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Parental knowledge, practices, and challenges in managing human Metapneumovirus (hMPV)-associated acute respiratory infections in children in Bangladesh

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ABSTRACT

Background: Acute respiratory infections (ARIs) are a major global health concern, particularly for children. Each year, approximately 13 million children under five dies, with ARIs accounting for one-third of these deaths. ARIs such as human metapneumovirus (hMPV) can cause severe illnesses, including pneumonia and bronchitis. The emerging trend of hMPV highlights the urgent need for surveillance and public health awareness. This study aims to assess parental knowledge, practices, and challenges in Bangladesh. **Methods:** A cross-sectional survey was conducted between December 2024 and January 2025, involving 405 parents of children aged 0–12 in Dhaka, Bangladesh. Data were collected through structured interviews and supplemented by focus group discussions (FGDs) with 40 stakeholders, including healthcare professionals and parents. **Results:** Findings revealed that 45.4% of parents were aware of hMPV; however, significant knowledge gaps existed in symptom recognition, prevention, and transmission. Seasonal variation was observed, with ARIs peaking in winter (73%), including cases of pneumonia and the common cold. Common symptoms were cough (22.75%), fever (12.09%), and wheezing (12.59%). Notably, 26% of cases required hospitalization. Alarmingly, 81.9% of parents reported relying on self-medication before seeking professional care. Challenges included limited healthcare access, overcrowded living conditions, and insufficient awareness. FGDs emphasized the need for targeted awareness campaigns and improved pediatric healthcare infrastructure. **Conclusions:** Reducing hMPV-associated ARI burden in children requires greater parental awareness and strengthened healthcare policies. Enhanced preventive strategies, early diagnosis, and community-based interventions are essential for decreasing child morbidity and mortality in Bangladesh.

Introduction

Every year, viral respiratory tract infections (RTIs) induce mild to severe diseases in millions of children. One of the common viruses for RTIs is the human metapneumovirus (hMPV). hMPV is a prevalent viral pathogen linked to acute respiratory infections (ARIs), and it was first identified in 2001 [1]. Every year around 13 million children under the age of five die prematurely. Roughly 95% of deaths come from underdeveloped nations, and ARI is responsible for one-third of all

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mortality [2]. Southeast Asian and African regions had the highest rates of severe ARIs [3]. Together, Bangladesh, India, Indonesia, and Nepal report that ARIs cause 40% of all deaths worldwide [4]. ARIs are prevalent viruses that spread in the winter and spring, such as seasonal influenza and hMPV [5]. Similar to the common cold, hMPV typically causes respiratory symptoms that last two to five days before going away on their own [6]. More serious illnesses like pneumonia or bronchitis may result from it in certain situations. Youngest and oldest people with compromised immune systems are most vulnerable [6]. The clinical symptoms of hMPV are difficult to distinguish from those of bronchiolitis and pneumonia [7, 8]. These symptoms include cough, fever, runny or stuffy nose, sore throat, wheezing, shortness of breath, and rash [6, 9, 10]. The real-time polymerase chain reaction (RT-qPCR) provides rapid results (within 1–3 h) [11] and can assess the viral load and the severity of the infection in hMPV detection. Additionally, a chest X-ray or bronchoscopy is used to look for pneumonia in the airways of the lungs [11].

Very recently, the prevalence of ARIs, including seasonal influenza and hMPV infection rates, has been raised in Asia, Europe, Central America, the Caribbean, and Western and Middle Africa. Late December 2024 marked a rise in hMPV infection cases in China and some neighboring countries [12]. The number of hMPV infections in northern China has sharply increased, according to the Chinese Center for Disease Control and Prevention (CDC) [13]. During this time, 6.2 percent of children under the age of 14 who tested had hMPV [12]. According to a recent study by the Malaysian Ministry of Health (January 2025), there were 327 new cases of hMPV in 2024, a 45% increase over 2023 [14]. More than 15 HMPV cases have been identified in various parts of India [15]. In the United Kingdom, the laboratory surveillance rate for hMPV-positive individuals is roughly 4.5% [16]. In the first week of January 2025, more than 2% of lab tests reported for hMPV tested positive, which is more than twice the rate observed in early December (0.87%) [17].

Bangladesh, a nation with a large population and a high prevalence of respiratory diseases, is highly susceptible to the spread of hMPV. A patient with hMPV died in Bangladesh from multiple organ failures in addition to pneumonia [18]. In November 2024, infection rates for ARI and influenza-like illness (ILI) were 4.56% and 5.83%, respectively [19]. In addition, the comparative case report of ARI from July 2022 to June 2023 was 2.89%, whereas this rate was slightly higher (2.97%) from December 2023 to November 2024 than the previous year. Delays in identifying symptoms and obtaining medical attention have been found to worsen illness outcomes [20, 21]. Parent adoption of beneficial practices may be delayed by sociocultural barriers, restricted access to healthcare facilities, and inadequate dissemination of health education materials in Bangladesh [22]. Despite the increasing awareness that hMPV plays a major role in the burden of ARI, little is known about parental awareness, management strategies, and obstacles. Comprehending these elements is essential for creating focused interventions, such as community-based initiatives and health education campaigns.

The purpose of this study is to assess the level of parental knowledge, daily practices, and awareness regarding the management of acute respiratory infections (ARIs), including human metapneumovirus (hMPV) infections, among children in Bangladesh. This study intends to contribute evidence-based understandings that can inform the development of effective public health policies to mitigate the rising burden and potential risks of ARIs, such as hMPV, in children.

Methods

Study Design

This cross-sectional study was conducted among the parents of children aged 0–12 years who were suffering from flu-like symptoms and receiving treatment in both outpatient and inpatient departments of three different hospitals in Dhaka city, Bangladesh. A total of 405 data were collected from December 2024 to January 2025 from the parents of children who were willing to participate. Inclusion criteria encompassed children who were suffering from flu-like problems confirmed by medical report and willing to participate in this study. Conversely, exclusion criteria included children older than 12 years, those who refused to participate, and those with a history of other types of respiratory infections.

Methodology for Data Collection

Data were collected using a structured questionnaire that included a total of four sections: the first section was about the socio-demographic characteristics of the patients, and the second section

was about the history and symptoms of infections in children. Additionally, clinical characteristics related to the children's infections were extracted from their medical diagnostic reports. The third section of the questionnaire was parental knowledge about ARIs such as hMPV and practices for infection prevention. Information was obtained through face-to-face interviews with parents or guardians. The questionnaire consisted of mixed types, both open-ended and closed-ended.

In the last section, a focus group discussion (FGD) was conducted to gather insights into the challenges and potential strategies for preventing seasonal ARIs in children in Bangladesh. The FGD included a diverse group of 40 participants: 20 experts (comprising five specialized medical doctors, five public health professionals, five researchers, and five academicians) and 20 parents (10 residing in Dhaka city and 10 from rural areas). Each participant was invited to provide their expert opinion on eight pre-structured questions. To interpret the focused group discussion results, participant responses were categorized as either "Yes", "No" or "Mixed." A "Yes" response reflects united agreement among all participants on a given issue, while "Mixed" indicates divergent views, where some participants agreed and others were uncertain or disagreed. The key points of agreement and expert consent were concise and presented in tabular form.

The random sampling technique was used to ensure that the sample is representative of the population, reducing selection bias. Conducted a pilot test of the data collection tools to identify any issues and make necessary adjustments before the main data collection. All procedures were conducted in accordance with the principles for human investigations (*i.e.*, the Helsinki Declaration). Participants were informed about the study's purpose, procedures, and the confidentiality measures taken to protect their information.

Sample Size Calculation

The sample size was calculated using the following equation[23]:

$$n = \frac{z^2 pq}{d^2}$$

Here, n = number of samples

z = critical value of the normal distribution

p = expected prevalence estimate

q = (1-p) = expected non-prevalence

d = precision limit or proportion of sampling error

The critical value (z) is included as 1.96 for a 95% confidence level. The precision limit, or proportion of sampling error (d), is usually considered to be a 5% confidence limit.

Therefore,

$$n = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.05^2}$$

$$\Rightarrow n = 384.16$$

Assuming a 5% more response rate, a sample size of 384 ≈ 405 participants was estimated.

Data Analysis Instruments

All data were analyzed using SPSS version 25.0 (SPSS Inc., Chicago, II, USA). Descriptive statistics (percentage, frequency, mean, etc.) and inferential statistics (p-value) were executed in the study. A chi-square test was used to evaluate the correlations between various kinds of variables. A p-value of <0.05 was set as statistically significant.

Ethical Consideration

All procedures followed the principles of the Helsinki Declaration. Participants were informed about the study's purpose, procedures, and confidentiality and provided voluntary consent. Written consent was also obtained from the parents or guardians before data collection using a structured questionnaire. Moreover, ethical approval was obtained from the Institutional Review Board of Daffodil International University (DIU), Faculty of Health and Life Sciences (FHLS) (Ref: FHLS-REC/DIU/2025/0017) prior to data collection, ensuring the privacy and confidentiality of participants were upheld throughout the study.

Results

This study conducted a comprehensive investigation into hMPV-associated ARIs among Bangladeshi children by systematically analyzing: (1) parental sociodemographic characteristics, (2) clinical outlines of affected children across different age groups, (3) potential association of infection with age of children, (4) possible way of infection and seasonal disease patterns to identify high-risk periods, (5) parental knowledge levels and preventive practices regarding ARIs, and (6) through focus group discussions with stakeholders, identified existing healthcare challenges and potential solutions for managing hMPV and similar seasonal respiratory diseases in Bangladesh.

Table 1 presents the socio-demographic profile of parents (n=405) who participated in this study, with both the numerical count (*n*) and corresponding percentages calculated for each category. Most of the responses (76.8%) were from mothers, followed by fathers (18%) and other family members (5%). Parents between the ages of 21 and 30 made up the highest percentage (54.1%), followed by those between the ages of 31 and 40 (32.3%). The majority of parents were in their ideal parenting years; a small percentage were under 20 years old (7.7%) or over 50 years old (1.5%). Almost half (48.6%) of the parents were homemakers, 7.9% were students, 16.3% engaged in business, and 27.2% were employed. 25.4% of parents held a master's degree, and 43.5% of parents had just completed high school, whereas 5.9% lacked formal education. 41.4% of participants lived outside of Dhaka City, whereas 58.6% of participants lived there. 39.3% of the family structure was joint, while the majority (60.7%) was nuclear families. The majority of families (47.9%) had monthly incomes between 31k and 50k BDT, and 4.9% have financial barriers to healthcare (less than 20,000 BDT). Significantly, 25.1% of respondents were unwilling to talk about it. Just 10.2% of parents had three children, 47.9% had two, and 41.9% had one child.

Some basic and clinical characteristics of pediatric patients are presented in Table 2. The majority (74.56%) were aged 0–4 years, with a nearly equal gender distribution (male: 48.64%; female: 51.35%). The most commonly reported symptoms were coughing (22.75%), fever (12.09%), and wheezing (12.59%), while 25.68% of patients exhibited multiple symptoms, such as cold, cough, and fever. The most frequently performed diagnostic investigations were blood and urine tests (47.40%), followed by chest X-rays (14.07%). Clinically, 20.49% of children were diagnosed with pneumonia, while 79.51% had the common cold. Most cases (74.07%) were managed on an outpatient basis, whereas 25.92% required hospitalization. Regarding recovery time, 48.39% of patients recovered within 2–4 days, while 17.77% experienced symptoms lasting more than a week. For further understanding, the severity of disease symptoms across different age groups of infected children is discussed in the following section.

Table 3 presents the association between age groups and the clinical features of the disease. The results show that age distribution indicates that younger children are more vulnerable to hMPV-associated respiratory infections. Children aged 0–4 years accounted for the majority of cases (74.56%), followed by those aged 4–8 years (14.07%) and 8–12 years (11.35%). The distribution of genders did not significantly correlate with age ($\chi^2 = 1.670$, $p = 0.796$); however, the youngest age category had a slightly greater percentage of females (76.4%) than males (72.6%). Age-group variations in symptom manifestation were significant ($\chi^2 = 53.214$, $p < 0.001$). The most prevalent symptom (57.6% in children aged 0–4) was cough, which was followed by fever (65.3%), wheezing or shortness of breath (66.7%), and multiple complaints (79.8%). Multiple symptoms (fever, cough, and cold) were more common in younger children; however, skin rash (24.2%) and sore throat (25.7%) were more common in older children. Although blood and urine tests were the most frequently conducted investigations (69.3%), no significant correlation was found between age and the type of diagnostic test performed ($p > 0.05$). Younger children were substantially more likely to be hospitalized ($\chi^2 = 9.177$, $p = 0.017$), with the maximum number of admitted cases (76.2%) coming from the 0–4 age group. Similar trends were observed when the diagnosis of the disease was also significantly linked with age ($\chi^2 = 14.719$, $p < 0.001$), with pneumonia and the common cold accounting for around 70% of cases among children under the age of 4 years. There was a significant relationship between age and sickness duration ($\chi^2 = 10.913$, $p = 0.028$). Younger children (ages 0–4) recovered faster (69.9%) in 2–3 days, whereas older children (8–12 years) experienced a little longer time to recover (>7 days, 9.7%). As part of further investigation, the possible causes of infection and the highest-risk seasons for ARI-related illnesses in Bangladesh are explored in the following section.

Figure 1(a) demonstrations parents' perceptions regarding the possible causes of ARI illness among children in Bangladesh. The results indicate a majority (42.96%) attributed infections to non-identified reasons by the parents, like seasonal changes and poor hygiene practices, while 37.03% supposed that children could get infected by the other sick person in the family. A smaller percentage (20%) of parents believed that it may have been caused by the contaminated food or drinks. **Figure 1(b)** demonstrates a distinct seasonal pattern in ARI prevalence among Bangladeshi children, with the highest incidence occurring during winter (73%;

November-January) when average temperatures range from 12°C to 17°C. This contrasts sharply with lower rates observed in spring (15.30%; March-May; average 35°C) and summer (14.18%; March-June; 33°C-37°C). The pronounced winter peak suggests temperature-dependent viral transmission dynamics, consistent with global observations of respiratory virus seasonality.

The results presented in **Table 4** show that parents in Bangladesh have a generally low level of knowledge regarding ARI, specifically hMPV. Among the parents, only 45.4% had heard of hMPV at all, and 54.6% had never heard of it in the past. The primary source of information for those who were aware (n=184) was social media (58.7%), followed by news sources (23.9%) and friends and family (17.4%). Merely 25.2% of parents knew how the virus transmits, compared to 74.8% who did not. This indicates that parents' knowledge of hMPV transmission was very limited. Additionally, there are significant discrepancies in symptom identification, as only 10.62% of parents were able to identify hMPV symptoms in their children, while 16.3% were unclear. Furthermore, 73.3% of parents were unaware that hMPV might cause respiratory infections in children, compared to 26.7% who were aware of this fact. Additionally, only 18.8% of respondents were aware that children who already had respiratory disorders such as asthma could be at serious risk for hMPV. However, just 20.2% of the participants were conscious of the potential risks associated with crowded surroundings and inadequate hygiene, while 79.8% were not.

The prevention practices used by parents varied significantly. Although 26.9% of parents were sure that their children avoided interacting with people who were sick, 24.4% didn't, and 48.6% said they just occasionally did. With only 13.3% of children using masks outside on a daily basis, 15.1% wearing them occasionally, and 71.6% not wearing them at all, mask-wearing was rare. Similarly, frequent handwashing was not a popular practice; 66.7% of parents did not exercise regular hand hygiene, while only 21.9% of parents reported washing their hands and their child's hands every 30 to 60 minutes. A significant percentage of parents (81.9%) used self-medication or home remedies prior to consulting a doctor, reflecting a possible delay in seeking professional medical care. It is encouraging to note that 70.1% of parents agreed that health education and awareness initiatives are essential in preventing hMPV infections, whereas 23.9% were unsure and 5.9% were skeptical that awareness campaigns were necessary.

A focused group discussion (FGD) was conducted with 40 diverse participants to explore the challenges of managing (hMPV) infections in children. The participants included 20 professionals comprising five medical doctors, five public health experts, five researchers, and five academicians as well as 20 parents, evenly divided between urban (Dhaka city) and rural areas. As shown in Table 5, across the majority of issues, there was a strong consensus among participants that the main obstacles to efficient hMPV management include low awareness, poor access to specialized healthcare, financial difficulties, overcrowded families, hospital traffic, and air pollution. However, there was still a mixed effect of cultural attitudes on treatment-seeking behavior, suggesting that some parents prioritize medical consultation while others continue to use traditional medicines. The following Table 5 is a summary of the expert opinions and parental experiences that were shared during the discussions.

Table1. Socio demographic information of the parents (n=405).

Categories		Count	Percentage (%)
Relationship with patient	Father	73	18.00
	Mother	311	76.80
	Others	21	5.20
Age range	Below 20 Years	31	7.70
	21-30 Years	219	54.10
	31-40 Years	131	32.30
	41-50 Years	18	4.40
	Over 50 Years	6	1.50
Occupation	Homemaker	197	48.60
	Job	110	27.20
	Business	66	16.30
	Students	32	7.90
Level of Education	No Formal Education	24	5.90
	Primary	102	25.20
	Secondary	176	43.50
	Graduate	103	25.40
Area of residence	Dhaka City	237	58.60
	Outside of Dhaka	168	41.40
Type of family	Nuclear (<4 members)	246	60.70
	Joint (>4 members)	159	39.30
Household income (in BDT)	<20k	20	4.90
	21-30k	62	15.30
	31-40k	80	19.80
	41-50k	114	28.10
	Over 50k	27	6.70
	No response	102	25.1
No. of children	1	170	41.90
	2	194	47.90
	3	41	10.20

Table 2. Basic and clinical characteristics of pediatric patients whose parents participated in the study.

Categories		**Count (n)**	**Percentage (%)**
Age of the Children/ Patient	0 to 4 Years	302	74.56
	4 to 8 Years	57	14.07
	8 to 12 Years	46	11.35
Gender	Male	197	48.64
	Female	208	51.35
Health problems (symptoms)	Cough	92	22.75
	Fever	49	12.09
	Runny/ Stuffy Nose	42	10.37
	Sore throat	35	8.6
	Shortness of Breath/Wheezing	51	12.59
	Skin Rash	29	7.16
	Multiple (Fever, Cough, Cold)	104	25.68
Lab tests for diagnosis	Chest X-ray	57	14.07
	Blood Test	67	16.54
	Urine/Stole Culture	40	9.87
	Both-Blood & Urine	192	47.40
	Multiple (X-ray, Blood, Urine)	49	12.09
Disease (diagnosis by doctor)	Common Cold	322	79.51
	Pneumonia	83	20.49
Admitted in hospital	Yes	105	25.92
	No	300	74.07
Time taken to cure	2-4 days	196	48.39
	4-7 days	137	33.82
	>7 days	72	17.77

Table-3. Correlation between age and clinical characteristics of diseases in affected children.

Category of patient		Patient age in Years			Sub-total	Total (n/%)	$\chi 2$ and p-value
		0 to 4 (n/%)	4 to 8 (n/%)	8 to 12 (n/%)			
Gender	Male	143 72.6%	30 15.2%	24 12.2%	197	405	1.670 (0.796)
	Female	159 76.4%	27 13.0%	22 10.6%	208		
Symptoms	Cough	53 57.6%	26 28.3%	13 14.1%	92	405	53.214 (0.000)
	Fever	32 65.3%	8 16.3%	9 18.4%	49		
	Runny/ Stuffy Nose	27 64.3%	8 19.0%	7 16.7%	42		
	Sore throat	20 57.2%	6 17.1%	9 25.7%	35		
	Shortness of Breath	34 66.7%	11 21.6%	6 11.8%	51		
	Skin Rash	16 55.2%	6 20.6%	7 24.2%	29		
	Multiple (Fever, Cough, Cold)	83 79.8%	13 12.5%	7 6.7%	104		
Diagnosis by	Chest X-ray	36 63.2%	13 22.8%	8 14.0%	57	405	6.891 (0.605)
	Blood test	46 68.7%	9 13.4%	12 17.9%	67		
	Urine/Stole culture	28 70.0%	5 12.5%	7 17.5%	40		
	Both-Blood & Urine test	133 69.3%	23 12.0%	36 18.8%	192		
	Multiple test (X-ray, blood, urine test)	29 59.2%	7 14.3%	13 26.5%	49		
Admitted in hospital	Yes	80 76.2%	15 14.3%	10 9.5%	105	405	9.177 (0.017)
	No	192 64.0%	42 14.0%	66 22.0%	300		
Disease diagnosis	Common Cold	225 69.8%	53 16.5%	44 13.7%	322	405	14.719 (0.000)
	Pneumonia	57 68.7%	18 21.7%	8 9.6%	83		
Duration of suffering	2-3 days	137 69.9%	27 13.8%	32 16.3%	196	405	10.913 (0.028)
	4- 7 days	82 59.9%	18 13.1%	37 27.0%	137		
	>7 days	53 73.6%	12 16.7%	7 9.7%	72		

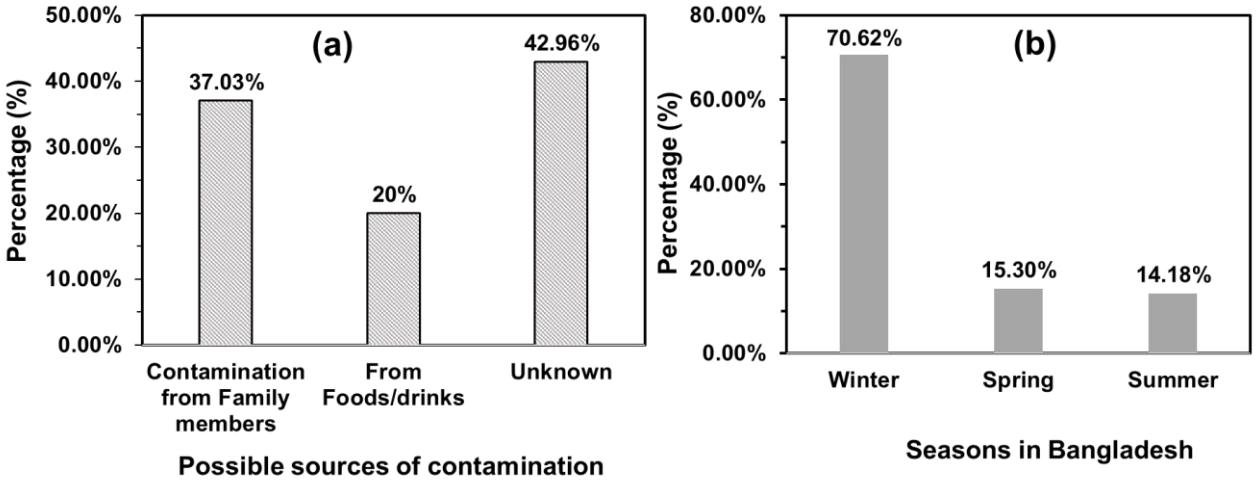
Table-4: Parental knowledge and practices related to the prevention of acute respiratory infections (ARIs), including hMPV.

Questions	**Response**	**Count**	**Percentage (%)**
Have you ever heard of ARI specifically hMPV?	Yes	184	45.40
	No	221	54.60
How did you know about hMPV? (where, n=184)	News	44	23.90
	Social media	108	58.70
	Friends and family	32	17.40
Do you know how hMPV spreads?	Yes	102	25.2
	No	303	74.8
Can you recognize hMPV symptoms in your child?	Yes	43	10.62
	No	296	73.1
	Not Sure	66	16.3
Do you know that hMPV can cause respiratory infections in children?	Yes	108	26.7
	No	297	73.3
Do you know hMPV can be severe for children with preexisting respiratory problem like asthma?	Yes	76	18.8
	No	329	81.20
Do you know poor hygiene and crowds raise hMPV risk?	Yes	82	20.20
	No	323	79.8
Do you ensure your child avoids contact with sick people of RTI?	Yes	109	26.90
	No	99	24.40
	Sometimes	197	48.60
Does your child wear a mask outside?	Yes	54	13.3
	Sometimes	61	15.1
	No	290	71.6
Do you and your child wash hands often, like every 30-60 mins?	Yes	89	21.90
	Sometimes	46	11.30
	No	270	66.70
Do you use home remedies or self-medication before consulting a doctor?	Yes	331	81.9
	No	74	18.1
Are health education and awareness necessary to preventing hMPV?	Yes	284	70.10
	No	24	5.90
	Not Sure	97	23.90

Table 5. Expert and parental perspectives on challenges in managing hMPV infections in children.

Possible Challenges	Expert Opinion	Parental Perspective	Consent
Does have limited awareness and knowledge on hMPV?	Lack of awareness about hMPV. So, awareness campaigns were suggested to improve knowledge of parents.	Parents were mostly unaware of hMPV and confused it with other respiratory illnesses.	Yes
Does have limited access to healthcare facilities?	Experts said only in rural areas have inadequate special care facilities.	People living in remote areas need to go for hospitals in urban area.	Yes
Does have a shortage of pediatric specialists?	Experts said rural areas have the shortage of pediatric pulmonologists. They advised training to general practitioners to handle pediatric respiratory cases.	Sometimes; parents were sent from one hospital to another because there weren't enough specialists.	Yes
Are financial constraints factors?	Some experts agree low-income households suffer by the high cost of healthcare, in private care compared to government facilities. Health insurance support is recommended.	Many parents said they were relying on local pharmacies since the expense of treatment was high for them.	Mixed (some said Yes, some not Sure)
Are overcrowded households and poor ventilation challenging factors?	Improved housing policies are advised by researchers to prevent spread of respiratory illnesses to children.	The congested living conditions in urban slums made it difficult for parents to prevent diseases.	Yes
Does overcrowding in hospitals increase the risk of co-infections?	Physicians emphasized the scarcity of ICU and hospital beds, particularly during periods of high respiratory disease.	In public hospitals, parents complained about lengthy wait times, overcrowding, and the risk of cross-infection.	Yes
Are air pollution and seasonal temperature changes risk factors for infection?	Experts have highlighted air pollution as a major contributing factor to the progression of respiratory diseases in urban areas.	Parents agree poor air quality and seasonal temperature changes can trigger ARI in their children.	Yes
Is cultural belief a challenge?	Public health experts noted that traditional beliefs and home remedies often delay proper treatment.	Some parents try herbal treatments or advice from elders before consulting a doctor.	Mixed (some said Yes, some not Sure)

Figure 1. (a) Parents' perceptions of the possible causes of respiratory tract infections; (b) Comparative rates of respiratory infections among children across different seasons in Bangladesh.



Discussion

Understanding the socio-demographic factors, including education levels of parents, financial ability, family structure, occupations, and so on, is essential for assessing parental knowledge, awareness, and practices regarding emerging hMPV infections of children. Similar to previous studies, results show that younger children (0–4 years) may be more susceptible to hMPV-associated respiratory infections since their immune systems are still developing and they are exposed more in public places like childcare centers, overcrowded hospitals, and infected family members [24, 25].

The presence of multiple symptoms in ARI-related diseases suggests a considerable disease burden. Because of the very high percentage of wheezing and shortness of breath (12.59%), there is a risk of severe respiratory distress [26]. The diagnostic trends show that blood and urine tests are preferred rather than RT-PCR-based diagnosis reports, which could cause uncertainty regarding pneumonia or any other ARI, such as hMPV. Although it is still essential in cases of pneumonia, the comparatively low use of chest X-rays (14.07%). In addition, 12.0% of multiple diagnostic tests indicate the complication of some situations. It is noteworthy that the common cold is more common than pneumonia, indicating that although hMPV causes respiratory morbidity, the majority of cases are mild and resolve on their own [27]. But around one-fourth of the percentage of children's hospitalization rate highlights how serious infections can be in some situations. In some cases, a longer duration of disease could be ascribed to host-specific immune responses, delayed medical treatment, or secondary bacterial infections [28, 29]. From a parental awareness perspective, the diverse recovery times and hospitalization rates indicate potential gaps in identifying severe symptoms and timely medical care [30].

In **Figure 1**, the high number of unknown sources of infection (about 43%) focuses on the necessity of parental education on symptom recognition and prevention to reduce hMPV-related complications in children [31]. Winter was considerably more common than both spring and summer in terms of seasonal variance of ARI-like pneumonia and hMPV [32]. This means that winter-time biological or environmental conditions can be more favorable for this kind of infection being studied [12, 33]. Environmental factors that are not as beneficial for the growth and spread of hMPV like viruses which may be the cause of the lower percentages of infections in the spring and summer compare to winter. These findings are consistent with earlier research showing seasonal interactions in a range of environmental and biological processes [34].

The findings in **Table 4** show a significant gap in parents' knowledge and practices related to hMPV, which may increase the disease burden among Bangladeshi children. The lack of timely and accurate information, along with reliance on unofficial sources such as social media, and the limited availability of accessible and reliable health education initiatives, are major factors contributing to insufficient knowledge of parents about hMPV-related ARIs in children in Bangladesh. The importance of specific efforts to encourage behavioral change is further proved by the low adherence to preventative measures like wearing mask and hand gloves, which means that the wider population is not well-informed about the health risk of hMPV and other respiratory viruses [35, 36]. The substantial prevalence of home cures and self-medication is also consistent with studies from other contexts, where cultural customs and restricted access to healthcare frequently encourage such behaviors [37].

The findings of the FGD obtained from experts regarding the limited resources, highlighting the necessity of family education, policy-level interventions, and upgrades to the healthcare system in controlling hMPV infections in Bangladeshi children. In rural areas, due to a lack of knowledge about disease symptoms and a limited number of specialized pediatric pulmonologists, it makes delays in diagnosis and treatment [38]. There is a need for awareness programs and training for general practitioners in rural areas for quick detection and starting treatment. Low-income people are usually trying home cures due to the high expense of healthcare in private sectors. Moreover, overcrowding in hospitals, air pollution, and poorly ventilated housing conditions are other risk factors. In addition, the use of traditional treatments sometimes delays proper medical treatment. Evidence-based healthcare can be promoted through community awareness campaigns, including healthcare improvements, health insurance support, public awareness, and environmental policies, which are crucial for effective prevention of AIR diseases like hMPV.

Overall, this study emphasizes a multi-dimensional approach is needed for improved parental awareness and behavioral interventions to mitigate the impact related to hMPV and other respiratory infections among children in Bangladesh. By addressing these gaps, public health initiatives can decrease the burden of hMPV and enhance overall child health outcomes. Future research should focus on early diagnosis, affordable treatment, and community engagement.

Conclusion

This study underscores critical gaps in parental awareness and healthcare practices regarding hMPV-associated acute respiratory infections (ARIs) among children in Bangladesh. Despite hMPV's significant burden, only 45.4% of parents were familiar with the virus, and misconceptions about its transmission and symptoms were common. The high reliance on self-medication (81.9%) and delays in seeking professional care further exacerbate disease severity, particularly during winter peaks when ARI incidence is highest. Structural barriers—including limited access to specialized pediatric care, overcrowded living environments, and inadequate public awareness-hinder effective management and prevention. To address these challenges, a multifaceted approach is essential: public health campaigns should promote targeted education to improve symptom recognition and preventive behaviors such as hand hygiene and mask use; healthcare systems must be strengthened by expanding affordable pediatric care, especially in rural areas, and by training general practitioners in early hMPV detection and response; and policy interventions are needed to reduce environmental risk factors like air pollution and overcrowding while providing financial support to low-income families for treatment costs. Additionally, future research should investigate the long-term health impacts of hMPV, explore potential vaccine development, and analyze socioeconomic barriers that limit access to timely and effective care. By integrating these strategies, Bangladesh can reduce the burden of hMPV and improve health outcomes for children suffering from ARIs. Collaborative efforts among policymakers, healthcare providers, researchers, and communities are pivotal to realizing these objectives and ensuring sustainable public health progress.

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Conflict of interest

The authors declare no conflict of interest. All aspects of this research were conducted impartially and independently. No financial or personal relationships with other people or organizations have influenced this work.

Authors' Contribution

Dr. Mahfuza Mubarak, principal investor, conceptualized and designed the study and reviewed the manuscript; Dr. Md. Shahinul Islam designed the research, prepared the draft of the manuscript, and reviewed the manuscript; Al Naheyan Arbin, Tanjila Akter, Rifat Zahan Orin Sumaiya, Nishat Tabassum Othai, and Abdullah Jaman led the questionnaire preparation and data collection; and Mohammad Shahinur Karim and Md. Mejbah Uddin Mithu led the analysis of data and interpretation of results.

Ethical Statement

This study did not involve human participants or animal subjects, and therefore, informed consent was not required. Beyond this, prior to data collection for this study, oral consent was taken from every participant. Moreover, this study was approved by the Institutional Review Board of Daffodil International University (DIU), Faculty of Health and Life Sciences (FHLS) (Ref: FHLS-REC/DIU/2025/0017).

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