Original Research Article

Socioeconomic determinants of anaemia in preschool children in Uttar Pradesh: evidence from NFHS-4 survey

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ABSTRACT

Background: In India, 89 million preschool children (6-59 months) suffer from anaemia. As per NFHS-4, the prevalence of anaemia in Uttar Pradesh was 63.2%. A study was undertaken to estimate the prevalence of anaemia among preschool children and to examine rural-urban differentials and association of socioeconomic determinants with anaemia. The secondary data of the National Family Health Survey-4 conducted in the year 2015-16 was used.
Methods: The prevalence of anaemia was calculated and chi-square test and binary logistic regression was carried out to identify the association between anaemia status and socioeconomic factors.
Results: Results show that 78% and 77% children in 12-23 months age group were anaemic in urban and rural areas respectively. Around 72% and 65% children whose mothers had no formal education were anaemic in urban and rural areas respectively. Around 73% of children belonging to poorest wealth index in urban areas and 64% belonging to poorer wealth index in rural areas were anaemic. Around 70% children whose mothers had anaemia were anaemic in both urban and rural areas of the state.
Conclusions: The association between anaemia in preschool children and different socioeconomic variables was profound. Educational status of mother and anaemia in mothers have a significant role in reduction of anaemia. The socioeconomic conditions of households, education level of mothers and their anaemia status need to be improved to reduce anaemia in preschool children in Uttar Pradesh and it requires immediate attention of planners and policy makers.

Keywords: Anaemia, Preschool children, Socioeconomic determinants, Wealth index

INTRODUCTION

As per the World Health Organization (WHO) anaemia is "a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet the physiological needs".[1] It remains a major public health problem affecting an estimated 2.36 billion people globally especially women and children.[2,3] Though the aetiology of anaemia is multifactorial but the most significant one is the iron deficiency which may account for more than 60% of all anemia cases.[4]

Among preschool children, anaemia is not only caused by iron deficiency, but also it is caused by other factors such as vitamin A and vitamin B12 deficiencies, and hookworm and malaria infections.[5-7] Iron deficiency anaemia reduces learning capacity, decreases attentiveness and causes low intelligence in preschool children.[8-11]

In India, 89 million preschool children (6-59 months) suffer from anaemia.[12] As per the World Bank data, the prevalence of anaemia among under 5 children, in India was 59% in 2011 and as per National Family Health Survey (NFHS-4) data, it was 60%.[3,13] Other studies also show its rising trend in India.[5,14-16] However, in the state of Uttar Pradesh (one of the Empowered Action Group states of India) the prevalence of anaemia in preschool children decreased from 73.9% (NFHS-3) to 63.2% (NFHS-4).[13,17]

The present study was carried out to assess the anaemia status of preschool children in urban and rural areas of Uttar Pradesh by using data from the most recent National Family Health Survey carried out in 2015-16.[13] The objective of the study was to assess the prevalence of anaemia among preschool children and its socioeconomic correlates.

METHODS

The study has analysed the unit-level cross-sectional secondary data of National Family Health Survey (NFHS-4) conducted in India in the year 2015-16 to estimate the prevalence of anaemia in preschool children and its socioeconomic correlates in Uttar Pradesh.[13]

NFHS is a large scale, multi round survey conducted in a representative sample of households throughout India by International Institute for Population Sciences (IIPS), Mumbai. Samples from urban and rural areas within each State were drawn separately. The rural sample was selected in two stages, with the selection of villages, using probability proportional to population size (PPS) at the first stage, followed by the random selection of households within each village in the second stage. In urban areas, a three-stage procedure was followed. In the first stage, wards were selected with PPS sampling. In the next stage, one census enumeration block (CEB) was randomly selected from each sample ward. In the final stage, households were randomly selected within each selected CEB. This used a multistage, stratified cluster sampling procedure which has been described elsewhere.[13] The total sample size of preschool children was 32103 in the state of Uttar Pradesh.[13]

In this survey, anaemia status was measured through the level of haemoglobin in the blood. Consent was taken from a parent, or an adult member of the household responsible for the child, for collection of a blood sample from the youngest 6- to 59-months old child in the household. A drop of blood was taken from a finger prick and collected in a micro-cuvette. Haemoglobin analysis was conducted on-site with a battery-operated portable Hemo CueHb 201+ analyser by the trained health personnel.[13] Levels of anaemia severity were as follows: mild (10.0–10.9 g/dl), moderate (7.0-9.9 g/dl) and severe (<7.0 gm/dl).

The preschool child's anaemia status was the dependent variable and the independent variables were age of the children (in months) (6-11, 12-23, 24-35, 36-47, 48-59); sex of the children (male, female); educational status of mother (no education, primary, secondary, higher), caste (SC/ST, Others); wealth index: the NFHS-4 constructed a wealth index, based on scores on ownership of consumer goods and household characteristics, such as availability of basic facilities like clean drinking water. It then used this information to classify all households into wealth quintiles i.e., poorest, poorer, middle, richer, richest; and anaemia in mothers of anaemic children (yes, no).

Analysis

The sample children were divided into five groups by age (in months) to assess the variation in anaemia status by the age group. The percentages of mild, moderate and severe anaemic children were computed and summed to give a total prevalence of anaemic children. In addition, the percentages of non-anaemic (normal) children were also calculated. The relationships between the anaemia status of the child and socioeconomic variables (age of the children, sex of the children, education status of mother, caste, wealth index and anaemia in mothers) were assessed using bivariate analysis and application of chi-squared tests. The chi-square test is used to determine whether there is a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories of a contingency table. For a Chi-square test, a p value that is less than or equal to <0.05 significance level indicates that there is sufficient evidence to conclude that the observed distribution is not the same as the expected distribution.

The combined effects of the socioeconomic variables were assessed by carrying out binary logistic regression by applying appropriate sampling weights. All explanatory variables were taken as categorical. Anaemic condition was considered as the dependent variable, with anaemic children being coded '1' and the rest as '0'. The coefficient of each explanatory variable, along with its significance, determined how the variable influenced the level of anaemia. A positive coefficient implied a positive relationship. All analyses were carried out using Statistical Package for Social Science (SPSS) version 19.0. Significance levels of p<0.01 and p<0.05 were considered.

RESULTS

Table 1 shows the distribution of preschool children of 6-59 months by age group and socioeconomic characteristics. It was found that 23.3% of children of 36-47 months age group were in rural areas in comparison to 22.2% in urban areas. More than half (53%) of the children were males. Almost half (47%) children were in rural areas whose mothers had no education. However, in urban areas there were 37% children whose mothers had secondary education. Around 40% children belonged to poorest wealth index in rural areas than 37% in richest wealth index in urban areas. More than 56% children had anaemia whose mothers were anaemic in both urban and rural areas of the state.

Table 2 shows the percent distribution of anaemia prevalence in preschool children and association between anaemia status and socioeconomic variables by place of residence. It also shows the Pearson's Chi-square test p values.

Table 1: Distribution of preschool children (6-59 months) by socioeconomic characteristics by place of residence, Uttar Pradesh, 2015-16.

	Urban	Rural	Total
	No. (%)	No. (%)	No. (%)
Age of the children (months)			
6-11	759 (11.2)	2686 (10.6)	3445 (10.7)
12-23	1508 (22.2)	5614 (22.2)	7122 (22.2)
24-35	1489 (22.0)	5528 (21.8)	7017 (21.9)
36-47	1505 (22.2)	5911 (23.3)	7416 (23.1)
48-59	1522 (22.4)	5581 (22.0)	7103 (22.1)
Sex of the children			
Male	3592 (53.0)	13289 (52.5)	16881 (52.6)
Female	3191 (47.0)	12031 (47.5)	15222 (47.4)
Educational status of mother			
No education	2064 (30.4)	11843 (46.8)	13907 (43.3)
Primary	849 (12.5)	3766 (14.9)	4615 (14.4)
Secondary	2500 (36.9)	7766 (30.7)	10266 (32.0)
Higher	1369 (20.2)	1945 (7.7)	3314 (10.3)
Caste			
SC/ST	1156 (17.0)	7531 (29.7)	8687 (27.1)
Others	5627 (83.0)	17790 (70.3)	23417 (72.9)
Wealth index			
Poorest	357 (5.3)	9993 (39.5)	10350 (32.2)
Poorer	754 (11.1)	7065 (27.9)	7819 (24.4)
Middle	1229 (18.1)	4387 (17.3)	5616 (17.5)
Richer	1939 (28.6)	2548 (10.1)	4487 (14.0)
Richest	2503 (36.9)	1327 (5.2)	3830 (11.9)
Anaemia in mothers			
Yes	4012 (57.5)	14696 (56.3)	18708 (56.5)
No	2964 (42.5)	11420 (43.7)	14384 (43.5)

Table 2: Percent distribution of preschool children (6-59 months) with anaemia prevalence and association between anaemia status and socioeconomic variables by place of residence, Uttar Pradesh, 2015-16.

	Urban		χ^2	Rural		χ^2	Total	
	Anaemic	Normal		Anaemic	Normal		Anaemic	Normal
	No. (%)	No. (%)		No. (%)	No. (%)		No. (%)	No. (%)
Age of the children								
6-11 months	557 (71.2)	226 (28.8)		2031 (71.5)	811 (28.5)		2588 (71.4)	1036 (28.6)
12-23 months	1223 (78.3)	339 (21.7)		4457 (76.6)	1359 (23.4)		5680 (77.0)	1698 (23.0)
24-35 months	1088 (70.4)	458 (29.6)	0.000	3976 (69.5)	1747 (30.5)	0.000	5064 (69.7)	2205 (30.3)
36-47 months	888 (57.8)	649 (42.2)		3349 (55.6)	2679 (44.4)		4237 (56.0)	3329 (44.0)
48-59 months	797 (51.4)	753 (48.6)		2583 (45.3)	3124 (54.7)		3380 (46.6)	3877 (53.4)
Sex of the children								
Male	2425 (65.3)	1286 (34.7)	0.847	8649 (62.8)	5130 (37.2)	0.966	11074 (63.3)	6416 (36.7)
Female	2127 (65.1)	1139 (34.9)		7747 (62.8)	4590 (37.2)		9874 (63.3)	5729 (36.7)
Educational status of mother								
No education	1519 (71.4)	608 (28.6)		7956 (64.7)	4332 (35.3)		9475 (65.7)	4940 (34.3)
Primary	594 (67.7)	283 (32.3)	0.000	2438 (63.1)	1426 (36.9)	0.000	3032 (64.0)	1709 (36.0)
Secondary	1683 (65.9)	869 (34.1)		4820 (60.6)	3133 (39.4)		6503 (61.9)	4002 (38.1)
Higher	756 (53.2)	664 (46.8)		1182 (58.8)	829 (41.2)		1938 (56.5)	1494 (43.5)

Continued.

	Urban		χ²	Rural		χ²	Total	
	Anaemic	Normal		Anaemic	Normal		Anaemic	Normal
	No. (%)	No. (%)		No. (%)	No. (%)		No. (%)	No. (%)
Caste								
SC/ST	797 (67.7)	381 (32.3)	0.056	4928 (63.4)	2846 (36.6)	0.185	5725 (64.0)	3227 (36.0)
Others	3755 (64.7)	2044 (35.3)		11468 (62.5)	6874 (37.5)		15223 (63.1)	8918 (36.9)
Wealth index								
Poorest	276 (72.6)	104 (27.4)		6553 (63.1)	3827 (36.9)		6829 (63.5)	3931 (36.5)
Poorer	506 (66.3)	257 (33.7)		4628 (63.7)	2633 (36.3)		5134 (64.0)	2890 (36.0)
Middle	868 (69.4)	383 (30.6)	0.000	2807 (62.3)	1697 (37.7)	0.018	3675 (63.9)	2080 (36.1)
Richer	1360 (68.1)	636 (31.9)		1585 (60.9)	1018 (39.1)		2945 (64.0)	1654 (36.0)
Richest	1542 (59.6)	1045 (40.4)		823 (60.1)	546 (39.9)		2364 (59.8)	1591 (40.2)
Anaemia in mothers								
Yes	2857 (71.2)	1155 (28.8)	0.000	10138 (69.0)	4557 (31.0)	0.000	12995 (69.5)	5713 (30.5)
No	1695 (57.2)	1269 (42.8)		6258 (54.8)	5163 (45.2)		7952 (55.3)	6432 (44.7)

Table 3: Binary Logistic Regression to determine association between anaemia in preschool children and socioeconomic variables, Uttar Pradesh, 2015-16.

	Urban				Rural			
	Unadjusted OR (CI)	P value	Adjusted OR (CI)	P value	Unadjusted OR (CI)	P value	Adjusted OR (CI)	P value
Age of the children								
6-11 months#	1.00		1.00		1.00		1.00	
12-23 months	0.68 (0.56-0.83)	0.00	0.68 (0.55-0.82)	0.00	0.76 (0.69-0.85)	0.00	0.75 (0.680-0.84)	0.00
24-35 months	1.04 (0.86-1.26)	0.68	1.02 (0.85-1.24)	0.79	1.10 (0.99-1.22)	0.06	1.09 (0.99-1.208)	0.08
36-47 months	1.81 (1.50-2.17)	0.00	1.81 (1.49-2.18)	0.00	2.00 (1.82-2.20)	0.00	2.05 (1.85-2.25)	0.00
48-59 months	2.33 (1.94-2.80)	0.00	2.43 (2.02-2.94)	0.00	3.03 (2.75-3.33)	0.00	3.11 (2.82-3.43)	0.00
Sex of the children								
Male#	1.00				1.00			
Female	1.010 (0.915-1.115)	0.85	-		1.00 (0.95-1.05)	0.97	-	
Educational status of mother								
No education#	1.00		1.00		1.00		1.00	
Primary	1.19 (1.00-1.41)	0.05	1.26 (1.05-1.51)	0.010	1.07 (1.00-1.15)	0.06	1.13 (1.05-1.23)	0.002
Secondary	1.29 (1.14-1.46)	0.00	1.37 (1.19-1.58)	0.000	1.19 (1.13-1.27)	0.00	1.34 (1.26-1.40)	0.000
Higher	2.19 (1.90-2.53)	0.00	2.16 (1.81-2.57)	0.000	1.29 (1.171-1.42)	0.00	1.53 (1.37-1.72)	0.000
Caste								
SC/ST#	1.00		1.00		1.00			
Others	1.14 (1.00-1.303)	0.05	1.03 (0.89-1.18)	0.72	1.04 (0.98-1.09)	0.19	-	
Wealth index								
Poorest#	1.00		1.00		1.00		1.00	
Poorer	1.35 (1.03-1.76)	0.03	1.29 (0.98-1.72)	0.07	0.97 (0.92-1.04)	0.41	0.96 (0.90-1.02)	0.19
Middle	1.20 (0.91-1.51)	0.23	1.08 (0.83-1.41)	0.58	1.03 (0.96-1.11)	0.35	0.99 (0.910-1.07)	0.71
Richer	1.24 (0.97-1.58)	0.09	1.09 (0.84-1.42)	0.50	1.10 (1.00-1.20)	0.03	1.00 (0.903-1.10)	0.95
Richest	1.79 (1.42-2.28)	0.00	1.22 (0.93-1.59)	0.15	1.14 (1.03-1.27)	0.03	0.98 (0.865-1.13)	0.85
Anaemia in mothers								
Yes#	1.00		1.00		1.00		1.00	
No	1.85 (1.67-2.05)	0.000	1.79 (1.62-1.99)	0.000	1.84 (1.74-1.93)	0.000	1.84 (1.75-1.93)	0.000

Results show that 78% and 77% children in 12-23 months age group were anaemic in urban and rural areas respectively. Around 72% and 65% children whose mothers had no formal education were anaemic in urban and rural areas respectively. Around 73% of children belonging to poorest wealth index in urban areas and 64% belonging to poorer wealth index in rural areas were anaemic. Around 70% children whose mothers had anaemia were anaemic in both urban and rural areas of the state.

Results of chi square test shows that age of children, educational status of mother, wealth index and anaemia in mothers were associated with anaemia prevalence in preschool children in urban and rural areas of the state (p<0.05).

The univariate and multivariate logistic regressions were done separately for both rural and urban areas of the state. In univariate analysis, it was found that age of the children, educational status of mother, caste, wealth index and anaemia in mothers were statistically significant in urban areas and therefore were used in multivariate logistic regression. However, in rural areas, age of the children, educational status of mother, wealth index and anaemia in mothers were found to be statistically significant and therefore used in multivariate logistic analysis (Table 3).

Univariate regression analysis results showed that with the increase in age of the children the prevalence of anaemia was decreasing and this trend was seen in both urban and rural areas of the state. Further, it was found that with the increase of educational status of mother and wealth index the chances of getting anaemia in children decreases.

Results of multivariate logistic regression analysis shows that the children of 48-59 months age group had 2.4 and 3 times less chances of getting anaemia than the children of 6-11 months age group after controlling for other independent variables like educational status of mother, caste, wealth index and anaemia in mothers in urban and rural areas respectively. Furthermore, it was found that the children whose mothers were not anaemic had 1.8 times less chances of getting anaemia in comparison with mothers who were anaemic by controlling other independent variables like age, education, caste and wealth index both in urban and rural areas of the state. The children whose mothers had higher educational status had 2.2 and 1.5 times less likely of getting anaemia than the children whose mothers had no formal education in urban and rural areas respectively.

DISCUSSION

The present study indicates the prevalence of anaemia among preschool children and differentials of anaemia in rural and urban areas of Uttar Pradesh. It was found that 78% of children below 24 months were anaemic in both urban and rural areas of the state and association of age with anaemia is found to be statistically significant. Similar studies found that lesser age children are vulnerable and prone of getting anaemia.[7,18-21] The possible reasons may be poor nutritional status of mother, poor breastfeeding practices, incomplete weaning practices, top feeding with diluted food products etc. As the child starts growing past 6 months the micronutrients requirements (especially iron) increases. Anaemic mothers pose risk of developing anaemia in children as their breast milk are deficient in iron contents.[7,21] While antenatal anaemia has impact on the birth weight and premature delivery which is major risk factor for childhood anaemia.

Association of educational status of mother and wealth index with anaemia in preschool children were also found to be statistically significant. Children of literate mothers were comparatively at lesser risk of anaemia than children of non-literate mothers. The results are in line with other studies.[6,7,22,23] The children belonging to the low wealth index were found to be anaemic. The findings are in consistence with other studies.[5,7,22-24]

Age of the children, educational status of mother, wealth index and anaemia in mothers were the most dominant factors affecting anaemia prevalence among preschool children in the target population.

The study had a limitation. It gives information on association and not causation due to its cross-sectional design.

CONCLUSION

The association between anaemia in preschool children and different socioeconomic variables was profound. Educational status of mother and anaemia in mothers have a significant role in reduction of anaemia. The socioeconomic conditions of households, education level of mothers and their anaemia status need to be improved to reduce anaemia in preschool children in Uttar Pradesh.

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