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Research Article

Morbidity patterns amongst hospitalized children in a secondary care hospital of Uttarakhand, India

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ABSTRACT

Background: Life expectancy at birth, mortality and morbidity rates are important indicators of health status of a population. This study aimed at providing statistical data related to the morbidity patterns of common illnesses seen in children admitted to a secondary care, state run hospital.
Methods: The study population comprised of children in the age group of 0 to 14 years, admitted during the year 2012 (from 1st January to 31st December 2012). A retrospective record analysis was carried out from the data available in the medical records department.
Results: During the study period, the total numbers of admissions were 3389. Nearly 39.80% (n=1349) were girl and 60.20% (n=2040) were boys with a sex ratio of 661 girls to 1000 boys. The median age for boys was 6.1 years, girls 6.5 years and for both 6.3 years and had statistical significance (11.40 (P<0.05)) at 5 percent level. Study shows that significant gender inequality was observed in morbidity prevalence in girls compared to boys. Case fatality rate (CFR) among boy infants (2.42%) was higher than girls in all age groups. The bed occupancy rate (BOR) was recorded at 135.3 per cent throughout the year. Neonates admitted were all referral cases.
Conclusions: The study highlights that three fourth of the hospitalized children were suffering from morbidity events like bacterial infection and acute respiratory problems. More care and attention needs to be paid in children of younger age group.

Keywords: Morbidity, Mortality, CFR, BOR

INTRODUCTION

Life expectancy at birth, mortality and morbidity rates are important indicators of health status of a population. India is a large country with huge variations in health indicators across states and districts of the country.[1] The life expectancy has increased from 23 years in 1901 to 62.6 in 2002-06, and infant mortality has declined from 215 per thousand in 1901 to 50 in 2009**.** The death rates have declined from 44 per 1000 in 1901 to 10 in 1992 and 7.3 in 2009.[2] However; there are no realistic and comparable estimates of morbidity over a period of time. The estimates of morbidity in general and the disease specific incidence rates in particular would serve as valuable information to the health planners and administrators for appropriate and timely measures to monitor, control and eradicate the diseases. It will also enable the administrators to allocate resources for health

facilities such as hospitals, physicians, medicines, etc., and provide basic infrastructure such as sanitation and drinking water. Recently morbidity estimates have been used to assess the burden of diseases.[3] Although a low morbidity rate can be considered as an indicator of better health status; it need not necessarily be true. Low morbidity can occur from actual reduction in incidence of illness or due to under reporting or due to lack of disease consciousness. Morris SK, Bassani DG et al observed that approximately 60% of all deaths in children are due to infectious diseases and nearly half of these deaths are due to diarrheal diseases and pneumonia.[4] Claeson M et al reported the slowing decline in infant mortality rates in India; a departure from the longer-term trends.[5] Gender differences were also observed in adults with women reporting significantly lower levels of morbidity than men. This suggests under-reporting of ailments amongst the female sex.[6] Studies have found contrasting patterns of evidences about disease burden between rural and urban population with some reporting greater burden among rural population than in urban population.[7,8] It has been argued that a better educated population takes more precautions against diseases which in turn reduce their morbidities. However, the nature of this relationship between economic status of household and risk of reporting morbidity is far from clear.

METHODS

The study was conducted amongst admitted children 0-14 years of age from 1st January 2012 to 31st December 2012 in a government hospital Dehradoon, India. Doon hospital is the biggest secondary care and referral hospital of the state. A plethora of complicated and advance diseases and cases are admitted in Doon hospital after being referred from all districts of Uttarakhand state, for taking appropriate treatment. The hospital has a separate peadiatric ward having capacity of 37 beds with 6 pediatricians.

The availability of hospital beds has always been a problem in developing countries. It is the single most important factor in determination of the utilization of hospital beds in a country. In India, shortage of hospital beds is also a problem; the average bed population ratio being 9 per 10,000 populations in comparison with the world average of 27 per 10,000 during 2000-2009.[9] In our study, bed occupancy rate was recorded at 135.3 per cent throughout the year. This results from the government policy of not refusing admission to any patient, irrespective of availability of vacant beds. As a result a single bed is often used to admit more than one child at a time.

The data on morbidity and mortality were collected from the case sheets of the children or the discharge registers kept in medical records department. Relevant information pertaining to socio-demographic indicators, 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 children 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. The worst affected were villagers who trekked several kilometers from the hilly terrains of the state. 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, Second Edition published by the WHO, Geneva.[10]

Statistical analysis

Collected data were entered in Microsoft excel and the results generated were analysed using software Statistical Package for Social Sciences (SPSS) version 16.0. Descriptive statistical measures such as percentage, mean, and standard deviation were applied. Inferential statistical test such as Z- test and Chi-square test was applied to identify important relationships between variables were used to determine the level of significance. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1 shows distribution of children according to morbidity by age and sex. A total of 3389 children were admitted from 1st January 2012 to 31st December 2012. Of these 39.80% (n=1349) were girls and 60.20% (n=2040) were boys with a sex ratio of boys 1000 to 661 girls, average age of children were 6.3 years (boys: 6.1 years and girls: 6.5 years). In boys the highest number of morbidity belonged to the age group 1-4 year (n= 681 i.e. 33.4%) followed by the 5-9 years age group (n=552 i.e. 27.1%). In girls, the highest number of morbidity belonged to the 10-14 years of age group (n=388 i.e. 28.8%) followed by the age group 1-4 years (n=380 i.e. 28.2%) (Figure 1), statistically significant association (11.40, $p<0.05$) was found between age and sex.

Table 2 shows the distribution of children according to number (#) and proportion (%) of classification of morbidity causes related to health problems and sex, predominant cause of morbidity was bacterial infection [n=1253 (37.0%), boys=730 (35.8%); girls= 523 (38.8%)] followed by disease of sign and symptoms [n=973 (28.7%), boys=571 (28.0%); girls= 402 (29.8%)], diseases of respiratory infection [n=271 (8.0%), boys=168 (8.2%); girls= 103 (7.6%)], diseases of neoplasms and disorder of blood and forming organs [n=189 (5.6%), boys=124 (6.1%); girls= 65 (4.8%)] and diseases of multiple organ effect [n=189 (5.6%),

boys=123 (6.0%); girls= 66 (4.9%)] respectively (Fig.2). Statistical significant association was found between the sex and morbidities categories groups of bacterial infection (ICD: A00-A79), diseases of neoplasms, disorder of blood and forming organs (ICD: C00-D89), diseases of endocrine, nutritional and metabolic (ICD: E00-E90), diseases of eye, adnexa, ear and mastoid (ICD: H00- H81), diseases of respiratory system (ICD: J00-J99), digestive system (ICD: K00-K93), sign & symptoms and abnormal clinical and laboratory findings (ICD: R00-R99) and poisoning and certain other consequences of external cause (ICD: T00-T98) at $p<0.001$ level, and the categories of morbidity injury (ICD: S00-S99) and (ICD: V01 - Y99) were found statistically significant at 5% level.

Table 1: Morbidity among children treated as in-patients by age groups and gender.

Age group in years	Boys		Girls		Total		Z statistics (p value)
	#	%	#	%	#	%	
<1	289	14.2	202	15.0	491	14.5	0.6 ns (p>0.05)
1-4	681	33.4	380	28.2	1061	31.3	3.2 sig. (p<0.05)
5-9	552	27.1	379	28.1	931	27.5	0.6 sig. (p<0.0001)
10-14	518	25.4	388	28.8	906	26.7	2.2 sig. (p<0.0001)
Total	2040	100.0	1349	100.0	3389	100.0	11.6 sig. (p<0.05)
% (All cases)	60.2		39.8		100.0		
Average age	6.1 years		6.5 years		6.3 years		

Table 2: Morbidity causes related to health problems and sex.

ICD.10	Classification of diseases system	Boys		Girls		Total		p-value
		#	%	#	%	#	%	
A00-A79	Diseases of bacterial infection	730[1]	35.8	523[1]	38.8	1253[1]	37.0	<0.001
A80-B34	Diseases of viral infections and other viral diseases	26	1.3	16	1.2	42	1.2	>0.05
B35- B89	Diseases of infections caused by fungi, protozoan's, worms infection	7	0.3	9	0.7	16	0.5	>0.05
C00- D89	Diseases of neoplasms, disorder of blood and forming organs	124[4]	6.1	65[5]	4.8	189[4]	5.6	<0.001
E00-E90	Diseases of endocrine, nutritional and metabolic	34	1.7	27	2.0	61	1.8	<0.001
G00- G99	Disease of nervous system	18	0.9	27	2.0	45	1.3	>0.05
H00- H81	Diseases of eye, adnexa, ear and mastoid	20	1.0	12	0.9	32	0.9	<0.001
I00- I99	Diseases of circulatory system	10	0.5	4	0.3	14	0.4	>0.005
J00- J99	Diseases of respiratory system	168[3]	8.2	103[3]	7.6	271[3]	8.0	<0.001
K00- K93	Disease of digestive system	60[6]	2.9	34[6]	2.5	94[6]	2.8	<0.001
L00- L99	Diseases of skin and subcutaneous tissue	19	0.9	9	0.7	28	0.8	>0.05
M00- M99	Diseases of musculoskeletal system and connective tissue	0	0.0	1	0.1	1	0.0	NS
N00- N85	Disease of genitourinary system	45	2.2	7	0.5	52	1.5	>0.05
Q00-Q99	Diseases of congenital malformations, deformations	2	0.1	0	0.0	2	0.1	NS
R00- R99	Diseases of symptoms signs and abnormal clinical and laboratory findings	571[2]	28.0	402[2]	29.8	973[2]	28.7	<0.001
S00- S99	Diseases due to injury	49	2.4	27	2.0	76	2.2	<0.05
T00- T98	Diseases due to poisoning and certain other consequences of external cause	123[5]	6.0	66[4]	4.9	189[5]	5.6	<0.001
V01- Y99	Diseases of external cause of morbidity and mortality	34	1.7	17	1.3	51	1.5	<0.05
Total		2040	100.0	1349	100.0	3389	100.0	

Superscript figures (1, 2, 3, 4, 5 and 6) are representing the rank order to diseases.

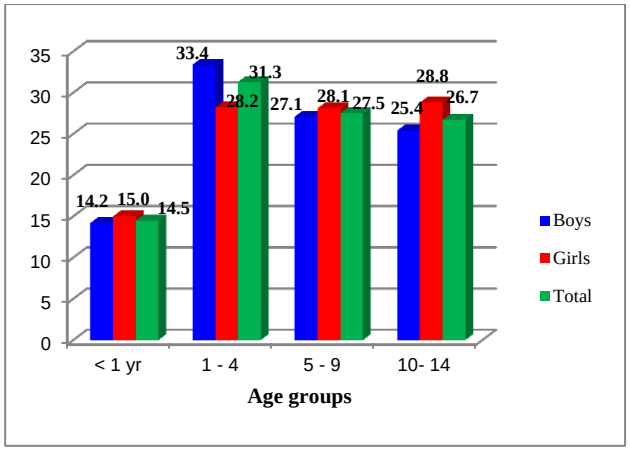

Figure 1: Percentage of morbidity among children by gender.

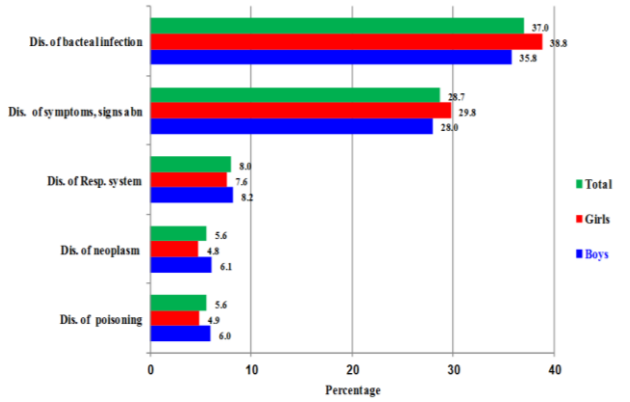

Figure 2: Percentage distribution of morbidity event in children.

Table 3 provides the distribution of seasonal variations among children in morbidity, mortality; case fatality rate (CFR) and bed occupancy rate (BOR).The climate in Dehradoon area cannot be exactly differentiated into the conventional four seasons. A more practical demarcation is the winter months of December, January and February, the spring season months of March and April, the hot-dry period of May and June, the hot-wet monsoon (rainy) period of July, August and September, and autumn comprising October and November (Figure 3a and 3b). Out of the total admission (n= 3389), the high point in the frequency of morbidities (n=885 i.e.26.1%) and mortalities (n=12 i.e. 31.6%) were found in the hot-wet season (July to September month) in comparisons to other seasons with bed occupancy rate (135.8%), followed by the season hot-dry (May and June month) morbidities (n=664 i.e.19.0%) with high bed occupancy rate (168.2%) of the year and mortalities during the season of spring (n=11 i.e. 28.9%) with BOR (134.8%). Overall case fatality rate was 1.12% with bed occupancy rate of 135.3%. The seasonal variation is given in red color (Figure 3b).

Table 3: Month wise distribution of children admitted, death cases, case fatality rate and bed occupancy rate.

Month/ Season	Morbidity		Deaths		CFR	BOR
	#	%	#	%		
Winter	721	21.3	3	7.9	0.42	106.7
December	301	8.9	1	2.6	0.33	149.8
January	230	6.8	2	5.3	0.87	89.5
February	190	5.6	0	0.0	0.0	78.0
Spring	553	16.3	11	28.9	1.99	134.8
March	264	7.8	5	13.2	1.89	125.0
April	289	8.5	6	15.8	2.08	144.9
Hot-dry	644	19.0	7	18.4	1.09	168.2
May	327	9.6	4	10.5	1.22	173.2
June	317	9.4	3	7.9	0.95	163.1
Hot-wet	885	26.1	12	31.6	1.36	135.8
July	270	8.0	6	15.8	2.22	115.6
August	296	8.7	3	7.9	1.01	120.2
September	319	9.4	3	7.9	0.94	172.9
Autumn	586	17.3	5	13.2	0.85	144.4
October	293	8.6	2	5.3	0.68	155.4
November	293	8.6	3	7.9	1.02	133.2
Total	3389	100	38	100	1.12	135.3

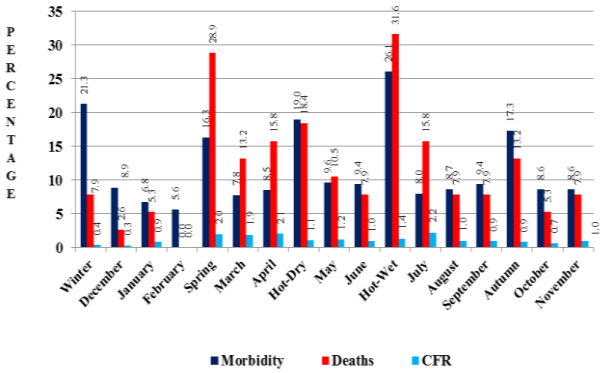

Figure 3a: Month wise proportion of children admitted, deaths and CFR.

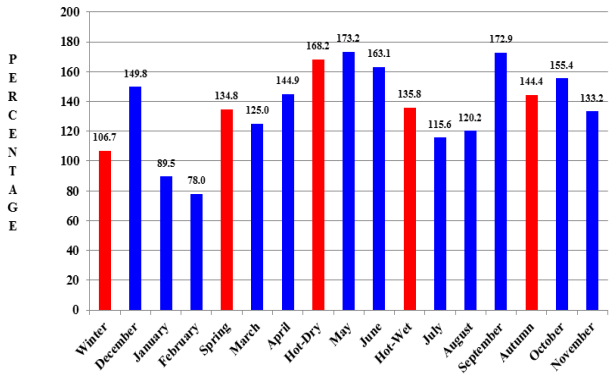

Figure 3b: Month wise distribution of BOR.

Table 4 provides the distribution of children according to condition at discharge. It was found that out of the total (n= 3389) admitted cases in hospital, 2219 children (65.5%) were discharged as cured, 710 (20.9%) were relieved, 342 (10.1%) left against medical advice (LAMA), 80 (2.4%) were referred and remaining 38 (1.1%) expired (Figure 4). Statistically significant (p>0.05) association was found between the age groups and discharge conditions.

Table 4: Distribution of children according to condition at discharge and ages.

Age group	Cured		Expired		LAMA		Relieved		Referred		Total		Chi-square statistic
	#	%	#	%	#	%	#	%	#	%	#	%	
<1Year	324	14.6	9	23.7	45	13.2	98	13.8	15	18.8	491	14.5	4.5473 ns (p>0.05)
1- 4	711	32.0	10	26.3	123	36.0	200	28.2	17	21.3	1061	31.3	11.46 sig (p<0.05)
5- 9	606	27.3	10	26.3	87	25.4	205	28.9	23	28.8	931	27.5	1.5298 ns (p>0.05)
10- 14	578	26.0	9	23.7	87	25.4	207	29.2	25	31.3	906	26.7	3.9645 ns (p>0.05)
Total	2219	100	38	100	342	100	710	100	80	100	3389	100	15.7752 ns (p>0.05)
% (All cases)	65.5		1.1		10.1		20.9		2.4		100.0		

Table 5: Distribution of CFR by ages and categories of disease classification.

ICD.10	Categories of disease	Age groups								Total	
		<1 year		1-4		5-9		10-14			
		No. of death	CFR	No. of death	CFR	No. of death	CFR	No. of death	CFR	No. of death	CFR
A00-A79	Bacterial infection	4	1.6	4	0.9	1	0.3	0	0.0	9	0.7
R00- R99	Symptoms & signs and abn.	2	2.1	1	0.3	2	0.7	5	1.7	10	1.0
E00-E90	Endocrine, nutritional	1	4.1[2]	2	6.9[2]	0	0.0	0	0.0	3	4.9
V01-Y99	External cause	1	50.0[1]	0	0.0	1	7.7[2]	1	4.5[2]	3	5.9[2]
G00- G99	Nervous system	0	0.0	1	8.3[1]	2	12.5[1]	0	0.0	3	6.7[1]
S00- S99	Injury	0	0.0	1	4.2	1	3.8	1	4.2	3	3.9
J00- J99	Respiratory system	1	1.1	0	0.0	1	1.9	0	0.0	2	0.7
C00- D89	Neoplasm	0	0.0	1	1.6	1	1.7	0	0.0	2	1.1
T00- T98	Multiple organ effect	0	0.0	0	0.0	0	0.0	1	1.4	1	0.5
N00- N85	Genitourinary system	0	0.0	0	0.0	0	0.0	1	5.6[1]	1	1.9
K00- K93	Digestive system	0	0.0	0	0.0	1	2.2	0	0.0	1	1.1
Total (CRF %)		9	1.9	10	0.9	10	1.1	9	1.0	38	1.1

Superscript figures (1 & 2) representing the rank order of case fatality rate (%).

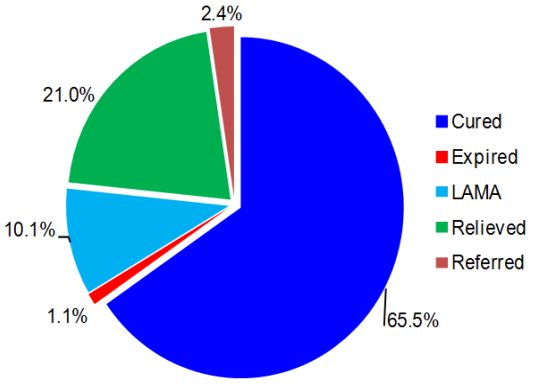

Figure 4: Condition at discharge in children.

Table 5 shows the distribution of case fatality rate by age and categories of disease classification. A total of 38 children deaths in all age groups were registered during the study period. Total case fatality rate was 1.1% to all morbidity events. In infants, the case fatality rate due to external causes of mortality (50.0%) was higher followed by endocrine diseases (4.1%), similarly in the age group (1-4 years) the case fatality rate due to diseases of nervous system (8.3%) was higher followed by endocrine disease (6.9%), in the age group (5-9 years) the case fatality rate of diseases of nervous system (12.5%) was higher followed by the external causes (7.7%) and in the age group (10-14 years) the case fatality rate of diseases of genitourinary system (5.6%) was higher followed by

external cause (4.5). 0.0% fatality rate means there is no fatality in defined diseases of respective age groups.

Table 6 depicts the morbidity and mortality with case fatality rate by sex. Out of 3389 morbidity cases, total number of mortality cases [(n=38, CFR (1.12%); boys n=21, CFR (1.03%), girls (n=17, CFR (1.26%)] in all age groups were registered. Amongst boys, the case fatality rate (2.42%) was higher in infants followed by the age group 10-14 (1.16%), in girls the case fatality rate were higher in the age group of 1- 4 (1.84%) and in 5-9 (1.32%).

Table 6: Distribution of morbidity and mortality cases with CFR by sex.

Age groups	Boys			Girls			Total		
	No. of morbidity	No. of mortality	CFR (%)	No. of morbidity	No. of mortality	CFR (%)	No. of morbidity	No. of mortality	CFR (%)
<1	289	7	2.42	202	2	0.99	491	9	1.83
1-4	681	3	0.44	380	7	1.84	1061	10	0.94
5-9	552	5	0.91	379	5	1.32	931	10	1.07
10-14	518	6	1.16	388	3	0.77	906	9	0.99
Total	2040	21	1.03	1349	17	1.26	3389	38	1.12

DISCUSSION

To the best of our knowledge there is no such detailed data available from any previous publication / official sources in either the state of Uttarakhand or the surrounding states.

This study only analyzed hospital admissions, which did not include children seen in the emergency and outpatients' department (OPD). Similar results would be expected if OPD children were to be included, since most of them presented for post- hospitalization follow-up, although some children with more acute problems are referred directly to the OPD. Despite limitations associated with the validity of hospital records, (e.g. omissions, inaccurate recording of diagnosis at the same time of admission, etc.) the present study shows that under-one year of age the morbidity events accounted for 14.5% and from aged 1-14 years accounted 85.5% of all admissions respectively. Statistically significant difference were found between the age groups and sex (z-statistic=11.40, $p<0.05$). Significantly more boys than girls were admitted during the study period. Lawal OM and Temiye EO et al reported a gender differential in rates of hospitalization in Lagos and a similar gender difference was also observed by Rajmil I, Fernamdaz E and Salas T et al.[11,12] There is no ready explanation for this male preponderance in hospital admissions. 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.

The data showed that the hospitalization of children was with following diseases, 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%). The digestive system maladies were because of lack of safe water and poor sanitation in the homes as well as unhygienic handling of the infant's feeds. Similar results were reported by Ogbeide MI and Feacham RG.[13,14] 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.[15-18] This underlies the need to strengthen preventive pediatrics. 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.

Study shows that, among boys, the case fatality rate was higher in infants (under one year) followed by the age group 10-14 years, in girls the case fatality rate were higher in the age group of 1-4 (1.8%) and in 5-9 (1.32%). 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 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.[19-23] 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.[24,25]

Indeed, despite the fact that more boys than girls were hospitalized, mortality rate was higher among girls in this study. This implies that intervention programmes aimed at reducing child mortality would need to correct the bias against girls if equitable access to health care is to be achieved. It should be noted that although hospital admission data are inevitably referral and access biased, they can provide useful information on morbidity and mortality in the community.

Strengths of the study

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

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.

CONCLUSION

The present study only highlights the status of different types of morbidities and mortalities in a secondary care hospital. This is the first study amongst admitted children of peadiatric age group with all causes of morbidity and mortality to highlights the morbidity, mortality pattern and the case fatality rate.

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Ethical approval: Specifying written permission for conducting the study was obtained prior to collecting the data from the additional health secretary and mission director, NRHM, Director General of Health Services (DGHS) of the Uttarakhand state and also from medical superintendent of the Doon Hospital by explaining the purpose of the study

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