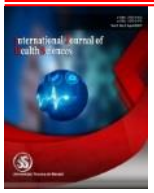

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Prevalence and Drivers of Treatment-Seeking Behaviour Among Under-Five Children Experiencing Acute Respiratory Infection in India: Treatment-Seeking Behaviour Among U5 Children Experiencing Acute Respiratory Infection

Koustav Ghosh [a], Atreyee Sinha Chakraborty [b], Banashri Haloi [c], Sarjoo Patel [d]

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Corresponding Author [a]

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acute respiratory infection;
prevalence;
treatment-seeking;
under-five children;
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Abstract

The present study aimed to examine the prevalence and determinants of treatment-seeking behaviour among under-five (U5) children experiencing Acute Respiratory Infection (ARI) in India. The last two rounds of the National Family Health Survey (NFHS), (NFHS-IV, 2015-16 & NFHS-V, 2019-21) data have been used for the study. Bivariate analysis with a chi-square test and multivariable logistic regression models were applied to examine the prevalence and determinants of treatment-seeking behaviour among U5 children in India. The prevalence of treatment-seeking behaviour among children in India has decreased from 78% in 2016 to 52% in 2021. The regression model indicated that children from rural areas (AOR: 0.85; 95% CI: 0.72-0.97), EAG states (AOR: 0.81; 95% CI: 0.67-0.99), and households reporting transportation as a barrier (AOR: 0.87; 95% CI: 0.75-0.97) had lower odds of seeking treatment compared to their counterparts. Conversely, treatment-seeking behaviour was more likely among households headed by women (AOR: 1.32; 95% CI: 1.15-1.51), mass media exposure (AOR: 1.23; 95% CI: 1.06-1.43), and those in the higher wealth categories. The current study recommends that public health programs should focus on highlighted indicators to improve treatment-seeking behaviour among children, which can help to reduce child morbidity and mortality due to ARI in India.

[a] Gokhale Institute of Politics and Economics, Pune, Maharashtra 411004, India & Population Research Centre Baroda, The Maharaja Sayajirao University of Baroda 390002, Gujarat, India
[b] Gokhale Institute of Politics and Economics, Pune, Maharashtra 411004, India
[c] Public Health Department, Central University of Kerala, Kerala 671316, India
[d] Department of Family and Community Resource Management, The Maharaja Sayajirao University of Baroda, Gujarat 390002, India

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1 Introduction

Globally, Acute Respiratory Infections (ARIs), are one of the leading causes of under-five (U5) mortality (WHO, 2022; Troeger et al., 2018; Naghavi et al., 2017). According to World Health Organisation (WHO), it is responsible for almost 20 percent of all deaths of U5 children globally (WHO, 2022). Mortality due to ARIs varies significantly across the regions (Wang et al., 2016). It is responsible for approximately 70 percent of U5 morbidity in developing countries (Selvaraj et. al, 2014). A study estimated the prevalence of ARI among U5 children across 28 sub-Saharan African countries in 2019, revealing that the overall prevalence was 25.3 percent (Seidu et al., 2019).

ARI is the major cause of mortality among children aged less than 5 years, especially in low-income (Walker et al., 2013) and developing countries (Frese et al., 2011) like India (Selvaraj et al., 2014; WHO, 1999). Bangladesh, India, Indonesia, and Nepal together account for 40% of the global ARI mortality (Kumar et al., 2015). Moreover, ARI contributes to 30-50 percent of outpatient visits and 20-40 percent of hospital admissions among U5 children, posing significant health challenges in India (Vashishtha, 2010). Beyond many health implications, ARI imposes a substantial economic burden on individual households and society (Kurskaya et al., 2018; Ramaekers et al., 2017; Krishna et al., 2015; Romieu et al., 2002). A study conducted in Bangladesh (2010) revealed that the average treatment cost for one episode of pneumonia is $13 for outpatient services and between $71 and $235 for severe cases requiring hospitalization (Alamgir et al., 2010). Additionally, recent estimates from northern India have shown that among children under U5 years old, the median direct cost of ARI was US$135 in private institutions and US$54 in public institutions (Peasah et al., 2015). Healthcare decision is influenced by socioeconomic, sociocultural, and demographic factors (Shaikh & Hatcher, 2005; Prakash, 2014). Previous research indicates that maternal literacy positively impacts their children's health-seeking behaviour (Prakash, 2014; Abdulkadir et al., 2016). Additionally, studies suggest that the size of the family and proximity to healthcare facilities also affect healthcare-seeking behavior (Sultana et al., 2019; Prakash, 2014; Abdulkadir et al., 2016).

India has set the target of Sustainable Development Goals (SDGs 3.2) to reduce U5 mortality by 25 per 1000 live births (LBs) by 2030 (SDG-UN, 2015). However, NFHS-V (2019-21) indicates that the current U5 mortality of our country stands at 42/1000 LBs (IIPS, 2021), which is alarming. Significant progress is still required to achieve the target. The Global Burden of Disease (GBD) study in 2019 indicates lower respiratory infection is the second leading cause of U5 mortality in the world (Paulson et al., 2021). The prevalence of ARI among U5 children in India has increased from 2016 to 2021, while, simultaneously, treatment-seeking behaviour has declined (IIPS, 2021). Effective prevention of ARI is critical for the reduction of child mortality. Treatment-seeking behaviour is a process of making decisions about healthcare services (Prakash, 2014) and plays a pivotal role in managing and mitigating the burden of ARI. However, several barriers hinder optimal treatment-seeking behaviour among caregivers, particularly mothers. Insufficient knowledge about child health (Chandwani & Pandor, 2015) and limited awareness regarding healthcare services and treatments (Liu et al., 2012) are significant challenges. Given the high burden of ARI and its contribution to U5 mortality, it is imperative to examine the factors influencing the treatment-seeking behaviour of ARI in children. A deeper understanding of these dimensions can foster targeted intervention to promote timely and appropriate care, ultimately contributing the reduction of U5 mortality. Therefore, the present study aims to assess the

prevalence of treatment-seeking behaviour among U5 children who have experienced ARI and also identify the determinants of this behaviour in India. By addressing these gaps, the present research seeks to provide actionable insights to support India's effort towards achieving the SDG target for child survival.

2 Data Source and Methods

Data Source

The current study utilized data from the last two rounds of the National Family Health Survey (NFHS), published in 2016 (NFHS-IV) and 2021 (NFHS-V). NFHS is an India-based Demographic and Health Survey (DHS). It is a comprehensive survey conducted in a representative sample of households across India. The survey provides state and national data on maternal and child health aspects. Child health components such as immunization, nutrition, anaemia, diarrohea, and ARI are also captured in this survey. We have used the kid's file for the study and the data is freely available from the DHS website: https://dhsprogram.com/data/dataset_admin/login_main.cfm

Study Design and Sample Size

Two-stage stratified sampling techniques have been used for this large-scale survey. In the first stage urban areas, Census Enumeration Blocks (CEB) are selected and from rural residences, villages are selected as Primary Sampling Units (PSUs). In the second stage households have been selected both in urban and rural areas. Considering our study objectives, NFHS-4 (2015-16) & NFHS-5 (2019-21) data sources have been used, and responses from women respondents were utilized for the analysis.

Sample size *in NFHS-IV:* In the fifth round of NFHS, 2,49,967 children's mothers were interviewed. Among these, 2,38,945 children (U5) who were alive during the interview were selected. Finally, 6,529 children were included in the present analysis based on their mothers' responses about the presence of AIR within the two weeks preceding the survey (See Figure 1).

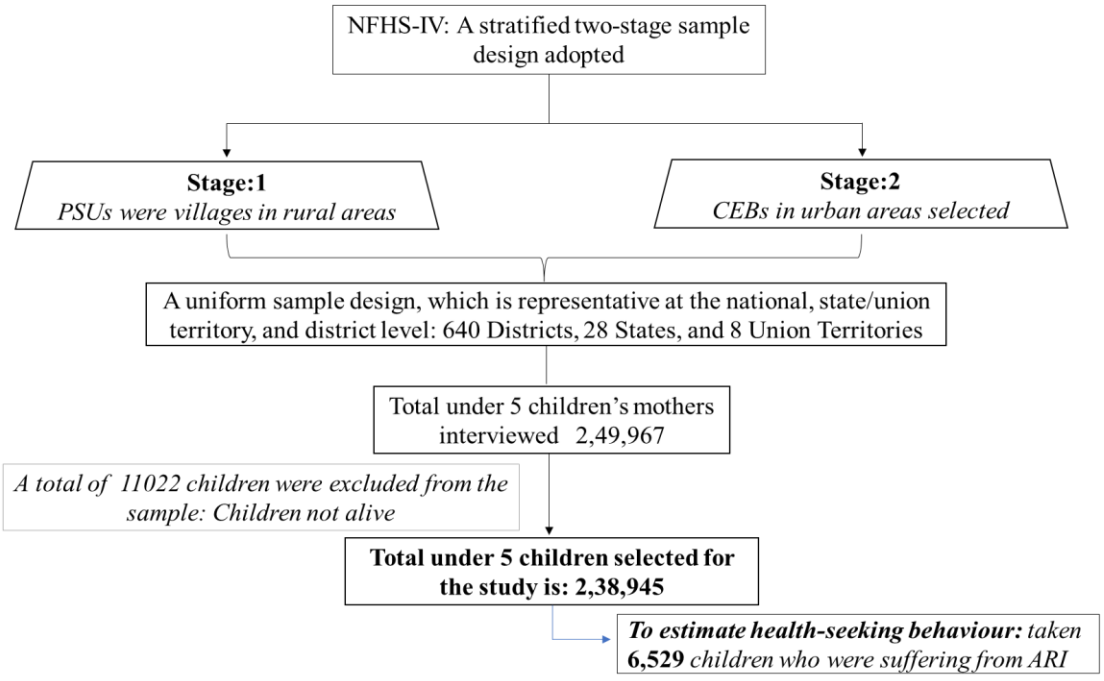

Figure 1. Child Inclusion Flowchart: NFHS-IV (2015-16)

***Sample size in NFHS-V*:** The total number of 230,870 children's mothers were interviewed in NFHS-V. Among them, a total of 2,22,233 children were selected who were alive during the interview. Finally, a total of 6,198 children were included in the present analysis based on their mothers' responses regarding the AIR existence in the last two weeks presiding the survey (See figure 2)

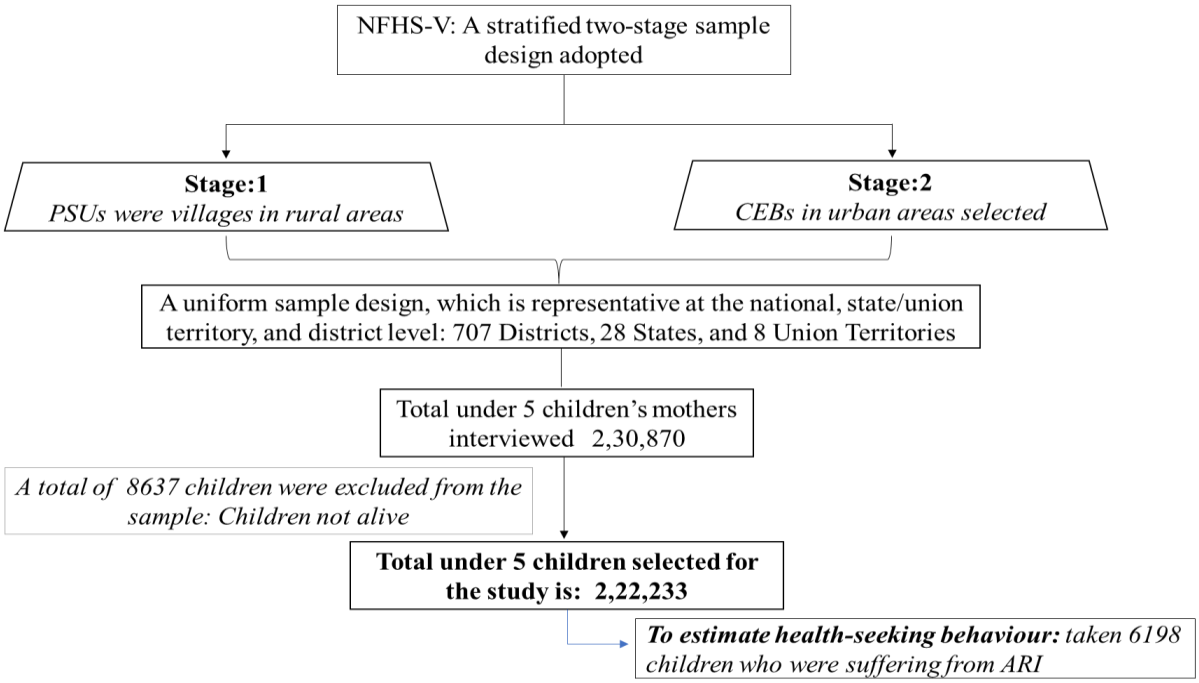

Figure 2. Child Inclusion Flowchart: NFHS-V (2019-21)

Measurement of variables

Outcome variables

Treatment-seeking behaviour of ARI: Regarding treatment-seeking behaviour, the outcome variable was assigned a value of 1 if the individual sought treatment from a health facility or provider, and a value of 0 if they did not. It's important to note that seeking help from traditional healers, friends, or relatives is not included in this categorization (IIPS, 2021; Varghese & Muhammad, 2023).

Explanatory variables

The selected explanatory variables have been used to determine the factors associated with treatment-seeking behaviour among children suffering from ARI in India (Table 1).

Table 1
Variable included in treatment-seeking behaviour for the children suffering from ARI based on NFHS-IV and NFHS-V in India

Background characteristics	Description of the variable with code
Place of Resident	Place of residence has two categories: (1) urban and (2) rural
Household Wealth Index	Wealth index classified into five category (1) poorest, (2) poorer, (3) middle, (4) richer, and (5) richest.
Gender of the Head of the Household	The gender of the Head of the Household has two categories: (1) male and (2) female
Household Size	The number of household members categorizes in to two parts ≤ 4 Members as (1) and 5 and more members as (2)
Religious group	Hindu and non-Hindu

Background characteristics	Description of the variable with code
Social Group	It's divided into Scheduled Caste (SC) (1), Scheduled Tribe (ST) (2), Other Backward Classes (OBC) (3), 'Others'
Distance to health facility	Distance to health facility has two categories (1) No/not a big problem, and (2) Big problem
Having to take transport	Having to take transport has two categories (1) No/not a big problem, and (2) a big problem
Mother's literacy	Mother's literacy recodes into two categories (1) as literate and (2) as illiterate
Mass Media Exposure	If mothers have had exposure to mass media (radio/TV/newspaper), it is coded as (1) Yes; otherwise, it is coded as (2) No.
Children ever born to women	Children ever born to women are recoded as (1) one child, (2) two children, and (3) more than two children.
Age of the child	The age of the child at the time of survey is recorded in completed months as follows: (1) 0-11 months; (2) 12-23 months; (3) 24-35 months; (4) 36-47 months; and (5) 48-59 months.
Sex of the Child	The sex of the child was used as original (1) male (2) female.
Region in India	Religion is categorized into two groups: (1) Hindu, (2) non-Hindu (including Muslim, Christian, Sikh, Buddhist, neo-Buddhist, Jain, Jewish, and others).
EAG and non-EAG state	Eight states—Rajasthan, Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, and Odisha—are designated as (1) Empowered Action Group (EAG) states, while the remaining states are designated as (2) non-EAG states.

Statistical Analysis

Multicollinearity: The degree of multicollinearity is measured with Variance Inflation Factors (VIFs) in the model (Midi et al., 2010). The computed mean VIF for NFHS-IV and NFHS-V are 1.76 and 1.72, respectively, which is less than the threshold value of five, indicating that multicollinearity does not exist in the analysed models (***Supplementary file 1***).

Multivariable Logistics Regression Model: The study used descriptive statistics and bivariate analysis, including the Chi-square test, to obtain initial results. Multivariable logistic regression models were used to identify the factors associated with treatment-seeking behaviour on ARI among children in India in 2016 and 2021.

The mathematical expression of the logistic regression analysis is:

$$logit(P) = [ln\, P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_k X_k$$

Whereas,

P = probability of occurrence of treatment seeking (children suffering from ARI)

β_0, β_1, β_2 ------ β_k: is the coefficients

X_1, X_2,--------X_k: are predictor variables.

P/(1-P): is the measure of odds, hence, the ratio of P/(1-P) is the log of odds or the *logit* of P.

We estimate dichotomous logit for the dependent variables and consider 1%, 5%, and 10% significance levels for all statistical tests. All analyses have been carried out using STATA version 14.

3 Results and Discussions

3.1 Results

Treatment-seeking behavior of ARI among children (0-59 months) across the States/UTs in India from 2016 to 2021:

The results indicate that there was a reduction in treatment-seeking behaviour of ARI among below 5 years children from NFHS-IV (78.10%) to NFHS-V (52.28%) in India (Table 2). The data from NFHS-IV indicates that the south region (88.21%) has the highest percentage of children with treatment-seeking behaviour for ARI, which has reduced to 53.45% in NFHS-V. The north-eastern region shows the lowest percentage (63.77%) of treatment-seeking behaviour of ARI in NFHS-IV, which has decreased further to 48.61 % in NFHS-V. However, the data from NFHS-V shows the Western region has the highest percentage of treatment-seeking behaviour for ARI among children at 62.60%, and the Central region has the lowest at 44.32 %.

All other States showed a decrease in treatment-seeking behaviour among U5 children except Chandigarh, Goa, and Ladakh. Chandigarh has shown an overall increase in treatment-seeking behaviour from NFHS-IV (80.89 %) to NFHS-V (100 %). In Goa, 100% of the U5 children showed treatment-seeking behaviour while experiencing ARI. Sikkim showed the highest reduction in treatment-seeking behaviour from 100 % in NFHS-IV to 19.07 % in NFHS-V. In NFHS-V, treatment-seeking behaviour is lowest in Nagaland (9.43%), Sikkim (19.07 %), Mizoram (21.77 %), Manipur (26.88 %), and Tamil Nadu (32 %).

Table 2
Treatment-seeking behavior of ARI among children (0-59 months) across the States/UTs in India by NFHS IV and NFHS-V

State/UTs	NFHS-IV (2015-16) *Weighted %*	NFHS-V (2019-21) *Weighted %*
A. North Region	**84.56**	**47.69**
Chandigarh	80.89	100.00
Delhi	71.87	55.10
Haryana	80.58	45.41
Himachal Pradesh	88.99	57.95
Jammu And Kashmir	81.90	47.14
Punjab	92.32	45.04
Rajasthan	87.79	44.19
Uttarakhand	80.14	63.89
Ladakh	NA	39.96
B. Central Region	**75.99**	**44.32**
Chhattisgarh	77.91	35.89
Madhya Pradesh	72.28	46.96
Uttar Pradesh	76.53	44.11
C. East Region	**71.15**	**59.21**
Bihar	67.96	62.66
Jharkhand	68.82	47.08
Odisha	70.74	40.62
West Bengal	76.79	64.29
D. Northeast Region	**63.77**	**48.61**
Arunachal Pradesh	51.33	46.69
Assam	62.74	45.51
Manipur	45.79	26.88
Meghalaya	76.26	67.94
Mizoram	63.58	21.77
Nagaland	32.28	9.43
Sikkim	100.00	19.07

State/UTs	NFHS-IV (2015-16) *Weighted %*	NFHS-V (2019-21) *Weighted %*
Tripura	55.17	43.50
E. West Region	**86.98**	**62.60**
Dadra And Nagar Haveli/Daman and Diu	83.30	43.47
Goa	100.00	100.00
Gujarat	79.09	61.56
Maharashtra	89.34	62.67
F. South Region	**88.21**	**53.45**
Andaman And Nicobar Islands	100.00	36.22
Andhra Pradesh	72.78	51.01
Karnataka	91.47	56.46
Kerala	96.02	69.56
Lakshadweep	100.00	48.03
Puducherry	76.67	54.98
Tamil Nadu	88.61	32.00
Telangana	87.93	60.21
India	**78.10**	**52.28**

Note: *UTs: Union territory, Weighted% %: Children suffering from ARI sought any treatment, NA: Not available*

Distribution of samples who seek treatment for ARI with the background characteristics in 2016 and 2021:

Table 3 presents the distribution of U5 children with ARI in India according to their background characteristics in NFHS IV and NFHS-V. The distribution of U5 children with ARI across NFHS-IV and NFHS-V was similar. Around 76% of the children in NFHS-IV and 77.77% of the children in NFHS-V resided in rural areas. 27.96% of the Children belonged to the poorest, and there is a gradual decline in the percentage of the children belonging to the higher wealth index, with 12.43% in the richest. A similar distribution is seen in NFHS-V, where 27.80 % belonged to the poorest and 13.61 % belonged to the richest quintile.

87.28 % of children in NFHS-IV and 82.76% in NFHS-V belonged to a household with a male head, and 56.23% of the children in NFHS-IV and 56.15% of the children in NFHS-V were boys. 25.30% of the children in NFHS-IV and 26.15% in NFHS-V belonged to households with less than 4 members, while others belonged to households with 5 members or more. A major percentage of the children belonged to OBC, and others were distributed among SC, ST, and other social statuses. The percentage of children who belonged to a family who stated distance problem was 40.37% in NFHS-IV and 30.74% in NFHS-V, and those who stated transport problem were 38.68% in NFHS-IV and 28.73% in NFHS-V. The percentage of children whose mothers were literate was 70.98% in NFHS-IV and 78.34% in NFHS-V, and with mass media exposure was 27.52% in NFHS-IV and 28.74% in NFHS-V. The highest percentage of children experiencing ARI lived in the Central Region, and the lowest percentage of children lived in the Northeastern region, both in NFHS-IV and NFHS-V. 60.57% of the children in NFHS-IV and 61.13% in NFHS-V belonged to EAG States. The percentage of children decreased with an increase in age.

Table 3
Treatment-seeking behavior of ARI among children (0-59 months) with the background characteristics in India by NFHS IV and NFHS-V

Background characteristics	NFHS-IV (2015-16)		NFHS-V (2019-20)	
	N	*%*	*N*	*%*
Place of Resident				
Urban	1,567	24.00	1378	22.23
Rural	4,962	76.00	4820	77.77
Household Wealth Index				
Poorest	1,825	27.96	1723	27.80
Poorer	1,495	22.89	1472	23.75

Background characteristics	NFHS-IV (2015-16)		NFHS-V (2019-20)	
	N	*%*	*N*	*%*
Middle	1,275	19.52	1167	18.83
Richer	1,123	17.20	993	16.02
Richest	811	12.43	844	13.61
Gender of the Head of the Household				
Male	5,699	87.28	5129	82.76
Female	830	12.72	1069	17.24
Household Size				
≤ 4 Members	1,652	25.30	1620	26.15
5 and more members	4,877	74.70	4577	73.85
Religious group				
Hindu	4,965	76.04	4927	79.50
Non-Hindu	1,564	23.96	1271	20.50
Social Group				
SC	1,559	23.88	1551	25.03
ST	556	8.51	532	8.59
OBC	2,859	43.78	2676	43.18
Others	1,556	23.83	1438	23.20
Distance to health facility				
No/not a big problem	3,893	59.63	4293	69.26
Big problem	2,636	40.37	1905	30.74
Having to take transport				
No/not a big problem	4,004	61.32	4417	71.27
Big problem	2,525	38.68	1781	28.73
Mother's literacy				
Illiterate	1,895	29.02	1343	21.66
literate	4,635	70.98	4855	78.34
Mass Media Exposure				
No	1,797	27.52	1781	28.74
Yes	4,733	72.48	4416	71.26
Children ever born to women				
One child	1,900	29.10	1853	29.89
Two Children	2,231	34.17	2262	36.50
More than 2 children	2,398	36.73	2083	33.60
Age of the child				
0-11 Months	1,545	23.66	1489	24.03
12-23 Months	1,578	24.17	1429	23.05
24-35 Months	1,233	18.89	1193	19.25
36 to 47 Months	1,216	18.62	1104	17.81
48 to 59 Months	957	14.66	983	15.86
Sex of the Child				
Boy	3,671	56.23	3480	56.15
Girl	2,858	43.77	2718	43.85
Region in India				
North	921	14.11	893	14.41
Central	2,405	36.84	1945	31.39
East	1,705	26.12	1816	29.30
Northeast	138	2.11	204	3.28
West	630	9.66	676	10.90
South	729	11.16	664	10.72
State				
Non EAG	2,575	39.43	2409	38.87

Background characteristics	NFHS-IV (2015-16)		NFHS-V (2019-20)	
	N	*%*	*N*	*%*
EAG	3,955	60.57	3789	61.13
Total	**6,529**	**100.00**	**6198**	**100.00**

Note: *N: Number, %: column percentage, EAG: Empowered action group*

Prevalence of treatment-seeking behavior of ARI among children (0-59 months) with the background characteristics in India:

Table 3 shows the prevalence of treatment-seeking behaviour among children below five years old with ARI in India by NFHS-IV and NFHS-V based on their background characteristics. There is a decrease in the prevalence of treatment-seeking behaviour across all the background characteristics from NFHS-IV to NFHS-V.

The prevalence of treatment-seeking behaviour among urban children (86.21%) is significantly higher than rural children (75.55%). However, no significant difference in prevalence is observed among the children based on the place of residence in NFHS-V. Households with a female gender as head (56.37%) had higher treatment-seeking behaviour compared to those with a male head (51.44%) in NFHS-V. However, there were no significant differences in prevalence based on the gender of the head of the household in NFHS-IV. The prevalence of treatment-seeking behaviour is significantly highest among the Richest (90.05%) in NFHS-IV and among the Richer (55.87%) in NFHS-V, and the prevalence is lowest among the Poorest (69.33%) in NFHS-IV and Richest (48.7%) in NFHS-V. It was found that the difference in prevalence was higher among the different quintiles of wealth index in NFHS-IV compared to NFHS-V, where the difference in prevalence was not much.

The prevalence of treatment-seeking behaviour of ARI does not significantly differ among children based on household size and religious group in both NFHS-IV and NFHS-V. The prevalence is significantly higher among male children than female children in both the NFHS-IV and NFHS-V. The prevalence among different social groups significantly differed in NFHS-IV, with the lowest prevalence among the ST groups. However, the prevalence among different social groups does not significantly differ in NFHS-V.

Those with distance problems and transport problems had a significantly lower prevalence of treatment-seeking behaviour in both studies. Children with literate mothers and those with mass media exposure had higher treatment-seeking behaviour in NFHS-IV. However, no significant difference in prevalence is found based on mothers' literacy and Mass Media Exposure in NFHS-V. The prevalence of treatment-seeking behaviour was significantly highest among 12-23 months old children (56.07%), followed by 0-11 months (52.9%), 48-59 months (52%), 24-35 months (49.86%) and 36-47 months (49.43%) in NFHS-V. However, there were no significant differences in prevalence based on age in NFHS-IV.

There was no significant difference in prevalence among U5 children based on the number of children born to women in NFHS-V. However, there was a significant difference in prevalence in NFHS-IV, where the prevalence decreased with the increase in the number of children.

The highest percentage of children with treatment exposure belonged to the South Region (88.22%) in NFHS-IV and to the West Region (62.61%) in NFHS-V. The percentage of children with treatment exposure is lowest in the Northeast Region (63.77%) in NFHS-IV and the Central Region (44.44%) in NFHS-V. Non-EAG States had a higher percentage of children (83.26% in NFHS-IV and 56.88% in NFHS-V) with treatment-seeking behaviour compared to EAG States (74.75% in NFHS-IV and 49.36% in NFHS-V).

Table 04
Prevalence of treatment-seeking behavior of ARI among children (0-59 months) with the background characteristics in India by, NFHS IV and NFHS-V

Background Variables	NFHS-IV *Prevalence N (%)*	NFHS-V *Prevalence N (%)*
Place of Resident	**$\chi2$=79.44, p<.001***	**$\chi2$=1.04, p=.308**
Urban	1351 (86.21)	737 (53.49)
Rural	3748 (75.55)	2503 (51.94)

Background Variables	NFHS-IV *Prevalence N (%)*	NFHS-V *Prevalence N (%)*
Household Wealth Index	**χ2=193.27, p<.001***	**χ2=13.69, p=.008***
Poorest	1266 (69.33)	872 (50.64)
Poorer	1122 (75.11)	798 (54.22)
Middle	1026 (80.51)	605 (51.81)
Richer	955 (85.01)	555 (55.87)
Richest	731 (90.05)	411 (48.7)
Gender of the head of the Household	**χ2=2.13, p=.145**	**χ2=8.63, p=.003***
Male	4467 (78.39)	2638 (51.44)
Female	632 (76.14)	602 (56.37)
Household Size	**χ2=0.78, p=.379**	**χ2=1.09, p=.297**
4 Members	1303 (78.87)	865 (53.4)
5 and more members	3797 (77.85)	2375 (51.89)
Religious group	**χ2=0.38, p=.541**	**χ2=0.22, p=.642**
Hindu	3869 (77.93)	2569 (52.14)
Non-Hindu	1231 (78.67)	672 (52.86)
Social Group	**χ2=21.71, p<.001***	**χ2=6.07, p=.109**
SC	1225 (78.58)	820 (52.88)
ST	391 (70.46)	256 (48.02)
OBC	2243 (78.46)	1387 (51.85)
Others	1240 (79.71)	777 (54.04)
Distance to health facility	**χ2=29.24, p<.001***	**χ2=6.47, p=.011***
No/not a big problem	3129 (80.38)	2291 (53.36)
Big problem	1970 (74.75)	950 (49.86)
Having to take transport	**χ2=42.73, p<.001***	**χ2=15.93, p<.001***
No/not a big problem	3234 (80.76)	2380 (53.9)
Big problem	1866 (73.89)	860 (48.29)
Mother's literacy	**χ2=47.94, p<.001***	**χ2=1.89, p=.169**
Illiterate	1375 (72.55)	680 (50.62)
literate	3725 (80.38)	2561 (52.75)
Mass Media Exposure	**χ2=97.55, p<.001***	**χ2=1.25, p=.265**
No	1256 (69.91)	951 (53.4)
Yes	3843 (81.22)	2289 (51.84)
Children ever born to women	**χ2=55.11, p<.001***	**χ2=0.97, p=.618**
One child	1563 (82.24)	984 (53.11)
Two Children	1780 (79.76)	1167 (51.57)
More than 2 children	1757 (73.29)	1090 (52.33)
Age of the child	**χ2=8.18, p=.085**	**χ2=14.74, p=.005***
0-11 Months	1213 (78.51)	788 (52.9)
12-23 Months	1258 (79.7)	801 (56.07)
24-35 Months	969 (78.6)	595 (49.86)
36 to 47 Months	942 (77.48)	546 (49.43)
48 to 59 Months	718 (75)	511 (52)
Sex of the Child	**χ2=25.62, p<.001***	**χ2=6.01, p=.014***
Boy	2951 (80.38)	1867 (53.66)
Girl	2149 (75.18)	1373 (50.53)
Region in India	**χ2=166.35, p<.001***	**χ2=121.96, p<.001***
North	779 (84.56)	426 (47.7)
Central	1828 (75.99)	862 (44.33)
East	1213 (71.15)	1075 (59.21)
Northeast	88 (63.77)	99 (48.62)
West	548 (86.99)	423 (62.61)

Background Variables	NFHS-IV *Prevalence N (%)*	NFHS-V *Prevalence N (%)*
South	643 (88.22)	355 (53.45)
State	**$\chi2$=66.09, p<.001***	**$\chi2$=33.36, p<.001***
Non EAG	2143 (83.26)	1370 (56.88)
EAG	2956 (74.75)	1870 (49.36)

Note: *$\chi2$=Chi-square test (applied for each variable), *=p-value <0.05 (Significance), CI: Confidence interval, SC: Scheduled Caste, ST: Scheduled Tribe, OBC: Other Backward Caste; EAG: Empowered Action Group*

Determinants of treatment-seeking behaviour of ARI among children in India (2016 and 2021):

The multivariable binary logistic regression analysis results (Table 4) reveal that in NFHS-IV, factors such as the place of residence, household wealth index, gender of the head of the household, mass media exposure, age, sex of the child and the regions showed significant association with the treatment-seeking behaviour of below 5 children. However, in NFHS-V, factors such as gender of the head of the household, the necessity to take transport, age, sex of the child, regions, and the EAG Status of States showed significant association with the treatment-seeking behaviour of children below 5 years.

Children living in rural areas had significantly 0.85 times lower odds (AOR: 0.85; 95% CI: 0.72-1.01) of having treatment-seeking behaviour compared to those living in urban areas in NFHS-IV. Also, in NFHS-IV, the odds of treatment-seeking behaviour significantly increased with the increase in wealth index across all the categories compared to the very poor household in the same time. However, no significant association was found for place of residence and wealth index in NFHS-V. Children belonging to households with female heads had 1.32 times (AOR: 1.32; 95% CI: 1.15-1.51) higher odds in NFHS-V of having treatment-seeking behaviour of ARI compared to those with male heads. In NFHS-V, children whose parents reported problems in availing transport had 0.87 (AOR: 0.87; 95% CI: 0.75-1) times lower odds of having treatment-seeking behaviour than those with no transport problem. However, this trend was not observed in NFHS-IV, where the necessity to take, transport was found to have no significant association. Interestingly, the mother's literacy was found to have no significant association with treatment-seeking behaviour in both rounds (NFHS-IV and NFHS-V). Mass Media Exposure was significantly associated with NFHS-IV, where those with exposure had 1.23 (AOR: 1.23; 95% CI: 1.06-1.43) times higher odds of treatment-seeking behaviour than those who had no exposure. However, no significant association of Mass Media exposure was found in NFHS-V. In NFHS-IV, Children who were in the age group of 48-59 months had 0.76 (AOR: 0.76; 95% CI: 0.63-0.92) times lower odds of having treatment-seeking behaviour compared to those aged 0-11 months, and in NFHS-V, Children who were in the age group of 36-47 months had 0.83 (AOR: 0.83; 95% CI: 0.7-0.97) times lower odds of having treatment seeking behaviour compared to those aged 0-11 months. Both in NFHS-IV and NFHS-V, Girl Child had a significantly lower odds (AOR: 0.75; 95% CI: 0.67-0.93) times lower in NFHS-IV and 0.88 (AOR: 0.88; 95% 0.79-0.97) times lower in NFHS-V of having treatment-seeking behaviour compared to boy child. In NFHS-IV, children belonging to the Central region had 0.75 (AOR:0.75; 95% CI: 0.6-0.93) times lower odds, the East Region had 0.59 (AOR: 0.59; 95% CI: 0.48-0.74) times lower odds, the Northeast Region had 0.33 (AOR: 0.33; 95% CI: 0.26-0.43) times lower odds of having treatment seeking behaviour compared to children belonging to the North Region. However, in NFHS-V, children belonging to the Central region had significantly 0.75 (AOR: 0.75; 95% CI: 0.6-0.93) times lower odds, the East Region had significantly 1.56 (AOR: 1.56; 95% CI: 1.29-1.88) times higher odds and the West Region had significantly 1.21 (AOR:1.21; 95% CI: 0.96-1.52) times higher odds of having treatment seeking behaviour compared to children belonging to the North Region. In NFHS-V, children belonging to EAG States had significantly 0.81 (AOR: 0.81; 95% CI: 0.67-0.99) times lower odds of having treatment-seeking behaviour of ARI compared to those belonging to Non-EAG States. However, the EAG status of the State was not significant in determining the treatment-seeking behaviour in NFHS-IV.

Table 05
Logistic regression model assessing the factors associated with treatment-seeking behavior of ARI among children (0-59 Months) in India, by NFHS IV and V

Background Characteristics	NFHS-IV AOR 95% CI [Lower-Upper]	NFHS-V AOR 95% CI [Lower-Upper]
Place of Resident		
Urban	***Ref.***	***Ref.***
Rural	0.85 (0.72-0.97) *	1.13 (0.98-1.31)
Household Wealth Index		
Very Poor	***Ref.***	***Ref.***
Poorer	1.25 (1.07-1.47) **	1.15 (1-1.33)
Middle	1.45 (1.2-1.76) ***	1.11 (0.94-1.32)
Richer	1.54 (1.22-1.94) ***	1.16 (0.95-1.4)
Richest	2.06 (1.55-2.74) ***	0.96 (0.77-1.2)
Gender of the head of the Household		
Male	***Ref.***	***Ref.***
Female	1.05 (0.88-1.25)	1.32 (1.15-1.51) ***
Household Size		
4 Members	***Ref.***	***Ref.***
5 and more members	1.04 (0.9-1.21)	0.97 (0.85-1.09)
Religious group		
Hindu	***Ref.***	***Ref.***
Non-Hindu	1.15 (0.99-1.33)	1.05 (0.92-1.2)
Social Group		
SC	***Ref.***	***Ref.***
ST	0.85 (0.69-1.04)	0.92 (0.77-1.1)
OBC	0.94 (0.8-1.11)	1.07 (0.93-1.23)
Others	0.84 (0.7-1.01)	1 (0.85-1.17)
Distance to health facility		
No/not a big problem	***Ref.***	***Ref.***
Big problem	0.98 (0.83-1.15)	1.04 (0.9-1.19)
Having to take transport		
No/not a big problem	***Ref.***	***Ref.***
Big problem	0.97 (0.82-1.14)	0.87 (0.75-0.97) *
Mother's literacy		
Illiterate	***Ref.***	***Ref.***
literate	1.07 (0.93-1.24)	1.06 (0.93-1.22)
Mass Media Exposure		
No	***Ref.***	***Ref.***
Yes	1.23 (1.06-1.43) **	0.9 (0.79-1.03)
Children ever born to women		
One children	***Ref.***	***Ref.***
Two Children	0.91 (0.78-1.07)	1.05 (0.92-1.19)
More than 2 children	0.79 (0.67-0.93)	1.12 (0.97-1.29)
Age of the child		
0-11 Months	***Ref.***	***Ref.***
12-23 Months	0.96 (0.81-1.13)	1.1 (0.95-1.28)
24-35 Months	0.88 (0.74-1.05)	0.9 (0.77-1.06)
36 to 47 Months	0.93 (0.77-1.12)	0.83 (0.7-0.97) *
48 to 59 Months	0.76 (0.63-0.92) **	0.91 (0.77-1.07)
Sex of the Child		

Background Characteristics	NFHS-IV AOR 95% CI [Lower-Upper]	NFHS-V AOR 95% CI [Lower-Upper]
Boy	***Ref.***	***Ref.***
Girl	0.75 (0.67-0.84) ***	0.88 (0.79-0.97) **
Region in India		
North	***Ref.***	***Ref.***
Central	0.75 (0.6-0.93) **	0.91 (0.76-1.09)
East	0.59 (0.48-0.74) ***	1.56 (1.29-1.88) ***
Northeast	0.33 (0.26-0.43) ***	1.03 (0.82-1.29)
West	1.06 (0.74-1.52)	1.42 (1.12-1.81) **
South	1.1 (0.79-1.53)	1.21 (0.96-1.52)
State		
Non EAG	***Ref.***	***Ref.***
EAG	0.93 (0.74-1.18)	0.81 (0.67-0.98) *
Cons	5.34	0.95
Number of obs	6,529	6,198
Pseudo R2	0.0532	0.0172
LR chi2	402.9	145.7
Prob > chi2	<0.001	<0.001
Log likelihood =	-3585.6679	-4166.996

Note: *AOR: Adjusted Odds Ratio, Ref: Reference Category, CI: Confidence interval, ***p<0.001, **p<0.01, *p<0.05, SC: Scheduled Caste, ST: Scheduled Tribe, OBC: Other Backward Caste, Empowered Action Group*

3.2 Discussion

The current study examines the prevalence and determinants of treatment-seeking behaviour among children infected with ARI in India. The last two rounds of NFHS data were analysed with the help of STATA 14 software. The study revealed that the prevalence of treatment-seeking behaviours among children suffering from ARI has decreased from 78 percent in 2016 to 52 percent in 2021 in India. Phase 2 of the NFHS-5 survey, conducted in 14 states/UTs, took place from 2nd January 2020 to 30th April 2021 (IIPS, 2021). The country was under total or partial lockdown during this period. Studies have shown a decrease in the number of people seeking medical treatment for acute health problems during the lockdown (Stalin et al., 2022; Yang et al., 2021). Therefore, the lockdown restrictions and fear of contracting COVID-19 infection decline in seeking treatment for ARI (Varghese & Muhammad, 2023).

A multilevel logistic regression model has been employed to identify the possible determinants of treatment-seeking behaviour. Our study found that children from rural areas have significantly lower odds of seeking treatment compared to urban areas. One possible reason is that due to higher air pollution in urban areas, the incidence is high. Therefore, treatment-seeking behaviour is also high in urban residents as compared to rural residents (Varghese & Muhammad, 2023). Our study highlighted that an increase in household wealth quantile status significantly improves treatment-seeking behaviour. This finding aligns with a study conducted in Indonesia, which revealed that children from wealthy families were less vulnerable to ARI incidence (Lutpiatina et al., 2022). The findings from the present research indicate that children U5 belonging to households with female heads had higher odds of having treatment-seeking behaviour compared to those with male heads. The finding resonates with the studies conducted in Tanzania (Adinan et al., 2017) and sub-Saharan Africa (Akinyemi et al., 2019). The possible explanation is that households with female heads may not encounter the challenge of obtaining permission to seek care, which is a common barrier to healthcare utilization among women and children (Charles et al., 2008; Aragaw et al., 2024). Another probable explanation is that women who are heads of households tend to allocate the available resources they control towards prioritizing their children's health, thereby increasing their health-seeking behaviour (Richards et al., 2013; Aragaw et al., 2024). The present study also indicated that children, whose parents reported taking transport is a problem, had lower odds of having treatment-seeking behaviour than those with no transport problem. Previous research suggested that the usage of healthcare services is adversely affected by factors

such as the significant distance to medical facilities, the absence of transportation options, and the subpar quality of roads (Okwaraji et al., 2012; Shiferaw et al., 2013; Astale et al., 2015; Varghese & Muhammad, 2023). Our research demonstrates that mothers who are exposed to the media are more likely to seek healthcare for their children compared to mothers who have not been exposed to the media. This finding aligns with studies conducted in West Bengal (Ghosh et al., 2013), and India (Chandwani & Pandor, 2015). One potential explanation is that exposure to mass media exposes people to healthcare information, which improves their behaviour in seeking healthcare. Evidence from the previous study also suggests that exposure to the media plays a crucial role in promoting healthy behaviours (Aragaw et al., 2024; Adinan et al., 2017). Additionally, our study indicates that children from EAG States were significantly less likely to seek treatment for ARI compared to those from non-EAG states. In India, there is a significant disparity in the accessibility and availability of healthcare between public health facilities in EAG and non-EAG states (Rani et al., 2008; Kumar & Singh, 2016; Sanasam, 2020). The possible reason for the lower treatment-seeking behavior in EAG states, which are mostly located in the northern and central regions, is the high percentage of the population living below the poverty line and a high proportion of women with limited access to education and mass media (NITI Ayog, 2016).

Limitations of the Study:

The present study had some limitations. Firstly, ARI was classified as per the signs and symptoms reported by the children's mothers, without confirmation from medical professionals. Secondly, mothers were asked to recall their children's symptoms from the past 2 weeks of the survey, which may raise the possibility of recall bias. Thirdly, a cross-sectional design prevented the establishment of a cause-and-effect relationship.

4 Conclusion

ARI is the major cause of U5 mortality and morbidity in low-income and developing countries like India. India has already set its goal to achieve the SDGs target to reduce U5 child mortality by 25/1000 live births in 2030 (SDGs) which is 42/1000 live births as per the NFHS-V. The current study aims to assess the prevalence and determinants of treatment-seeking behaviour among children infected by ARI in India. the study highlighted the the treatment-seeking behaviour among children infected with ARI has been decreased from 2016 to 2019. Although COVID-19 is a likely cause, it remains a significant public health issue in India. The present study also identified the determinants of treatment-seeking behaviour. The place of residence, household wealth quantile, gender of the head of a household, challenges related to transport, and mass media exposure were found to be significantly associated with treatment-seeking behaviour. Based on these findings, the study recommends that public health programs should focus on the indicators to improve treatment-seeking behaviour among children, and also can help to reduce child morbidity and mortality due to ARI in India. Additionally, these efforts may contribute to reducing the risk of ARI and achieving the country's SDG target by 2030.

Abbreviation: AOR: Adjusted Odds Ratio; **ARI**: Acute Respiratory Infections; **CEB**: Census Enumeration Blocks; **DHS**: Demographic and Health Survey; **EAG:** Empowered action group; **GBD**: Global Burden of Disease; **LRTI**: Lower Respiratory Tract Infections; **NFHS**: National Family Health Survey; **OBC:** Other Backward Caste; **PSU**: Primary Sampling Unit; **SC:** Scheduled Caste; **SDGs**: Sustainable Development Goals; **ST:** Scheduled Tribe; U5: Under-five; **UN**: United Nations; **WHO**: World Health Organization

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Supplementary file 1: Variance inflation factors with treatment seeking behaviour in NFHS-IV (2015-16) and NFHS-V (2019-21)

Background Variable	NFHS-IV		NFHS-V	
	VIF	1/VIF	VIF	1/VIF
Place of Resident				
Urban				
Rural	1.27	0.79	1.21	0.83
Household Wealth Index				
Poorest				
Poorer	1.73	0.58	1.53	0.65
Middle	2.00	0.50	1.72	0.58
Richer	2.14	0.47	1.86	0.54
Richest	2.26	0.44	2.09	0.48
Gender of the head of the Household				
Male				
Female	1.01	0.99	1.04	0.96
Household Size				
4 Members				
5 and more members	1.16	0.86	1.17	0.86
Religious group				
Hindu				
Non-Hindu	1.39	0.72	1.41	0.71
Social Group				
SC				
ST	1.93	0.52	1.84	0.54
OBC	1.89	0.53	1.75	0.57
Others	1.88	0.53	1.74	0.58
Distance to health facility				
No/not a big problem				
Big problem	1.99	0.50	1.75	0.57
Having to take transport				
No/not a big problem				
Big problem	2.03	0.49	1.77	0.56
Mother's literacy				
Illiterate				
literate	1.40	0.72	1.26	0.80
Mass Media Exposure				
No				
Yes	1.48	0.68	1.33	0.75
Children ever born to women				
One children				
Two Children	1.53	0.65	1.48	0.68
More than 2 children	1.85	0.54	1.83	0.55
Age of the child				
0-11 Months				
12-23 Months	1.56	0.64	1.54	0.65
24-35 Months	1.50	0.67	1.50	0.67
36 to 47 Months	1.50	0.67	1.50	0.67
48 to 59 Months	1.46	0.69	1.50	0.67
Sex of the Child				

Background Variable	NFHS-IV		NFHS-V	
	VIF	1/VIF	VIF	1/VIF
Boy				
Girl	1.01	0.99	1.01	0.99
Region in India				
North				
Central	2.98	0.34	2.72	0.37
East	2.17	0.46	2.32	0.43
Northeast	1.94	0.52	2.31	0.43
West	1.30	0.77	1.53	0.65
South	1.45	0.69	1.64	0.61
State				
Non EAG				
EAG	3.45	0.29	3.82	0.26
Mean VIF	1.76		1.72	

Biography of Authors

Koustav Ghosh
I am a research scholar currently pursuing a Ph.D. at the Gokhale Institute of Politics and Economics (GIPE), India, specializing in public health and demography. Alongside my doctoral studies, I work as a Research Investigator at the Population Research Centre (PRC), under the Ministry of Health and Family Welfare (MoHFW), at The Maharaja Sayajirao University, Vadodara, Gujarat. My research focuses on monitoring and evaluation of healthcare services, with a particular emphasis on maternal and child health, including childhood morbidities such as acute respiratory infections (ARI), diarrhoea, anaemia, and nutritional status, using geo-spatial analysis and large-scale survey data.
Email: koustav2020@gmail.com

Atreyee Sinha Chakraborty
I am an Associate Professor at the Gokhale Institute of Politics and Economics. My primary research interests are in international trade, with a special focus on non-tariff barriers and their impact on developing economies. Additionally, I study the economics of discrimination, exploring why gaps in opportunities and outcomes persist for marginalized groups. My work also spans environmental economics, gender studies, and child health, where I investigate how policies affect access and well-being.
Email: atreyee.chakraborty@gipe.ac.in

Banashri Haloi
I am a public health professional with 6 years of experience, holding a Master's degree in Public Health from the Central University of Kerala, India. My research and professional focus lie in maternal and child health, with a special emphasis on nutrition. I am deeply committed to improving health outcomes through evidence-based public health practices and targeted interventions in these areas.
Email: banashrihaloi@gmail.com

Sarjoo Patel
I am an Associate Professor in the Department of Family and Community Resource Management at The Maharaja Sayajirao University of Baroda, Gujarat. My research focuses on population and health, energy conservation, air pollution, resource management, interior designing, hospitality management, and consumer awareness. I have led projects such as designing solar-powered food stalls to reduce pollution, studying the impact of cooking on air pollution, and assessing and enhancing urban homemakers' awareness of consumer rights through folk media.
Email: sarjoo.patel-fcrm@msubaroda.ac.in