet monsoon (rainy) period of July, August and September, and autumn comprising October and November. Out of the total admission (n= 3572), the high point in the admission was found in the hot-wet (n= 1000, 28.0%) season (July: 8.3%, August: 9.3% and September: 10.4%) followed by winter (n= 806, 22.6%) season (December: 8.9%, January: 7.5% and February: 6.1%), autumn (18.0%) season (October: 9.0%, November: 9.0%), hot-dry (15.7%) season (May: 8.0% and June: 7.8%) and spring (15.7 %) season (March: 8.1% and April: 7.6%) (Fig. 10). A statistically significant association was found between the India and other countries cases in all seasons.

Table 7: Seasonal variations of children admitted

Month	India	Other Countries	India + Other Countries	Z-statistic (p value)
	Nos. (%)	Nos. (%)	Nos. (%)	
Winter (Dec.-Feb.)	637 (79.0)	169 (21.0)	806 (22.6)	14.2378, Significant (p <0.05)
Dec.	252 (79.2)	66 (20.8)	318 (8.9)	8.9876, Significant (p <0.05)
Jan.	214 (79.6)	55 (20.5)	269 (7.5)	8.3476, Significant (p <0.05)
Feb.	171 (78.1)	48 (21.9)	219 (6.1)	7.2519, Significant (p <0.05)
Spring (Mar.- April)	412 (73.4)	149 (26.6)	561 (15.7)	10.0357, Significant (p <0.05)
March	224 (77.2)	66 (22.8)	290 (8.1)	8.1338, Significant (p <0.05)
April	188 (69.4)	83 (30.6)	271 (7.6)	5.9561, Significant (p <0.05)
Hot-dry (May-June)	401 (71.3)	161 (28.7)	562 (15.7)	9.2868, Significant (p <0.05)
May	201 (70.5)	84 (29.5)	285 (8.0)	6.4028, Significant (p <0.05)
June	200 (72.2)	77 (27.8)	277 (7.8)	6.7537, Significant (p <0.05)
(hot-wet) July-Sept.)	774 (77.4)	226 (22.6)	1000 (28.0)	15.197, Significant (p <0.05)
July	233 (78.7)	63 (21.3)	296 (8.3)	8.563, Significant (p <0.05)
Aug.	252 (76.1)	79 (23.9)	331 (9.3)	8.4158, Significant (p <0.05)
Sept.	289 (77.5)	84 (22.5)	373 (10.4)	9.3097, Significant (p <0.05)
Autumn (Oct. – Nov.)	512 (79.6)	131 (20.4)	643 (18.0)	12.913, Significant (p <0.05)
Oct.	246 (76.4)	76 (23.6)	322 (9.0)	8.3787, Significant (p <0.05)
Nov.	266 (82.9)	55 (17.1)	321 (9.0)	9.8537, Significant (p <0.05)
Total	2736 (76.6)	836 (23.4)	3572 (100.0)	28.0719, Significant (p <0.05)

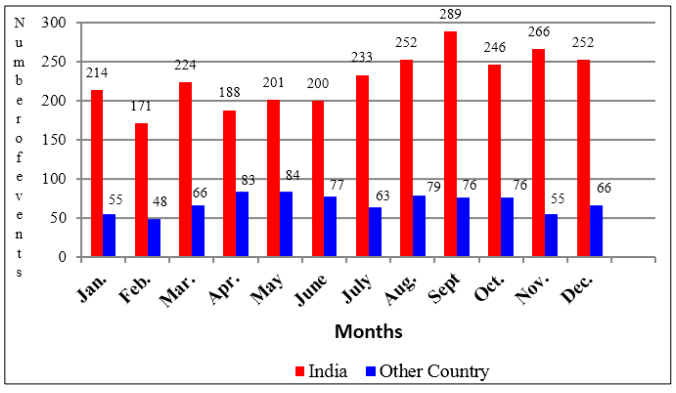

Fig 10: Month wise distribution of morbid events

4. Discussion

This analysis was limited to hospital admissions only, which did not include patients seen in the emergency and outpatients departments (OPD) per se. Nevertheless, similar results would be expected if OPD patients were to be included, since most of them present there for post-hospitalization follow-up, although some patients with more acute problems are referred directly to the OPD. The present study shows that, more boys than girls were hospitalized, the percentage of morbidities among boys (India- 60.0%, other countries- 62.9% and total- 60.7%) were higher in comparision to girls (India- 40.0%, other countries- 37.1% and total- 39.3%); A statistically significant association was found between boys and girls among the Indian, other countries and total children was similar to other studies from central India[9]. It is possible that parents have a higher acceptance of hospital admissions for their ill sons than for ill daughters. This is probably because of the cultural parental preference for male children. A study conducted by Lawal OM *et al.* [10] reported a gender differential in rates of hospitalization in Lagos, Nigeria and a similar gender difference was also observed by Rajmil I, Fernamdaz E and Salas T *et al.* [11, 12]. The reason for this gender differential in child mortality is that the past studies have also documented the reasons behind the preference for sons over daughters in the context of the Indian subcontinent. They have found that sons are preferred over daughters for a number of economic, social and religious reasons (perceived

greater economic, social, and religious utility of sons than of daughters), including financial support, old age security, property inheritance, dowry, family lineage, prestige and power, birth and death rituals, and beliefs about religious duties and salvation [13, 17] Parents of girls are socially bound to find grooms for their daughters and often pay all the marriage expenses (including dowry); social customs and norms dictate that parents cannot expect much support (emotional or economic) from married daughters. In contrast, parents expect sons to provide financial and emotional care and regard them as a social security for old age, inheritance laws largely favour sons and sons perform important religious roles, ensure the continuation of the family lineage, and are desired to increase a family's capacity to defend itself or to exercise power". Reports from Burkina Faso and United States of America (Blacks), shows that female child mortality rate was higher than male child mortality [18, 19].

In our study, it is observed that the highest number of morbidity among the children were in infant (<1 year) accounted 33.6% of all admissions followed by 5-9 years 28.0%, 1-4 years 26.0%, and 10-14 years accounted 12.5% respectively. More boys than girls were admitted for all age groups, with a statistically significant association were obtained between boys and girls in all age groups. A statistically significant correlation (0.056, p<0.01 level) was found between the age and sex and similar results was also observed by AN Onyiriuka [12] study conducted at mission hospital in Benin City, Nigeria. Pediatrics age group (<15yrs) was most commonly affected age group observed by Borade PV. *et al.* [20].

Present study revealed that major morbidities identified among the Indian boys were live born infants **(**23.6%) followed by lymphoid leukemia (6.2%), aplastic anemia (4.4%), congenital malformations of heart (3.2%), malignant neoplasm of brain (3.1%), congenital malformations of cardiac septa (3.0%), chronic diseases of tonsils and adenoids (2.2%), malignant neoplasm of other connective and soft tissue (1.8%), convulsions, not elsewhere classified (1.8%) and diseases of gastroenteritis and colitis (1.5%). Among the other countries boys, diseases of congenital malformations of heart (8.4%) was the leading cause followed by malignant neoplasm of bone and articular cartilage of other and unspecified (3.4%), malignant neoplasm of brain (2.7%), malignant neoplasm of bone and articular cartilage of limbs (2.5%), malignant neoplasm of eye and adnexa (2.3%), chronic diseases of tonsils and adenoids (2.1%), Hodgkin's lymphoma (1.5%), cerebral palsy (1.5%) and congenital deformities of hip (1.5%) respectively.

Major morbidities identified among the Indian girls were diseases of live born infants **(**31.4%) followed by lymphoid leukemia (14.0%), congenital malformations of heart (3.5%), short gestation and low birth weight (2.3%), convulsions, not elsewhere classified (2.3%), leukemia of unspecified (2.2%), neonatal jaundice (1.9%), gastroenteritis and colitis (1.8%), malignant neoplasm of peripheral nerves and autonomic nervous system (1.7%) and diseases of malignant neoplasm of brain (1.6%). Among the other countries girls, diseases of congenital malformations of heart (10.3%) was the leading cause followed by aplastic anemia (6.5%), malignant neoplasm of of adrenal gland (6.1%), malignant neoplasm of eye and adnexa (5.2%), chronic viral hepatitis (4.5%), malignant neoplasm of bone and articular cartilage of limbs (2.6%), cerebral palsy (1.9%), malignant neoplasm of liver and intrahepatic bile ducts (1.3%), malignant neoplasm of other connective and soft tissue (1.3%) and diseases of hemangioma and lymphangioma (1.3%) respectively. A study from Delhi reported ARI and diarrhea have been seen to account maximum morbidity [21]. Venketesh *et al.* also observed ARI to account for 42% of morbidity followed by diarrhoea (13.6%) and skin disease (11.8%) [22]. A study amongst under-fives in the Anganwadis also reported the above as most common cause of morbidity [23]. A study from Haryana also reported fever, prematurity, diarrhoea and respiratory infection as the major causes of mortality in early childhood [24]. Biswas *et al.* in rural west Bengal also observed ARI, diarrhoea and prematurity to be the important causes of infant and early child mortality [25].

Present study shows that the rate of hospitalisation was significantly higher during the hot- wet season (28.0%) than the winter (22.6%), autumn (18.0%), hot-dry (15.7%) and spring (15.7%). This is the similar to findings from Benin City, Nigeria [12], Gambia, West Africa [26]. Maharashtra, India [27]. A study conducted by Tyagi BB *et al.* [28, 29] reported that bacterial infection (37%) was the predominant cause of morbidity followed by the non-specific diseases with admission as per the sign and symptoms (28.7%), acute respiratory infection (8%), neoplasm and multiple organs effect (5.6%) and disease of digestive organs (2.8%).

Similar results were reported by Ogbeide MI and Feacham RG [30, 31]. Gastroenteritis, acute lower respiratory tract infection (ALRTI) and severe anemia are the most important causes of childhood morbidity and mortality in Benin City, Nigeria, reports from other African countries also confirm the leading role of these preventable diseases as causes of childhood morbidity and mortality [32, 35].

A study conducted by Sharma *et al.* [36] had reported that most cases of ADDs (38.89%) and pulmonary tuberculosis (4.68%) in summer, and typhoid (1.57%) and viral hepatitis (1.23%) in the monsoon season**.** Several other studies reveled that most episodes occurred during late monsoon season. This indicates that infection is a common underlying cause for acute illness in Sickle Cell Disease (SCD) in India. Further studies should evaluate the association with viral infections. Similar to our study, infection was the most common cause of hospitalization reported from Nigeria [37]. This may be due to poor socio-economic status and poor hygienic conditions which predispose the population infections. However, in a study conducted by NA Alkr, Adekile from Kuwait [38] vaso-occlusive crisis was the most common cause of hospitalization in SCD children. Another study from central India has reported severe anaemia requiring blood transfusion as the most common cause of hospitalization in SCD children [39]. Maximum hospitalizations were seen during the late monsoon and early post monsoon season (August-October). This finding was similar to previous reports from India [40, 41]. However, the studies from other countries have shown temperature**[42]** or high wind speed and low humidity as precipitating factors for vaso-occlusive crisis in SCD subjects but not rainfall [43]. A number of studies have attempted to assess the impact of social factors on health. A review by McGinnis *et al.* estimated that medical care was responsible for only 10%–15% of preventable mortality in the U.S [44] while Mackenbach's studies suggest that this percentage may be an underestimate. They affirm the overwhelming

importance of social factors [45, 46] McGinnis and Foege concluded that half of all deaths in the U.S. involve behavioral causes [47] other evidence has shown that health-related behaviors are strongly shaped by social factors, including income, education, and employment[48, 49] Jemal *et al.*, studying 2001 U.S. death data, concluded that "potentially avoidable factors associated with lower educational status account for almost half of all deaths among working-age adults in the US [50] Galea *et al.* conducted a meta-analysis, concluding that the number of U.S. deaths in 2000 attributable to low education, racial segregation, and low social support was comparable with the number of deaths attributable to myocardial infarction, cerebrovascular disease, and lung cancer, respectively [51]. The health impact of social factors also is supported by the strong and widely observed associations between a wide range of health indicators and measures of individuals' socioeconomic resources or social position, typically income, educational attainment, or rank in an occupational hierarchy. In US, as well as European data, this association often follows a stepwise gradient pattern, with health improving incrementally as social position rises.

Increased hospitalisation during the hot- wet season may be explained by our finding that the major causes of admission such as problem in live born infants according to place of birth/born outside hospital/unspecified as to place of birth, other congenital malformations of heart, other aplastic anemias, chronic disease of tonsils and adenoids, malignancy of brain, lymphoid leukemia, convulsions, gastroenteritis and colitis occur more frequently during the wet season than during the dry season. This difference in morbidity patterns may be explained by the improvement in immunization coverage against the target diseases as covered by the expanded programme on immunization and the current breast-feeding practices being advocated.

5. Strengths of the study

This study is the first study in the study area to highlight the morbidity pattern in hospitalized children of age 0-14 years.

6. Future research direction

This study was a hospital based study and hence, does not represent the true rate of events for children in the general population. Further hospital-based and community-based cohort study or a birth cohort studies are recommended in order to further explore the highlights of morbidity and mortality pattern in children.

7. Conclusion

The present study only highlights the status of different types of morbidities in a tertiary care hospital. This is the first study amongst admitted children of Pediatric age group with all causes of morbidity to highlights the morbidity pattern.

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