The Nutritional and Health Status of Children in Bahraich, Uttar Pradesh, India

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Abstract

Introduction Bahraich is the least developed and most flood-exposed district in Uttar Pradesh (UP), India. Despite the economic growth that could be observed in India over the recent years, crushing poverty and malnutrition are unforgiving realities for millions of women and children in the country [11].

Objective The objective of the survey was to assess and compare the nutritional and health status of children living in flood and non flood exposed areas and to understand the economic and social characteristics of populations living in Fakharpur, Bahraich, India.

Methods A 2-stage stratified cluster survey was carried out over a period of two weeks in July 2009. The data was entered into SPSS and analysed using Stata, PASW Statistics and the ENA software.

Results Wasting was found to be 23.6% [20.0 ; 27.2], with no difference between the exposed and unexposed areas. The overall prevalence of illness was 70.3% [67.2;73.51], with children suffering from at least one of the symptoms of cough or diarrhea.The children whose mother had their first child at a younger age reported significantly higher illness.The average annual income was equal to 21162.94 rupees ($1.18/day). The annual income significantly differs between household living in exposed and unexposed villages with a 28% difference on average. The main occupation in both group was farming.

Conclusion The health and nutritional status of the youngest children aged 6-17 months as well as the household economic status, especially for those families living in exposed area, are reason for great concern.

Key words: Malnutrition, Natural Disasters, Flood, Child Health, Morbidity, India

1. Background and Objective

Proper nutrition is a powerful good: people who are well nourished are more likely to be healthy, productive and able to learn.Good nutrition benefits families, their communities and the world as a whole. [12].

Malnutrition plays a part in more than a third of all child deaths in developing countries

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[12].

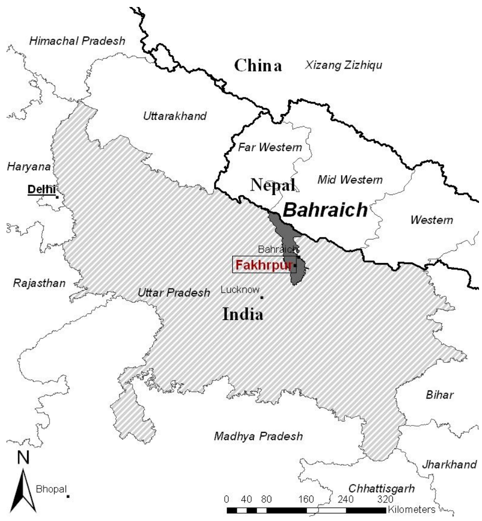
While significant progress has been made in relation to vitamin A supplementation and salt iodization, micronutrient deficiency remains a significant public health problem. According to figures from the United Nations Children's Fund (UNICEF) 1 in 4 children under the age of 5 in developing countries is underweight [12].

A child's dietary condition is threatened by the recurrence of disasters such as tsunamis, floods and earthquakes. Floods are the most common natural disaster in both the developed and developing world. In recent years, the occurrence of floods has increased with Asia witnessing the greatest rise [1]. The international child rights and development organization Save the Children estimates that around 175 million children a year will be affected by climate related disasters over the next decade [9]. Most children, however, do not die due to the natural disaster as such, but rather due to the consequence of inadequate health care, malnutrition and poor water and sanitation. According to UNICEF, malnutrition increases dramatically in emergencies because livelihoods and food crops are lost, food supplies are interrupted, diarrheal diseases break out resulting in mal-absorption and nutrient losses, and infectious diseases suppress the appetite whilst increasing the need for micronutrients to help fight illness [12, 4, 3].

Despite the economic growth that could be observed in India over the recent years, crushing poverty and malnutrition are unforgiving realities for millions of women and children [11]. According to UNICEF malnutrition is more common in India than in Sub-Saharan Africa with 1 in every 3 malnourished children in the world living in India. Infant mortality remains as high as 63 deaths per 1,000 live births [11]. Most infant deaths occur in the first month of life, with up to 47% in the first week [11]. This shows that there is a great need to translate the economic growth into improved healthcare and nutrition. The situation becomes even more urgent when taking into account the increasing threat of natural disasters and their potentially devastating impacts on the poor in particular[2].

Bahraich is the least developed and most flood-affected district in Uttar Pradesh (UP), India. It is located on the Saryu River, 125 km North-east of Lucknow, the capital state [6, 8] (see Figure 1). At the local level, the most flood-exposed blocks are: Kaisarganj, Fakharpur, Mahsi, Shivpur and Mihinpurwa. Fakharpur was the most affected flood area in the district of Eastern UP with 173 villages being affected in 2007 and 183 villages in 2008. Out of the 74 Gram Panchayats (GPs) in Fakharpur 12 were severely affected by floods while the rest remained less or non-affected [6].

Figure 1: Bahraich



Ensuring that high-level policy commitments are translated into improved outcomes for the poorest remains a challenge. A key element for effective policy includes sound data in order to measure outcomes and provide quantifiable risk profiles for action.

The objective of the survey was to assess and compare the nutritional and health status of children living in both exposed and un-exposed areas. Further, economic and social household characteristics were examined in order to get a broader understanding of the survey setting.

2. Material and methods

Study design, sampling method and sample size A 2-stage stratified cluster survey was carried out from the 5th to the 15th July 2009 in the Fakharpur block in Bahraich, India. This methodology was chosen in order to ensure adequate coverage of the target population even though no population registers were available. Each stratum was defined according to the flood exposure. For the purpose of the survey, the following definition of exposure was used: (1) exposed group: This group included villages which were situated on the river side of the embankment and were therefore exposed to one or several floods every year (one or more times). (2) unexposed group: The unexposed group included villages which were situated on the other side of the embankment and therefore being protected from the floods. In some flood events, however, if the water level surpasses the embankment or due to a breech in the embankment, some such villages, even though, lying on the safer side of embankment, may also get flooded.

Each stratum consisted of a sample size of approximately 400 children. The sample size (SS) was calculated using the Emergency Nutrition Assessment (ENA), given an expected Global Acute Malnutrition (GAM) rate of 15% in both strata a design effect of 2, and the total population (number of children) in both areas[4] as presented in table 1. The SS was increased by 5% in each stratum to account for non-response and missing values.

Table 1: Sample Size Calculation

	Exposed	Unexposed
no. households	6302	26045
Estimated U5[4]	6957	27905
Required SS	381	389
Clusters	20	20
Final SS	400	400

The survey was carried out following the following the SMART methodology[5] [10]. Within each stratum the first stage of sample selection was done through allocating cluster numbers to villages according to the probability proportional to their population size (PPS). In the second stage the EPI-revised sampling method was used to identify study population. A direction was randomly chosen taking the center of the village as a reference point and spinning a bottle. The interviewers then walked to the edge of the village where the bottle was spun again. Following the direction of the bottle interviewers started counting the households[6]. Thereafter the first household was selected randomly by taking a number between 1 and n. The subsequent household was selected by proximity, going into the first door on the right of the previous household. Health, anthropometric and vaccination data were collected on all children aged between 6 and 59 months belonging to the selected households until data had been obtained on a total of 30 children for that particular cluster.

Data collection After obtaining informed consent from parents/caregivers, 11 trained data collectors interviewed the parents using a pre-designed and pre-tested questionnaire which had been translated into Hindi. The questionnaire was administered to the parents in the local language. The child's age was determined through the date of birth by using a calendar of local events. This was judged to be more reliable than the reported age, which was often unknown by mothers. The following results are therefore based on the re-calculated ages. The re-calculation of ages excluded 8 children out the 6-59 age-range for analysis purposes.

The structured questionnaire covered symptomatic information on both the acute child morbidities as perceived by the mother in the 2 weeks preceding the survey, as well as nutritional information. Anthropometric measurements were taken for all children between 6-59 months in selected households and GAM was calculated on the basis of a weight-for-height index less than 2 z-score from the WHO reference population and/or edema.Weight was determined to 100 grams and height to 1 mm. Further, wasting was used as an indicator of acute malnutrition, as our information on edema prevalence was judged as unreliable.Wasting can be used as a proxy indicator for the general health of the entire population.

In addition, information on the immunization status was collected. As vaccination cards were scarce and often lost during floods, information on immunization was mainly based on verbal report by the parents. The information was analyzed only for children between the age of 9 and 59 months.

[4]Estimated from the number of children under six years according to $U5 = U6 - \frac{U6}{6.5}$

[5]Standardized Monitoring Assessment of Relief and Transition

[6]defined as people who eat from the same kitchen

The socioeconomic status was assessed by average annual income, household landholdings, occupation, credit practices, education and characteristics of the parents.

Data analysis The data was entered into Statistical Package for Social Science (SPSS) version 15.0. The data analyses was performed using Stata version 9.0, PASW Statistics version 18.0 and the ENA software. The 95% confidence intervals (CIs) were calculated and adjusted for the design effect.

Associations between risk factors and morbidity were evaluated by using t-tests and contingency analysis. Subjects were excluded from the analyses if data regarding age, morbidity, parent's assets or nutritional status were missing. Further, subjects were also excluded from the analyses if their reported age did not fall with the determined age range (6 - 59 months).

3. Results

Household flood exposure A total 577 households were selected for the study. Among those 50% were living in severely flood exposed areas. However, 64.9% of the people interviewed reported to have lived in a village that had been flooded at least once in the last five years on average. Among those households, half had been flooded once a year or less. The remaining households reported flood events up to six times a year. In two households, the parents could not recall the flood experience. The villagers reported that the floods resulted in the destruction of crops, houses and roads. Inadequate sanitation, disease emergence, food and water shortages, and school disruption were mentioned as major problems encountered as a result of the floods.

Study population A total of 809 children between 6 and 59 months were examined for the study with 403 children living in villages that were severely flood-exposed and 406 children living in unexposed areas.

In total, 8 subjects had to be permanently excluded from the data analysis due to the age variable. Available data on age was present in 801 child records. Out of these 801 subjects, the highest proportion of children (26.4%) was aged between 42-53 months, followed by 25.1% of children being aged between 6-17 months. Just over half of the children were male (51.4%).

Table 2: Distribution of age and sex of sample

Months	Boys		Girls		Total	
	no	%	no	%	no	%
6-17	94	46.8	107	53.2	201	25.1
18-29	105	57.7	77	42.3	182	22.8
30-41	78	47.6	86	52.4	164	20.5
42-53	113	53.6	98	46.4	211	26.4
54-59	24	57.1	18	42.9	42	5.3
Total	414	51.7	386	48.3	801	100

Disregarding the 8 excluded records (translating into the exclusion of 7 households), the average household size was 7 persons with a median of 6. The household size in unexposed areas showed to be significantly higher (n=7.35) than in the exposed areas (n=6.53) (p = 0.0043).

Further, 5 subjects had either missing data on health symptoms and/or height/weight characteristics; Outliers were excluded from the analysis (n=6) [7]. These subjects were excluded from the analyses where appropriate (See Table 3).

Parental profession and educational status The occupational status of fathers was mainly farmer (38%) in both exposed and non-exposed areas. The proportion of unskilled laborer was 37% in the exposed group and 25% in the unexposed group. Small traders and private sector employees account for 11.4% of the occupations in the unexposed area. The majority of the mothers in the sample were house wives (93%) with only 18% of them being able to read or write. The average number of school going years was 6.8 fore educated mothers and 7.2 for educated fathers.

Household income and landholding In 80% of the households only one parent had an income. The average annual income was equal to 21162.94 rupees ($1.18/day). The annual income significantly differs between household living in exposed areas, who earn on average $30 [25.04;34.91] per month and

[7] Were excluded from the nutrition data analysis the children that presented weight-for-height < - 5 z-score or > 3 z-score from the reference population

Table 3: Exclusion of children due to age or missing data

n = 809

Rationale for exclusion	no. children excluded	n
Out of age-range	**8**	**801**
> 59	2	
< 6	1	
Age missing	5	

Morbidity (6-59 months)

Exclusion	**2**	**799**
Diarrhea missing	1	
Cough missing	2	

Malnutrition (6-59 months)

Exclusion	**9**	**792**
WFH missing	3	
WFH outliers	6	

Parent's assets

Exclusion	**56**	**745**
Landholding missing	1	
Annual Income missing	43	
Credit missing	14	

household in the unexposed villages, whose monthly income was reported to be on average 28% higher with \$41.7 [32.84;50.48] (p = 0.025)[8].

Landowners represented 66% of the households. Among non-flooded households 77% had landholdings, whereas in the exposed villages only 56% of parents were landowners (p=0.0000). The actual number of landholding between exposed and non-exposed areas was not shown to be different.

Household loans Among all the households included, 52.6% reported to having taken a loan in the past. Twenty eight percent of the microcredit was used in order to treat disease and finance health care. In 18% of the cases the loan was used for covering wedding expenses. Other uses of the credit included the purchase of food or agricultural materials and home repair work. The source of the loan was a money lender (39%) or a friend or relative (34%). Only 22% of the loans were borrowed from a public sector bank.

Religious background Overall 76.3% of the households belonged to the Hindu religion, 23.5% indicated to be Muslims and only one household belonged to the Sikh religion. Among the selected households the largest group were member of the Other Backward Class (OBC) caste (38.6%), 22.6% belonged to the general caste and 14% to the Scheduled Tribes (ST) caste.

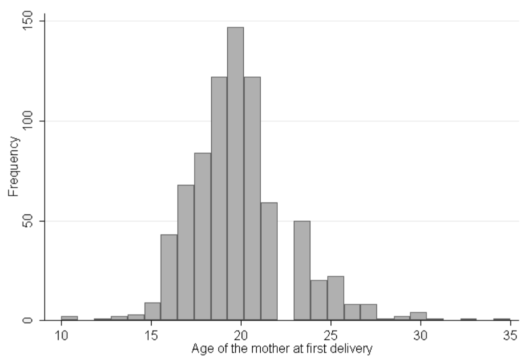
Marriage and child bearing age The average age for marriage was found to be around 16.5 years. Table 4 depicts the age at marriage according to the household flood exposure status and the ability of the mother to read or write. Differences are significant at 95% confidence between education level (p = 0.0001) and across strata (p = 0.0092).

Table 4: Age at marriage

	Educated	Not Educated
Unexposed	17.58	16.45
Exposed	16.78	16.11

There is no difference however regarding the age at first child birth. On average, women have their first child at the age of 20. Figure 2 shows the related distribution.

Figure 2: Age at first delivery



Child immunization The proportion of vaccinated children according to immunization cards and mother's recall are reported in Table 5. Only 10.6% of the children had

[8] with the exchange rate being 1 rupee = 49.1\$

a vaccination card. The Polio immunization coverage was the highest with 93.4% of the children having received polio drops.

Over half of the children were also reported to have received the BCG (58.8%) and MCV (51.3%) vaccines. DTP vaccine coverage was however lower than 50%.

Table 5: Vaccination coverage among children from 9 to 59 months

Vaccine	% of vacc. children [CI]	% confirmed by card	n
BCG	58.8 [55.2; 62.4]	16.5	723
MCV	51.3 [47.6; 54.9]	14	714
Polio	93.4 [91.6; 95.2]	11	730
DTP	45.5 [41.8; 49.2]	17	701

Child illness

Overall analysis. Next to the 8 subjects that needed to be excluded due to the age variable another 2 records had to be excluded due to missing values of cough and/or diarrheal symptoms. The total number of child records included in the analyses was n=799.

The overall prevalence of illness was 70.3% [67.2;73.51] (n = 562/799) is defined as, the child suffered from at least one of the symptoms being cough or diarrhea. Of those about 59.3% [55.2;63.3] (n= 333/562), of children reported to have had both coughing and diarrhea during the 2 weeks preceding the survey. Out of the remaining 40%, 19.75% [16.5;23.1] (n= 111/562) had only diarrhea. Half of the children suffering from these symptoms were give treatment. Table 6 provides more insights on the morbidity profiles of the entire sampled population.

Table 6: Morbidity profile

% ill children (n)			% healthy children (n)
70.34 (562)			29.66 (237)
Diarrhea	Cough	Both	
19.75%	21%	59.25%	
(111)	(118)	(333)	

In the whole sample, the prevalence of diarrhoea and/or cough was lowest (57%) in children age 54 to 59 months, while it was highest (81%) in 6 to 17 months children (see Table 7).

Table 7: Disease prevalence per age group

Agegroup	Morbidity prevalence	n
6-17	81.31	198
18-29	73.51	185
30-41	68.1	163
42-53	62.14	206
54-59	55.32	47

When looking at the prevalence of cough among the children, you can see a higher prevalence amongst the first age group Table 8.

Table 8: Children ill with cough by age group

Age group	Children ill (cough)	%
1	131	29.05%
2	113	25.06%
3	92	20.4%
4	102	22.62%
5	13	2.88%
	451	100%

The prevalence of diarrhea is associated to the prevalence of cough, exhibiting a correlation of 41% (Pearson $\chi^2(1) = 134.86$, p = 0.000). Indeed, 74.89% of children that had had diarrhea were also reported to have suffered from cough.

Morbidity of children was significantly higher among women (13%) that had had their first child at a younger age (p=0.0049).

Child illness and flood exposure. There is no significant difference in the occurrence of diarrheal illness between the exposed and the unexposed children. However, the occurrence of cough was significantly different between households that had been flooded at least once and the others (p=0.0299). Further, there is no significant difference in diarrheal disease or coughing in children between sex groups as well as religious groups.

Child illness and households' income. In order to examine the association between the prevalence of disease and household revenue, an income class variable was created. The variable was defined by the categories of the annual income as presented in Table 9.

Table 9: Income categories

Income Quintile	Income range (Rupees)
1	0 - 6000
2	6001 - 12000
3	12001 - 18000
4	18001 - 24000
5	24001 - 600000

While the prevalence of diarrheal disease was not shown to be associated with income, the prevalence of coughing among children showed a negative correlation (p = 0.011). First, children from richer households were shown to have less cough than the others. Children from the lower side of the income distribution show a lower proportion of cough than in the middle income households. The same holds true for the highest income category.

Table 10: Prevalence of cough and household revenue

Income	% reporting cough (n)		
quintile	Overall	Exposed	Unexposed
1	28.98 (122)	55.1 (75)	54 (47)
2	22.8 (96)	50 (39)	56.4 (57)
3	17.1 (72)	66.7 (36)	62.1 (36)
4	15.2 (64)	62.5 (30)	68 (34)
5	15.91 (67)	44 (22)	47.4 (45)
Total	100 (421)	48(202)	52(219)

Table 11 below shows the distribution of children reporting cough across the different income groups.

The average child age is lowest among the third and fourth income category. The first and fifth income category showed that the average age of children in these two income groups lies around 33 months (Table 12).

Child nutritional status A total of 801 children were included in the anthropometric analysis (Table 2). Both global and severe wasting was calculated for children from 6 to 59 months. Outliers were defined as less than - 5 or more than 3 z-scores from the mean. Six children were excluded as being out of range, and 3 z-score are not available as measurements could not be taken. From 801 children, 792 children were included for the nutrition analysis.

Table 11: Chidlren reporting cough across income categories

Unexposed

Income	Cough	Total	% sick
1	47	87	21.46%
2	57	101	26.03%
3	36	58	16.44%
4	34	50	15.53%
5	45	95	20.55%
Total	219	391	100%

Exposed

Income	Cough	Total	% sick
1	75	136	37.13%
2	39	78	19.31%
3	36	54	17.82%
4	30	48	14.85%
5	22	50	10.89%
Total	202	366	100%

Table 12: Children age and Wealth

Income Quintile	Average Age	n
1	32.6	162
2	31.44	277
3	29.70	112
4	28.97	97
5	32.82	144

When the Bahraich child sample was compared to WHO reference population, the prevalence of wasting was found to be 23.6% [20.0 ; 27.2] for the entire sample (n=792). Among boys, this proportion goes up to 25.4% [20.3-30.5], which is not significantly higher than among girls, where GAM is 21.7% [17.3-26.2].

Figure 3 shows the distribution of z-score of the Bahraich sample compared to the WHO reference population, which reveals a high level of acute malnutrition.

Severe wasting is reported in Table 13.Overall, the percentage of children below -3 z-score is below the country average reported by the National Family Health Survey (NFHS) in 2005-2006, which is 6.1% (among under 5s)

Figure 3: Global Wasting

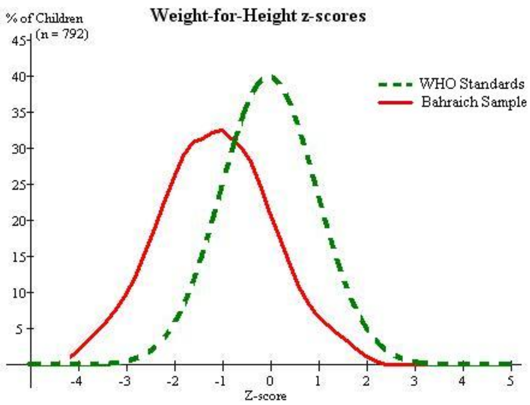


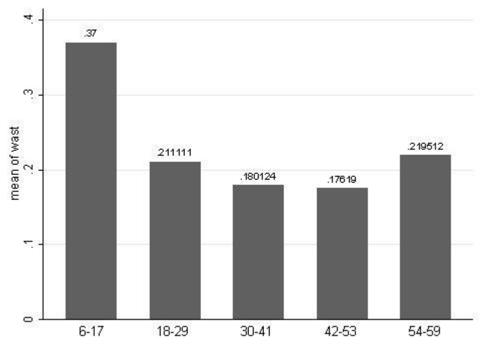
Table 13: Severe Wasting by sex

Sample	n	%	CI
All	792	5.9%	3.8- 8.1
Boys	410	8.3%	5.0-11.6
Girls	382	3.4%	1.5- 5.3

and it does not differ much from the provincial average (5.1%) [7].There are significant differences between boys and girls in the sample as far as severe wasting is concerned (p=0.0013).

Using the age-group presented in Table 2 and quintiles of the z-scores, it can be demonstrated that older children are less wasted on average ($\chi^2(16) = 27.54$ (p=0.000)). This is illustrated in Figure 4, which shows a decreasing relation between age and wasting. This results holds for both areas.

Figure 4: Wasting and Age



Overall, no significant difference in acute malnutrition was found in children living in exposed and non exposed areas (p= 0.6269), neither between sick children and healthy ones (p=0.4528) nor between children whose mother's characteristics differed.

4. Strengths and limitations

The survey succeeded in achieving a high response rate of almost 100%. Only one parent refused to take part in the study. In total, 809 questionnaires were successfully administered involving 577 households in exposed and non-exposed areas in Bahraich.

The strength of the survey can be judged on the sampling design, which assured that the representativeness of the study sample was maximized. Further, the data was collected by means of a systematic questionnaire as opposed to unstructured interviewing which increases the reliability of the data. Moreover, the questionnaire did not last more than 30 minutes, maximizing the accuracy of responses.

The study was inevitably subject to limitations which need to be acknowledged. An important restraint of the survey relates to information bias possibly introduced by parental over or under reporting. The study, for instance, indicated that children from richer households are less ill than the others which may be due to parental over reporting of either income or child illness. Further, the reliability regarding immunization data as well as the data may have been subject to parental recall bias.

Another retrain refers to the timing of the study. These findings may be subject to measurement bias as the survey was conducted around 10 months after the most recent flood. The nutritional indicator for instance, which was used to measured acute malnutrition and thus the outcome between the two groups may have been different if the study would have been conducted right after the flood. Further some of the study population such as the youngest children may not even be old enough the have had a flood exposure. This restricts the conclusion regarding the health impacts attributable to the flood as such.

5. Discussion

In the study region a high proportion of children were reported to have received the polio immunization (93.4%). Although only 11% of immunizations were confirmed by card, the high coverage is consistent with the coverage reported by the 2005-2006 NFHS among 12-23 months children [7]. The high coverage could be explained by the Plus Polio Immunization Campaign, which was launched in 1995 across India in addition to routine polio immunization. Every child below 3 years of age was given two doses of oral polio drops with one month apart. One year later, the target age was increased to cover children below 5 years of age [5].

The survey was carried out in a very poor part of Northern India with an average annual income of 21162.94 rupees ($1.18/day) which is below the UN Millennium Development Goal poverty line of $1.25 per day indicating the precarious living conditions of the families. Despite similar occupational profiles and comparable number of landholdings, the results showed a noticeable difference in economic status with higher income among families in non exposed areas. Cultivating land takes much more time than a flood needs to destroy it. The 28% higher income may thus be partly due to the rather long-term and maybe even chronic economic damage due to the floods.

When looking at the average age of children across each income category. The average age of children in the middle income families was lower compared to the average age of children in low and upper income categories. The proportional age distribution within each income group explains that within the middle income families there was a higher proportion of children belonging to the first age group (6-17 months) (34% and 31% respectively) than in the other income categories. This does not imply that the middle income groups (3 and 4) have the largest number of young children from the sample. However, when looking at the entire sample, 32.7% of the youngest children, do indeed belonged the fourth income category. One would thus assume that this age group would also bear the highest burden of cough.

As the results revealed, the youngest age category was found to bear highest share of cough among the children in the entire sample (29%). Indeed, families belonging to the middle income categories (12001-18000 rupees) reported a very high cough prevalence while the first and second income category reported less cough within their groups. The richer families reported the lowest proportion of children with cough. This proportional distribution of cough prevalence by income category was shown to very similar in both exposed and unexposed areas.

So all in all, the youngest age category were found to bear highest share of cough among the children in the entire sample (29%). In addition, the fourth income category was shown to have the highest number young children out of the whole sample. Middle income families also reported to have the highest percentage of children with cough among their group (65.3%). One has to bear in mind that a remaining 71% of the cough burden is distributed among the older age groups and is decreasing by age. This therefore does not indicate that the youngest children belonging to the middle income group are the sick ones.

When looking at the cough distribution across the income categories, the higher share of illness is found in the two lowest income groups. This means, although the highest proportion of cough was reported among children in the middle income households, the highest number of children with cough, however, belongs to the first two income categories. Further, the number of children with cough in the first two income categories living in the exposed area (56.4%) was significantly higher than in the unexposed (47.5%). This indicates that more than half of the cough is reported in among the poorest, with a smaller number of young children belonging to this group.

In conclusion, the results show the majority of the young children that are sick are poor. However, the distribution of the sick and poor children is uniformely distributed across age groups.

The risks of both illness and malnutrition are prone to amplify in the immediate aftermath of the flood given especially considering more vulnerable economic situation of the exposed households.

Although discrimination against girls in feeding are often cited, our study did not find a significant difference between the nutritional status of girls and boys. This is consistent with what other studies found when nutrition status was based on anthropometric data calling for an improvement in nutritional assessment tools.

Conclusions

Although the sample population was drawn from a poor part of northern India a difference in income was very clear with families living in the un exposed areas being richer.

The morbidity data[9] showed that the overall prevalence of child illness was quite high (70.3 %) with most of children having both cough and diarrhea. While there was no difference found in the occurrence of diarrheal illness between exposed and unexposed children, the occurrence of respiratory disease differed significantly among the two groups. Further, overall wasting was found in 23.6%. Overall, the youngest children from the sample (aged between 6 - 17 months) bear the highest burden of illness and acute malnutrition.

The health and nutritional status of the youngest as well as the household economic status - especially of those families living in exposed areas- are of great concern. Knowing that floods will geographically spread and are most often than not reoccurring events, they can transform acute health impacts to long term problems and long lasting economic damages to chronic situations.

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[9] keeping in mind all included records from children aged between 6 and 59 months (n=799)