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# Individual- and community-level predictors of healthcare-seeking behaviour for acute respiratory tract infections among children under five in 29 low- and middle-income countries: a multilevel analysis

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ABSTRACT

*Objectives:* This study aimed to identify the individual- and community-level determinants of mothers' healthcare-seeking behaviour for children under the age of 5 years with acute respiratory infection (ARI) symptoms in low-and middle-income countries (LMICs).

*Study design:* Nationally representative Demographic and Health Survey datasets from 29 LMICs were used.

*Methods:* The study included 16,893 children aged under 5 years with ARI symptoms in the 2 weeks prior to the survey. A multilevel logistic regression model was used to examine associations between individual- and community-level factors with health-seeking behaviour for ARIs. The adjusted odds ratio (AOR) along with 95% confidence intervals (CIs) were reported as a measure of association.

*Results:* The overall prevalence of healthcare-seeking behaviour for ARIs among children under 5 years in LMICs was 58.83% (95% CI: 58.08, 59.57). Findings showed that mothers with primary or higher education (AOR = 1.20; 95% CI: 1.08, 1.33), and those residing in rich households (AOR = 1.32; 95% CI: 1.18, 1.48), attending antenatal care (ANC) visits (AOR = 1.53; 95% CI: 1.31, 1.79) and delivering at a healthcare facility (AOR = 1.28; 95% CI: 1.16, 1.41) were more likely to seek healthcare for ARIs. A higher level of community maternal education (AOR = 1.44; 95% CI: 1.24, 1.68) was positively associated with seeking healthcare for ARIs, while a higher level of community poverty (AOR = 0.83; 95% CI: 0.72, 0.96) was negatively associated with healthcare seeking for ARIs.

*Conclusions:* This study revealed that mothers' healthcare-seeking behaviour for ARIs was closely linked to modifiable risk factors, including maternal education, household wealth, use of maternal health services (e.g., ANC), as well as community poverty and literacy levels. Future interventions should consider these modifiable risk factors when developing strategies to improve child health outcomes in LMICs.



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## Introduction

The Sustainable Development Goal (SDG) Target 3.2 aims to end all preventable deaths of children under 5 years worldwide by 2030.[1] Despite this target, approximately 5 million children worldwide died before reaching the age of 5 years in 2021, with over 80% of these deaths occurring in low- and middle-income countries (LMICs).[2,3] The major causes of these childhood deaths are diarrhoea, acute respiratory tract infections (ARIs), malaria and measles.[1] ARIs contribute to nearly 20% of deaths among children under the age of 5 years globally, and LMICs represent 83% of these deaths and 90% of reported cases.[4] The behaviour of mothers in seeking treatment is of utmost importance in effectively managing these diseases, including early diagnosis, which can prevent the deterioration of the child's condition.[5,6] Failure to seek treatment for these conditions can lead to complications and increased mortality rates.

Children with ARI can experience both short- and long-term complications. In the short term, children with ARIs may have immediate complications, such as pneumonia (a severe infection that causes inflammation and fluid buildup in the lungs).[7] Ear infections (otitis media) can also occur as a result of ARIs, causing ear pain, fever and hearing difficulties.[9,8] In the long term, children who have experienced recurrent or severe respiratory infections may be more prone to developing chronic respiratory conditions, such as chronic obstructive pulmonary disease (COPD) or bronchiectasis, later in life.[9,10]

Healthcare-seeking behaviour is defined as any action undertaken by individuals who perceive themselves to have a health problem or to be ill to find an appropriate remedy.[5] Cultural beliefs and perceptions of disease, the perceived severity of the disease and the efficacy of treatment, area of residence (urban/rural), gender, household income/household wealth quintile, treatment costs, child's age, household size, mother's age and mother's education level all influence parents' decisions about whether to access healthcare for children under the age of 5 years.[11–14]

Despite the high burden of ARIs among children in LMICs, less than one-third of ARI cases in these regions access medical care.[15] Ensuring the incorporation of health-seeking behaviours in management approaches for childhood ARI is crucial to enable early detection, treatment and, ultimately, life-saving interventions.[16,17] To the best of the authors' knowledge, no previously published studies have identified the drivers and barriers of health-seeking behaviour of mothers in LMICs. Identifying the factors associated with mothers or caregivers seeking healthcare for their children with ARI symptoms is essential for developing strategies and interventions that accelerate the reduction of childhood mortality in LMICs. This study aimed to identify individual- and community-level determinants of mothers' healthcare-seeking behaviour for children under the age of 5 years who had ARI symptoms in LMICs using recent nationally representative large datasets.

## Methods

### *Study design, setting and period*

This study was based on a secondary data analysis of the most recent Demographic and Health Survey (DHS) datasets from 29 LMICs between 2016 and 2021. The DHS is a nationally representative cross-sectional survey that collects health, nutrition and demographic data from over 90 nations globally. The DHS surveys are conducted regularly by the health ministry or governmental agencies of each country, with the support of the Inner-City Fund (ICF) International. To ensure uniformity in survey methodology across countries, the DHS used a standardised questionnaire and survey methodology.[18] Supplementary Table S1 presents the list of countries along with their respective sample sizes.

### *Sampling procedure and populations*

To select study participants, the DHS employs a two-stage stratified sampling technique. In the first stage, a stratified sample of Enumeration Areas (EAs) is selected using Probability Proportional to Size. Then, a predetermined number of EAs is selected with probability proportional to the EA's size. A listing procedure is then performed in the selected EAs to list all dwellings/households. This procedure provides a framework for household selection. In the second stage, after completing household listings in the selected EAs, a fixed (or variable) number of households are selected using an equal probability systematic sampling in each selected EA.[18] Data were obtained from the DHS website (www.dhsprogram.com) after a formal request. This study used kid record (KR) data.

### *Outcome variable*

The main outcome variable was the healthcare-seeking behaviour of mothers for their children aged under 5 years with ARI symptoms. For this study, the healthcare-seeking behaviour of mothers/caregivers was dichotomised into 'receiving no medical care' and 'receiving any medical care', consistent with previously published studies and DHS guidelines.[19,20] 'Receiving no medical care' was defined as mothers seeking care from untrained health workers or non-healthcare professionals, or not seeking any healthcare for their children with ARIs. Meanwhile, 'receiving any medical care' was defined as mothers seeking care from healthcare providers, such as doctors, nurses and midwives, in any healthcare facility, including hospitals, clinics, healthcare centres and private healthcare practices.[21,22]

### *Explanatory variables*

Based on previously published studies,[23–26] the explanatory variables were broadly classified as individual-level and community-level factors. Individual-level factors included the mother's and partner's education level, household size, attending antenatal care (ANC) visit, birth order, wealth index, place of delivery, coverage by health insurance and media exposure. The selection of these variables was based on previous studies[23,25,27] and the availability of data.

Community-level factors included community-level poverty, community-level media exposure and community-level literacy. The community-level variables were computed by aggregating individual-level factors at the community (cluster) level. For this study, community-level factors were grouped as 'low' or 'high' based on the distribution of the proportion values calculated for each cluster. The definitions of the community-level factors were as follows:

Community-level poverty was classified as 'high' if the proportion of women from the two lowest wealth quintiles (poor and poorer) in a given community was 50–100% and 'low' if the proportion was <50%.

Media exposure was measured dichotomously as follows: respondents used any newspaper/magazine, radio, television or internet regardless of frequency levels 'almost every day', 'at least once a week' and 'less than once a week' were recoded as 'have

media exposure', and the response 'not at all' was recorded as 'no media exposure'. Community-level media exposure was categorised as 'high' if the proportion was 50–100% and as 'low' if the proportion of women who use media in the community was <50%.

Community-level literacy was categorised as 'high' if the proportion of women who have primary, secondary and higher educational attainment was 50–100% and as 'low' if the proportion was <50%. These approaches were based on previous studies.[25,28]

### *Data management and analysis*

After computing potential variables, DHS data from 29 LMICs were used. The extracted data were weighted using sampling weight (v005), primary sampling unit (v023) and strata (v021) to obtain a valid statistical estimate. Data cleaning, coding and descriptive analyses were performed using STATA Version 14. The adjusted Odds Ratio (AOR) with a 95% confidence interval (CI) in the multivariable model were used to determine statistically significant associations with the outcome variable.

A fixed effect for both the individual- and community-level factors and a random effect for the between-cluster variation was estimated using a two-level mixed-effect logistic regression analysis, by assuming that each community has a different intercept and fixed coefficient, with a random effect applied at the cluster level.[29–31] Hence, using the two-level multilevel model, the likelihood of seeking health care for ARI was modelled as follows:

$$log\frac{\pi_{ij}}{1-\pi_{ij}} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \beta_3 X_{3ij} + \ldots. + \beta_k X_{kij} + \mathrm{u}_j$$

where πij is the probability of seeking health care for ARI and 1-πij represents the probability of not seeking health care for ARI. β1xij are individual- and community-level variables for the ith individual in group j, respectively.

$\beta_0$ is the intercept that indicates the effect of ARI on the probability of healthcare-seeking behaviour in the absence of the influence of predictors.

$\beta_1$ …… $\beta_k$ are the regression coefficients of the individual- and community-level variables.

$X_1$, $X_2$ …., $X_k$ are the individual- and community-level independent variables for the ith individual in community j, respectively.

$\mathrm{u}_j$ represents the random effect for the jth community, which indicates the effect of the community on healthcare-seeking behaviour for ARI.

For measures of variation (random effects), intraclass correlation coefficient (ICC) and median odds ratio (MOR) statistics were computed. The ICC demonstrates the differences between clusters in healthcare-seeking behaviour for ARI, and it is computed as ICC $= \frac{VA}{VA+3.29}$*100, where: VA = area-level variance. The MOR indicates the central value of the odds ratio between the highest and lowest risk regions when two clusters are chosen at random. The MOR was calculated as MOR = e0·95 $\sqrt{VA}$, where VA is the area-level variance.[32,33] Deviance Information Criteria (DIC) was also used for model comparison. This study used the DIC because the nested and hierarchical model benefits from its ability to assess both goodness of fit and model complexity when comparing hierarchical models.[34]

In the multilevel analysis, four models were fitted. The first (Model 0) was the null model containing no independent variables that were used to check the variability of mothers' healthcare-seeking behaviour for ARIs in the community. The second (model I) contained individual-level variables, whereas the third (model II) contained community-level variables. In the fourth model (Model III), both individual- and community-level variables were considered in the analysis simultaneously. No multicollinearity was found after checking with the variance inflation factor (VIF).

## Results

A total weighted sample of 16,893 mothers or caregivers who had children with ARI symptoms were included in the study. The majority of participants (12,287 [72.82%]) lived in rural areas. The mean age of children with ARIs was 26.74 months (SD = 16·77). Overall healthcare-seeking behaviour for ARIs was 58.83% (95% CI: 58.08, 59.57) [see Table 1].

### *Random effect analysis*

In the null model, the ICC showed that about 31% of the total variation among mothers who sought healthcare was due to differences between clusters. The other 69%, which could not be explained, was due to individual variation. The MOR in the final model indicated that if mothers were randomly chosen from two different clusters, those from a higher-risk cluster were three times more likely to have healthcare-seeking behaviour than mothers who came from the lower-risk cluster. In addition, the best-fitted model was the final model as it had the lowest DIC with the individual-as well as community-level factors (Supplementary Table S2).

### *The fixed effect analysis result*

The final model in this study identified several modifiable factors that were associated with the healthcare-seeking behaviour of mothers. Specifically, maternal educational status, place of delivery, ANC visit, wealth index, residence and distance to a health facility were found to be significant predictors of healthcare-seeking behaviour.

Mothers who gave birth in a health facility had a 28% higher likelihood of seeking healthcare for their children with ARIs (AOR = 1.28; 95% CI: 1.16, 1.41). Those who had ANC visits were 53% more likely to seek healthcare for their children aged under 5 years with ARIs (AOR = 1.53; 95% CI: 1.31, 1.79). Urban mothers had a 31% higher likelihood of seeking healthcare for their children with ARI symptoms (AOR = 1.31; 95% CI: 1.17, 1.45), while those living in communities with high media exposure were 22% more likely to seek healthcare for their children with ARIs (AOR = 1.22; 95% CI: 1.06, 1.40) [Table 2].

## Discussion

This study aimed to identify individual- and community-level determinants of mothers' healthcare-seeking behaviour for their children aged under 5 years who had ARI symptoms in LMICs. This study added to the existing literature with a relatively large sample size and broad coverage of individual- and community-level factors that impact mothers' healthcare-seeking behaviour for ARIs in 29 LMICs, which have a high burden of ARIs. This quantitative evidence can be used to design targeted strategies to reduce ARIs. Seeking treatment from a healthcare setting for common childhood illnesses is important not only for reducing child mortality but also for improving the well-being and development of children, building a healthy generation and improving productivity on a large scale.

Children whose mothers attained primary, secondary or higher education were more likely to seek healthcare than mothers with no education, which is consistent with previous studies.[35–38] This could be because educated mothers are more aware of the

**Table 1**
Sociodemographic characteristics of the study participants in LMICs ($n$ = 16,893).

| Variables | Categories | Frequency ($n$) | Percentage (%) |
|---|---|---|---|
| Age of mother (in years) | 15–24 | 5150 | 30.52 |
| | 25–34 | 8866 | 52.55 |
| | 35–49 | 2856 | 16.93 |
| Age of child (in months) | 0–12 | 4401 | 26.09 |
| | 12–24 | 3976 | 23.57 |
| | 24–35 | 8494 | 50.34 |
| Maternal education status | No education | 4879 | 28.92 |
| | Primary | 4435 | 26.29 |
| | Secondary | 6049 | 35.85 |
| | Higher education | 1509 | 8.95 |
| ANC visits | No | 1200 | 7.12 |
| | Yes | 15,672 | 92.88 |
| Place of childbirth | Home | 4218 | 25.00 |
| | Health institution | 12,654 | 75.00 |
| Birth order | First | 4802 | 28.46 |
| | 2–4 | 8761 | 51.93 |
| | >5 | 3308 | 19.61 |
| Covered by health insurance | No | 13,752 | 84.03 |
| | Yes | 2613 | 15.97 |
| Wealth index | Poor | 8567 | 50.78 |
| | Middle | 3258 | 19.31 |
| | Rich | 5047 | 29.91 |
| Residence | Urban | 4585 | 27.18 |
| | Rural | 12,287 | 72.82 |
| Distance to a health facility | Big problem | 6455 | 38.37 |
| | Not a big problem | 10,367 | 61.63 |
| Community-level poverty | Low | 7859 | 46.58 |
| | High | 9012 | 53.42 |
| Community-level media exposure | Low | 8497 | 50.36 |
| | High | 8374 | 49.64 |
| Community-level literacy | Low | 8504 | 50.40 |
| | High | 8368 | 49.60 |

ANC, antenatal care; LMICs, low-and middle-income countries.

aetiology of diseases (e.g., ARI), illness symptoms, danger signs and their consequences, which increases their healthcare-seeking behaviour.[39,40] Additionally, educated mothers are more likely to have better incomes to seek appropriate healthcare for their children.[41] Furthermore, it has been shown that mothers living in communities with high levels of female education were more likely to seek healthcare for their children.[37,40,42] This is associated with educated women being more likely to know the health risks and the importance of seeking healthcare services, and they may also have greater decision-making power within their households. This can lead to increased healthcare-seeking behaviour for themselves and their children.

Mothers who gave birth in a health facility and those who had ANC visits were more likely to seek healthcare for their children aged under 5 years with ARIs. This finding is similar to previous studies conducted in Ethiopia[38] and Nigeria.[43] A possible reason might be that women who have ANC visits and who deliver at health facilities may have been provided with information regarding child health, which increases the likelihood of subsequent visits to the healthcare facility.[44,45] Mothers who have first-born children were less likely to seek healthcare for their children with symptoms of ARIs compared to mothers with five or more children.

The odds of seeking healthcare for ARIs were higher among households with a high wealth index than among households with a poor wealth index. This finding is consistent with reports from Ethiopia[37] and Indonesia.[46] The possible justification might be that those with a high wealth index have access to more information about health and can seek appropriate healthcare as they have a good income.[47] Also, mothers living in communities with high levels of community poverty were less likely to seek healthcare for their children with symptoms of ARIs compared to mothers who live in areas with low levels of female education.

Mothers living in communities with high media exposure were more likely to seek healthcare for their children with symptoms of ARIs than mothers who live in communities with low media exposure. This finding is similar to results from studies in East Africa,[40] India,[48] West Bengal[49] and Tanzania.[50] One possible explanation is that mass media exposes people to messages about healthcare management, which improves their health-seeking behaviour. Evidence also suggests that exposure to the media is important for promoting healthy behaviours.[50] Hence, community mass media exposure may lead to changes in their healthcare-seeking behaviours and increased awareness among the community or mothers/caregivers about the importance of child healthcare healthcare-seeking behaviours.

### *Strengths and limitations*

The strengths of the study include the use of a weighted nationally representative dataset and an advanced model that considered the hierarchical structure of the data at individual and community levels. Although this study assessed many important factors related to ARIs, some possible factors, such as mothers' perception of the illness, were not examined in the model as these were not measured in DHS.

### *Conclusion*

Both individual- and community-level factors, including poor maternal education, low household wealth, inadequate ANC visits and high community poverty levels, were positively associated with poor health-seeking behaviour of mothers with ARIs in children aged under 5 years. Future interventions should consider these modifiable risk factors not only to enhance maternal health-

**Table 2**
Factors associated with mothers' healthcare-seeking behaviour for ARI episodes in LMICs after accounting for cluster variability, 2016–2021.

| Variables | Categories | Null model | Model I | Model II | Model III |
|---|---|---|---|---|---|
| | | | AOR [95% CI] | AOR [95% CI] | AOR [95% CI] |
| **Individual-level variables** | | | | | |
| Maternal educational status | No education | | 1.00 | | 1.00 |
| | Primary education | | 1.10 [1.00, 1.22] | | 1.20 [1.08, 1.33] * |
| | Secondary education | | 1.31 [1.17, 1.46] | | 1.45 [1.28, 1.64]* |
| | Higher education | | 1.63 [1.36, 1.95] | | 1.79 [1.49, 2.15]* |
| Covered by health insurance | No | | 1.00 | | 1.00 |
| | Yes | | 0.99 [0.88, 1.11] | | 0.99 [0.88, 1.11] |
| Place of childbirth | Home | | 1.00 | | 1.00 |
| | Health institution | | 1.30 [1.18, 1.43] | | 1.28 [1.16, 1.41]** |
| ANC visits | No | | 1.00 | | 1.00 |
| | Yes | | 1.57 [1.35, 1.83] | | 1.53 [1.31, 1.79]** |
| Birth order | First | | 0.77 [0.67, 0.90] | | 0.78 [0.67, 0.90] |
| | 2–4 | | 0.95 [0.84, 1.07] | | 0.94 [0.84, 1.06]* |
| | >5 | | 1.00 | | 1.00 |
| Wealth index | Poor | | 1.00 | | 1.00 |
| | Middle | | 1.03 [0.93, 1.15] | | 1.07 [0.95, 1.20] |
| | Rich | | 1.35 [1.22, 1.49] | | 1.32 [1.18, 1.48]* |
| **Community-level variables** | | | | | |
| Residence | Urban | | | 1.65 [1.50, 1.82] | 1.31 [1.17, 1.45]** |
| | Rural | | | 1.00 | 1.00 |
| Distance to a health facility | Big problem | | | 1.00 | 1.00 |
| | Not a big problem | | | 1.19 [1.10, 1.29] | 1.09 [1.02, 1.20]** |
| Community-level poverty | Low | | | 1.00 | 1.00 |
| | High | | | 0.97 [0.85, 1.10] | 0.83 [0.72, 0.96]** |
| Community-level media exposure | Low | | | 1.00 | 1.00 |
| | High | | | 1.17 [1.02, 1.34] | 1.22 [1.06, 1.40]** |
| Community-level literacy | Low | | | 1.00 | 1.00 |
| | High | | | 1.15 [1.01, 1.32] | 1.44 [1.24, 1.68]** |
| **Random-effect analysis** | | | | | |
| | VA | 1.49 | 1.73 | 1.50 | 1.62 |
| | ICC | 0.31 | 0.34 | 0.31 | 0.33 |
| | MOR | 3.15 | 3.39 | 3.16 | 3.28 |
| **Model comparison** | | | | | |
| | Deviance | 21,879 | 20,989 | 21,663 | 20,890 |
| | Mean VIF | – | 1.58 | 1.13 | 1.58 |

ANC, antenatal care; AOR, adjusted odds ratio; CI, confidence interval; ICC, Inter cluster correlation coefficient; LMICs, low- and middle-income countries; MOR, Median odds ratio; VA, Area level variance; VIF, Variance inflation factor.
* $P$ <0.05; ** $P$ <0.001.

seeking behaviour for ARIs in LMICs but also to address child health targets and improve child health outcomes.

## Author statements

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*Ethical approval*

The DHS surveys were conducted after ethical approval from the respective countries. During the survey, permission from administrative offices and verbal consent from study participants was obtained before the commencement of data collection. For this study, no ethical approval was required as publicly available data were used.

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*Competing interests*

None declared.

*Data availability statement*

The datasets generated during and/or analysed during the present study are available from the corresponding author upon reasonable request.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.08.028.

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