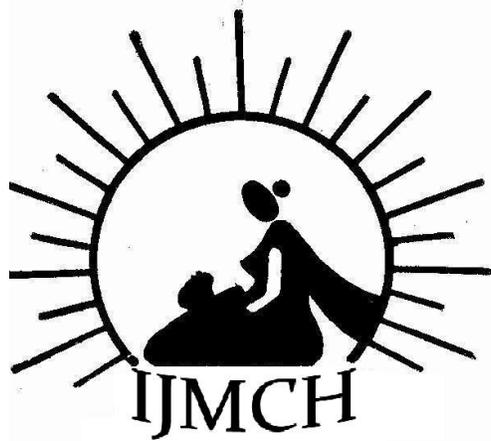


Does Domestic Environment Influence the Acute
Respiratory Infection Among Children: A Regional
Analysis of Highest Populous State of India?

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Does Domestic Environment Influence the Acute Respiratory Infection Among Children: A Regional Analysis of Highest Populous State of India?

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ABSTRACT

The study shows the regional variation of Acute Respiratory Infections among children under age five years in Uttar Pradesh. Using data DLHS-3 around a sample of 48551 under age five years children for this analysis. Bivariate and logistic regression has been applied to see the variation and association with household and socioeconomic factors on ARI among children. Western and central region of Uttar Pradesh reported more symptom of ARI than eastern and southern region.

Occurrence of ARI was 17% more likely among children where unclean cooking fuel used in the household. Availability of separate kitchen with clean cooking fuels (electricity, gas, kerosene) also playing a significant negative role on ARI among children. Mothers having 10 or more years of education were 19 percent less likely to occurrence of ARI among children. Younger children, living in rural areas, kachha houses, belonging to the poorest quintile, having crowded room, were significantly associated with ARI among children. Based on these findings it is necessary that the occurrence of ARI may reduce by availability of clean fuel, separate kitchen with clean fuel, improvement of socio-economic condition, awareness about indoor air pollution.

Key words: *Acute respiratory infection, cooking fuel, children, Environment and Region*

INTRODUCTION

Acute Respiratory Infection (ARI) is a leading cause of the global burden of disease and these causes are linkages with the use of domestic cooking fuel in the less developed countries.^{1,2} In the study of burning issues regarding indoor air pollution, suggested that the best vaccine for pneumonia is if kids do not breathe dirty air at home.³ According to census 2011, in India, 69% people are living in a rural area and 31% in the urban area. National Family health survey third shows that three fourth of the household in India using non-cleaner cooking fuel. This non-cleaner cooking fuel is a serious health hazard for a child as well as for family.^{4,13} Environmental factors are more vulnerable to the child than an adult because they are constantly growing and consuming more food water and air. Their immune, reproductive, digestive and central nervous systems are still developing, and they spend their time closer to the ground where most dust and chemicals accumulate.⁵

Usually, child spends more time surrounding home, school and the local community. These places should be healthy and clean for the protection of child health. In the developing world, due to unhealthy surrounding environment underline majority of deaths and a huge burden of disease among children.² In Millennium Development Goals (MDGs), target was set to reduce the child mortality by two thirds, that is, from 93 children out of 1000 dying before age five in 1990 to 31 by the year 2015. Each year more than 70 percent of child deaths are attributable to six causes; viz. diarrhea, malaria, neonatal infection, pneumonia, preterm delivery, or lack of oxygen at birth.⁶ Access to basic amenities, such as proper housing safe drinking water and sanitation, and clean cooking fuel is not only important measure of the socio- economic status

of the household but is also fundamental to the health of its member.^{2,7} Traditional biomass fuels are leading contributors of indoor air pollution in developing countries because fuels extract health damaging gases such as carbon monoxide, nitrogen oxide, formaldehyde, and polycyclic aromatic hydrocarbons and many other toxic organic compounds in the air which individuals inhale knowingly or unknowingly.⁸

In rural and urban area basic household amenities such as proper and adequate housing, safe drinking water, sanitation, and electricity play a crucial role for improving the morbidity and mortality⁹. Health is directly related to socioeconomic status of the people. Socioeconomic and demographic factors have an influence on morbidity of the people belonging to different cultures. Socioeconomic status has been found to have an inverse relationship with morbidity levels.¹⁰

Socioeconomic and environmental factors affect a child's physical, social, and mental development. ARI is affected by various factors such as breast feeding, nutrition, indoor smoke pollution parental smoking habit, and immunization, which affect the incidence of ARI.¹¹ After implementation of different policies and programmes in Uttar Pradesh infant mortality rate (IMR) and child mortality rate (CMR) still high as compared to other states in India. Domestic environment may play an important role in reducing the child morbidity; in this connection this study analyzes that how domestic environment and socio-economic characteristics are associated with acute respiratory infection (ARI) among under age five years of children.

MATERIALS AND METHODS

Data: Present study based on the third round of District level household survey (DLHS-3), conducted in 2007-2008 by the International Institute for Population Sciences, Mumbai under the umbrella of ministry of health and family welfare (MoHFW). The data collected from 720320 household from 34 states and union territories of India. From this household, 643944 ever married women aged 15-49 years and 166260 unmarried women aged 15-24 years were interviewed. In Uttar Pradesh total out of 90415 household, 87564 ever married women and 23110 unmarried women were interviewed.

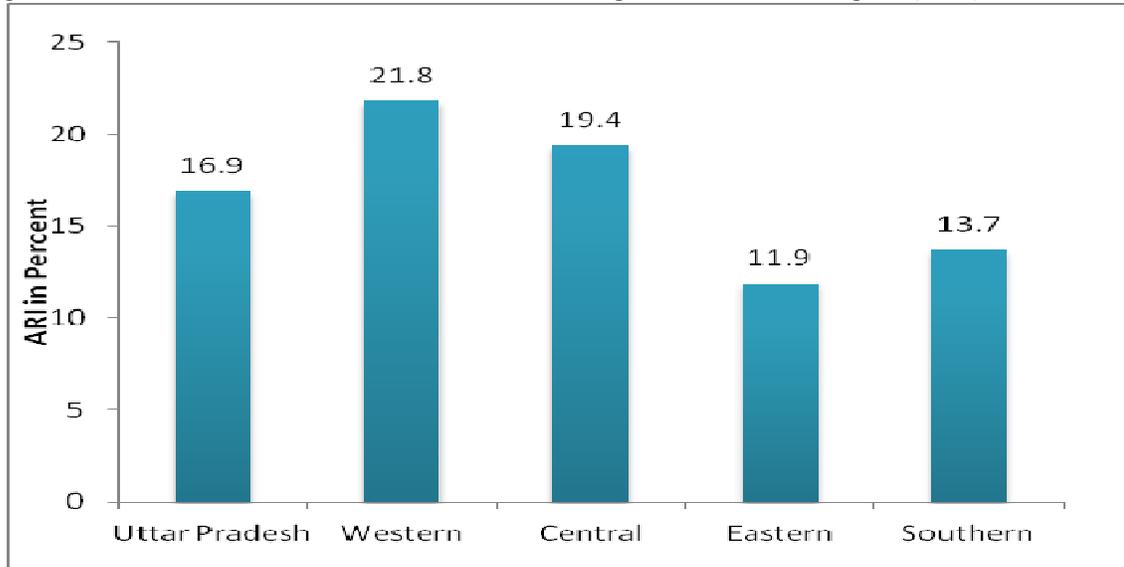
Methods: Bivariate and multivariate techniques (logistic regression) have been used for the study. Regional division has been computed according to the National Family Health Survey third 2005-06, where state has been divided into four regions i.e. western central eastern, and southern

Variables:

- a. **Dependent variable:** Acute Respiratory Infections.
- b. **Independent variables:** Age of child, sex of the child, residence, mother's education, caste, working status of the mother, religion, wealth quintile, type of house, number of the person per room, separate kitchen, cooking fuel and region.

RESULT

Figure 1 shows the percentage of children with symptom of ARI during last two week preceding the survey in Uttar Pradesh and its region-2007-08. About 17 percent of underage five years children suffered from ARI in Uttar Pradesh. The symptom of ARI varies across the region. More than two fifth of the children suffering in the western region (22%) which was



highest among all regions, followed by central region (19%), southern region (14%), and Eastern region (11%) under age five years children are suffering from ARI in Uttar Pradesh.

Table 1 shows the bivariate analysis of Acute Respiratory Infection (ARI) by selected background characteristics in Uttar Pradesh and its region. Findings show that percentage of ARI among children who are living in the pucca houses are lower (16%) than those who are living in kachcha and semi kachcha houses (16% & 18% respectively). Availability of separate kitchen and cooking fuels in household is also playing significant positive impact in decreasing of ARI among children. Children, living in the households where there is no separate kitchen and non-clean fuel (coal, grass, wood, dung cakes etc.) used have a higher prevalence of ARI 18% compared to those children who were living in separate kitchen and using clean cooking fuel (electricity, gas, kerosene) 14%.

Findings reveal negative association with increasing age of the child and decreasing ARI among children. Data shows that nearly one-fifth of the children of 12-23 months were suffering from ARI since last two weeks but as the age increases from 24 months and more the prevalence of ARI is decreasing among them preceding the survey.

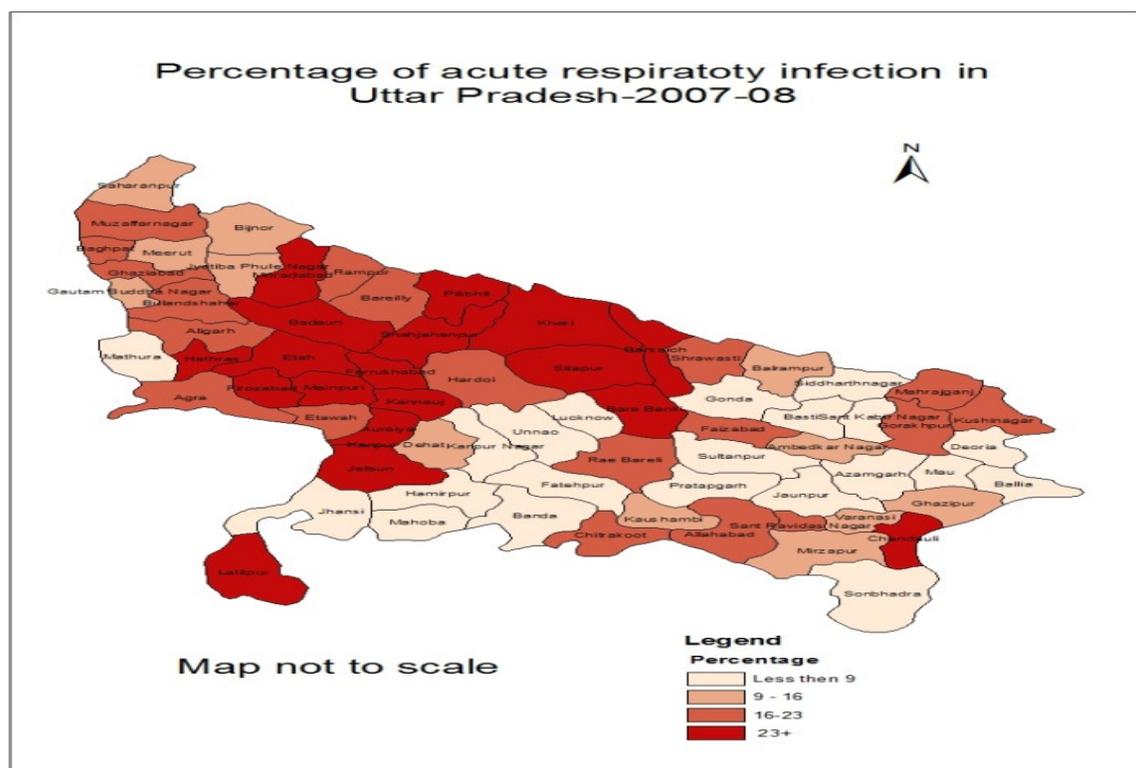
Similarly mothers education playing measure role for reducing the prevalent of ARI among children, 15% of children are suffering from ARI with those mother's who had completed ten and above years of schooling where as less educated mothers reported increasing symptoms of ARI, comparatively.

Table 1: Percentage of Acute Respiratory Infection (ARI) among children less than five years by background characteristics in Uttar Pradesh, 2007-2008

Characteristics	Uttar Pradesh	Western Region	Central Region	Eastern Region	Southern Region
Household Environment Indicators					
Type of House					
Kachha	16.5	23.4	20.3	12.4	14.0
Semi-Pucca	17.8	22.1	20.2	12.0	14.0
Pucca	15.8	19.8	14.6	10.7	12.3
No. of Person per room in the House					
Less than 3	15.7	21.3	17.4	11.7	12.8
3 & above	18.0	22.3	20.9	12.1	15.3
Separate Room For Kitchen					
Available	15.1	19.6	17.4	11.6	13.2
Not Available	17.5	22.4	19.9	12.1	14.1
Separate kitchen & Fuels					
No Separate Kitchen & No Clean fuels	17.6	22.5	20.1	12.1	14.2
No Separate Kitchen & Clean fuels	16.9	20.9	15.6	11.8	5.0
Separate Kitchen & No Clean fuels	15.3	20.5	18.7	11.6	13.6
Separate Kitchen & Clean fuels	14.2	17.2	12.5	11.5	9.5
Socio-Economic and Demographic Characteristics					
Wealth Index					
First Quintile	18.1	25.3	22.8	12.9	14.1
Second Quintile	17.3	24.4	17.5	11.9	13.6
Third Quintile	17.5	20.0	20.2	11.3	16.5
Fourth Quintile	16.4	20.4	19.1	12.1	11.3
Fifth Quintile	14.5	17.9	13.3	10.4	11.0
Age of Child (in months)					
<11	19.1	24.8	21.5	13.8	13.9
12-23	19.3	24.2	22.8	14.0	14.8
24-36	15.4	20.0	16.8	10.7	13.2
36+	13.8	18.2	16.0	9.3	12.8
Sex of the child					
Male	17.8	22.8	19.8	12.7	14.7
Female	16.0	20.7	19.0	11.1	12.7
Mother's Education (In years)					
Non literate	17.0	22.2	19.3	12.1	13.6
Less than five	19.2	21.5	26.4	13.7	15.4
Five to nine	17.2	21.4	20.0	11.8	14.5
Ten & above	15.0	20.5	14.8	10.7	11.6
Working Status of mother					
Working	16.9	23.9	18.2	12.2	14.8
Not working	16.9	20.9	20.1	11.7	12.5
Residence					

Rural	17.0	22.8	20.0	11.8	14.6
Urban	16.2	18.3	15.9	13.3	8.6
Religion					
Hindu	16.6	22.3	18.8	11.6	13.8
Muslim	18.4	20.9	22.9	13.6	12.5
Others	15.4	14.7	30.8	0.0	33.3
Mother's Castes					
Scheduled castes & Tribe	16.2	20.9	18.8	11.8	15.2
Other Backward castes	16.7	22.1	19.0	11.6	13.1
Non SC/ ST & OBC	18.4	22.1	21.3	13.3	13.2
Total number	48551	19109	6340	19237	3865

Decreasing economic status of the household leads to increasing ARI symptoms in the state, data shows that those children belongs to the highest wealth quintile among them prevalence of ARI was found low (15%) in compare to other children belongs to poorest



quintile (18%). Regional variation in terms of ARI infection among children of Uttar Pradesh shows that every fifth (22%) child of the western region, and every tenth (11%) child of the eastern region were infected with ARI in the state. Children of the western region were more infected with ARI symptoms as compared to other regions. In households of the western region, where no separate kitchen and no-clean fuels were used, the prevalence of ARI was found high (23%) compare to households having separate kitchen and using clean fuels (17%). Similar pattern shows with central, eastern and southern region.

Map shows the District wise percentage of Acute Respiratory infection (ARI) among children under age five years in Uttar Pradesh. Map clearly shows that western and central parts of the region were more prevalent of ARI than eastern and southern part of the region.

Determinants of ARI

Multivariate analysis demonstrates the odds ratio of Acute Respiratory Infection among children in Uttar Pradesh by selected background characteristics (Table 2). Five models have implemented to see the effect of associated factors on ARI in the study. The first model considered only types of cooking fuel used as a predictor of ARI. In the second model we considered separate room for the kitchen, similarly third model includes household level indicator viz. Cooking fuels, separate room for the kitchen, types of house, number of persons per room and wealth quintile. In the model four, socio-economic and demographic factors taken as a predictor indicator and model five include all factors together.

The effect of odds ratios in the model first depicts that in those households where non-cleaner cooking fuel used the occurrence of ARI among children were 17% more likely (OR-1.17) compared to those households where cleaner fuel used at one percent level of significant. Similarly in those households where separate kitchen was not available, occurrence of ARI was 20 percent more likely compare to those households (OR-1.19) where separate kitchen was available in the household.

All household indicators were significantly associated except cooking fuels in model third. Odds ratio shows that having three or above person per room are positively associated with ARI among children. The result of odds ratio clearly depicts that as the economic status of the household was increases from second to highest strata, chances of getting infected with ARI was negatively associated. Children belong to second wealth quintile (OR-0.92), were eight percent less likely, and children belong to highest wealth quintiles (OR-0.77) were 23 percent less likely to get infected with acute respiratory infection compared to children belongs to lowest wealth quintiles in the state.

When we were adding some more variables in model four, the effect of odds ratio shows a significant positive association with increasing the age child and reducing the risk of ARI in the state. Occurrence of ARI was 35% less likely among children aged 36 months and above as compared to infant age of the child. Place of resident plays a significant role in the occurrence of ARI. Children residing in urban areas were negatively associated with getting infected with ARI as odds ratio shows that chances of getting infected was six times less likely (OR-0.94) than those residing in rural areas.

Sex differential is also showing that female children were less likely to be affected (OR-0.88) of ARI as compared to male children. Children whose mothers have less than 5 years of education were 16 times more likely to get infected by ARI compare to those children whose mothers having 10 or more years of education were 19 percent less likely to get infected with ARI. All indicators included in the last model together and found that cooking fuels, separate kitchen, household type and person per room was found insignificant where as all other were significantly associated with ARI.

Table 2: Determinants of ARI among less than five years of children using Logistic Regression

Background characteristics	Model 1	Model 2	Model 3 Exp(B)	Model 4	Model 5
Types of Fuels					
Cleaner [®]					
Non cleaner	1.166***		0.935		0.948
Separate room for kitchen					
Available [®]					
Not Available		1.199***	1.074**		0.987
Type of House					
Kachha [®]					
Semi-Pucca			1.167***		1.030
Pucca			1.101**		1.031
No. of Person per room in the household					
Less than 3 [®]					
3 & above			1.117***		1.043
Wealth Index					
Lowest [®]					
Second			0.924**		0.888***
Middle			0.935*		0.860***
Fourth			0.867***		0.760***
Highest			0.767***		0.622***
Age of Child (In Month)					
0-11 [®]					
12-23				1.004	0.998
24-36				0.752***	0.754***
36 and above				0.663***	0.666***
Residence					
Rural [®]					
Urban				0.948	0.918**
Sex					
Male [®]					
Female				0.880***	0.883***
Mother's Education (In year's)					
Non literate [®]					
Less than 5 year				1.162***	1.148**
5 -9 year				0.994	1.071**
Ten or above				0.818***	1.047
Working Status of mother					
Not Working [®]					
Working				0.974	0.931***
Mother's Religion					
Hindu [®]					
Muslim				1.121***	1.103**
Other castes				0.925	0.771
Mother's Castes					
Non SC/ ST & OBC [®]					
Other Backward caste				0.839***	0.825***
Schedule caste & tribe				0.868***	0.866***
Region					
Western [®]					
Central					0.820***
Eastern					0.467***
Southern					0.551***
-2 log likelihood	44131.26	44100.46	44032.35	43716.03	43605.52

Note: *** P<0.01, ** P<0.05 and * P<0.10, First category of each predictor has been taken as a reference category for application of logistic regression

DISCUSSION

Overall 17% of children are suffering from ARI in the last two week preceding the survey in Uttar Pradesh. In this western and central part of children is more prevalent than other two regions (eastern and southern). Study found that cooking fuel indivisibly playing measure prevalent role on ARI among children, these findings also supported in another study that exposure risk of lower acute respiratory infection is more in the household where non-cleaner cooking fuel used.^{1,2,3} but when we try to look with some other indicatoer its not coming significant where as seprate kithen and other indicatoers were significantly associated with ARI among children.

In the state like Uttar Pradesh where patriarchal socity is rooted and son preference is more, this study focuse that female children were less exposure to get risk of ARI than male child which is supported by another studies also.^{12,3} There are some different possible reason which may play role behind this, first possible reason may be under reporting, second may be cultural factor child care practices is more with son than female child because mother always early conciouses about health care with son than daughter.

Mother education, economic states of the household shows significant factor to reduce the prevleant of ARI among children. ARI among children are more whose mother's were currently working where as ARI is lower among children whose mother's are currently not working. An another study on mother's empolymet and child mortality shows that mother who are employed have negative consequence for infant and child survival if mother work away form the home for cash.¹² Working mother at the time of working hour not able to take care properly so child is more prevalnt of morbidity than other children whose mother is always with child. After analyzing the household and individual factors separatly and simeltensily study found that economic status of the household ,education, age of child, religion, sex of the child are playing significant role with Acute Respiratory Infection.

SUMMARY AND CONCLUSION

Present study found that western and central region of Uttar Pradesh reported more symptom of ARI than eastern and southern region. Household, Individual and community level factors playing measure role to occurrence of Acute Respiratory Infection among children. Domestic environmental factors such as cooking fuel, availability of kitchen, crowding, household types are more significantly associated with ARI among children. Similarly age of child, sex of the child, mother's education, economic status of the household, residence of the child, working status of mothers, religion, caste were also prevalent factors of ARI among children. Based on this findings we can assume that occurrence of ARI may reduce by improving socio-economic status of household, individual, and community level factors, awareness about indoor air pollution and accessibility and availability of health facility at grass root level.

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Appendix1

Regional division along with district of Uttar Pradesh			
Western region	Central region	Eastern region	Southern region
Saharanpur, Bijnor, Muzaffarnagar, Rampur, Moradabad, Jyotiba Phule Nagar, Meerut, Baghat, Ghaziabad, Gautam Buddha Nagar, Bulandshahr, Aligarh, Hathras	Kheri, Sitapur, Hardoi, Unnao, Lucknow, Rae Bareli, Kanpur Dehat, Kanpur Nagar, Chitrakoot, Fatehpur, Barabanki	Pratapgarh, Kaushambi, Allahabad, Faizabad, Ambedkar, Nagar, Sultanpur, Bahraich, Shrawasti, Balrampur, Gonda, Siddharthnagar, Basti, Sant Kabir Nagar, Maharajganj, Gorakhpur, Kushinagar, Deoria, Azamgarh, Mau, Ballia, Jaunpur, Ghazipur, Chandauli, Varanasi, Sant Ravidas Nagar Bhadohi, Mirzapur, Sonbhadra.	Jalaun, Jhansi, Lalitpur, Hamirpur, Mahoba, Banda

Source: National family health survey 2005-06.