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Original Article

Turkish pediatricians' knowledge, attitudes, and awareness of respiratory syncytial virus (RSV) infection and immunization strategies: a cross-sectional study

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ABSTRACT

Background. This study aims to assess Turkish pediatricians' knowledge and attitudes regarding respiratory syncytial virus (RSV) infection and its current immunization strategies.

Methods. From May 10 to June 4, 2024, we invited 1603 pediatricians who subscribed to the website of The Turkish Pediatrics Atelier via e-mail to respond to an online questionnaire. A total of 401 pediatricians responded.

Results. Of pediatricians, 11% stated that they routinely use chest X-ray (CXR) for diagnosing RSV illness. When managing RSV-positive patients, while 44.4% of pediatricians indicated that they need a CXR if there are lung auscultation findings, the rate of routine CXR usage was 22.7%. While most pediatricians (74.8%) stated that they prefer nebulized salbutamol and/or corticosteroid; 43.4% used hypertonic saline; and 22.7% used nebulized epinephrine as a treatment option. While 60.3% of pediatricians had no information about the maternal RSV vaccine; 58.1% stated that they would recommend it to only willing women; 16% stated that they would not recommend it; and 25.9% indicated that they would recommend it to every pregnant individual. While most pediatricians (79.8%) had knowledge about nirsevimab; 14% indicated that it was not approved in children worldwide; 49.1% stated that it is more effective than palivizumab; and 37.9% indicated that they would start administrating it immediately after its approval and availability in Türkiye.

Conclusions. The use of CXR and administration of non-evidence-based therapies in diagnosing and managing RSV illness were relatively high. Additionally, there is a notable gap in knowledge and awareness regarding the maternal RSV vaccine and nirsevimab.

Key words: respiratory syncytial virus, immunization, nirsevimab, pediatrician.

Respiratory syncytial virus (RSV) is a predominant cause of acute lower respiratory tract infection (ALRTI), hospital admissions, and hospitalization in children under two years of age throughout the world regardless of income status, resulting in a considerable global burden on healthcare systems.[1] While healthy infants born at term are mostly hospitalized due to RSV, premature infants and those with underlying heart and lung disease are at the highest risk for serious illness.[2-4] It was estimated that globally in 2019, there were 33

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million RSV-associated ALRTI incidents, 3.6 million RSV-associated ALRTI hospitalizations, and over 100,000 deaths in children aged under 60 months.[5]

Many patients continue to be treated with non-evidence based therapies, although the mainstay of therapy for RSV infection remains supportive care, which includes respiratory support and maintaining hydration and nutrition status.[6] Prevention of RSV infection approaches include preventive measures to avoid RSV exposure and immunization.[7] Palivizumab, which was first recommended in 1998, is the first humanized monoclonal antibody used for immunoprophylaxis during the bronchiolitis season in infants at risk of severe ALRTI.[8,9] With the approval of the first bivalent RSV prefusion F protein–based vaccine in pregnancy to prevent RSV illness during the infancy period and a new RSV-neutralizing antibody (nirsevimab), 2023 has been considered a game-changing year in preventing morbidity and mortality of RSV infections in infants.[10,11]

This study aimed to evaluate the knowledge, attitudes, and practices of Turkish pediatricians regarding RSV infection and current immunization strategies

Materials and Methods

Study design

We performed a cross-sectional study using an online questionnaire form and distributed it to pediatricians through the involvement of the Turkish Pediatrics Atelier. The Turkish Pediatrics Atelier group was first established on the Telegram application on October 31, 2018. It has also had a website since 2023 (https://www.pediatriatolyesi.com). The group consists mainly of pediatricians, pediatric sub-specialists, pediatric surgeons, child psychiatry specialists, and physicians serving the pediatric population including pediatric dermatologists, pediatric ear, nose, and throat (ENT) specialists, pediatric radiologists, and pediatric urologists. Group members were included by invitation and memberships were confirmed by the Telegram group directors. The group functions as a professional forum where members can seek expert opinions on various pediatric topics, including radiological images, dermatological conditions, laboratory results, and drug dosages.[12] Its Telegram channel and website have approximately 2600 and 1600 registered members, respectively.

An online questionnaire, prepared using Google Forms, was sent via email to 1,603 members of the Turkish Pediatrics Atelier's website between May 10 and June 4, 2024. The questionnaire consisted of questions regarding the pediatricians' basic demographic features, knowledge, attitudes and behaviors toward RSV illness and its current immunization strategies. The pediatricians provided consent for participation in the online survey. This study was approved by the Ataşehir Memorial Hospital Ethics Committee.

Data analysis

Data were presented as mean ± standard deviation or median (25th-75th percentile) according to their distribution characteristics. Chi-square or Fisher's exact tests were used to compare categorical variables. Significance was set at $p < 0.05$. All these analyses were carried out using Jamovi 1.6 software.

Results

A total number of 401 (25%) pediatricians from 60 cities of Türkiye participated in this study. The median age of the pediatricians was 42 years (35-50), with 53.6% were female. The demographic features of the pediatricians are presented in Table I.

RSV general knowledge

Overall, 85.5% of pediatricians had managed at least one RSV case in their practice, while 81.5% had diagnosed at least one RSV case in the last year. Rapid antigen test and polymerase chain reaction (PCR) from nasopharynx swab

Table I. The demographic characteristics of the pediatricians.

Variables		n	%
Gender	Male	186	46.4%
	Female	215	53.6%
Specialty	Pediatrician	349	87%
	Pediatric subspecialist	52	13%
Professional experience in pediatrics	<5 years	46	11.5%
	5-10 years	92	22.9%
	10-20 years	122	30.4%
	>20 years	141	35.2%
Working setting	Private hospitals	137	34.2%
	Training and research / university hospitals	127	31.7%
	State hospitals	88	21.9%
	Private practice	43	10.7%
	Outpatient clinics	6	1.5%

preference among the pediatricians were 55.6% and 33.4%, respectively. Of the pediatricians 11% stated that they routinely use chest X-ray (CXR) for diagnosing RSV illness.

According to the pediatricians in this study, indications of ordering a CXR for children diagnosed with RSV illness were as follows; lung auscultation findings (44.4%), respiratory distress (26.2%), and high fever (1.5%). Among the pediatricians, 22.7% reported routinely ordering a chest X-ray (CXR) after diagnosing RSV illness. It was observed that pediatricians working in private practice had lower rates of ordering CXR compared with pediatricians working in hospitals ($p < 0.01$). Additionally, there was a statistically significant difference ($p = 0.015$), with pediatrician having >10 years of experience indicating lower CXR necessity (19% vs 29.7%).

While most pediatricians (75.8%) stated that they hospitalized at least one patient with RSV infection in the last year, 6.2% of pediatricians reported that they had hospitalized every RSV-positive patient. In the past year, at least one patient of 171 pediatricians (42.6%) required admission to the pediatric intensive care unit (PICU), while at least one patient of 219 pediatricians (54.6%) required high-flow nasal cannula (HFNC) oxygen therapy after being diagnosed with RSV illness. There were 13 (3.2%) pediatricians who stated that they lost at least one patient secondary to RSV infection.

91.3% of pediatricians reported that RSV is a seasonal virus that causes epidemics between November and March. The majority of pediatricians (84.4%) stated that RSV is the most common cause of LRTI in children under 2 years of age. The thoughts of the pediatricians regarding the hospitalization requirement and mortality of RSV, influenza, and SARS-CoV-2 infection in children are shown in the Table II.

99.8% of pediatricians considered congenital heart disease as a risk factor for RSV infection, followed by prematurity (99.5%), neuromuscular diseases (97.8%), HIV infection (94.5%), trisomy 21 (81.8%), and frequent infections (26.7%).

According to the survey, the most common indication for hospitalization due to RSV illness was severe respiratory distress (99%) and it was followed by decreased food or fluid intake (98.2%), toxic appearance or lethargy (97.7%), low (<92%) peripheral oxygen saturation (96.7%), apnea (93.7%), being younger than 3 months of age (88.2%), infiltration on the CXR imaging (46.6%), auscultation findings (28.6%), high fever (10.2%), and coughing (2.7%). The treatment preferences for RSV illness are presented in the Table III.

Table II. The thoughts of the pediatricians regarding the hospitalization requirement and mortality of RSV, influenza, and SARS-CoV-2 infection in childhood.

Statement	True		False	
	n	%	n	%
The hospitalization requirement of RSV illness is lower than SARS-CoV-2 infection	144	36.7	248	63.3
The mortality rate of RSV illness is higher than SARS-CoV-2 infection	338	86.2	54	13.8
The mortality rate of RSV illness is higher than influenza infection	354	90.3	38	9.7
The hospitalization requirement of RSV illness is higher than influenza infection	340	86.7	52	13.3

RSV, respiratory syncytial virus; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Table III. The treatment preferences of the pediatricians and pediatric sub-specialists for RSV illness.

Treatment Option	n	%
Nebulized salbutamol and/or corticosteroids	300	74.8
Nasal oxygen support	255	63.6
Hydration and oxygen	189	47.1
Nebulized 3% hypertonic saline	174	43.4
Cool mist	109	27.2
Nebulized epinephrine	91	22.7
Antibiotics	46	11.5
Cough syrups	4	1

Knowledge and attitudes towards immunization strategies

Among the pediatricians, 26.4%, 14.5%, and 6.7% believed that the administration of a single dose nirsevimab in the first RSV season in healthy infants under 8 months of age, the RSV vaccine for pregnant individuals, and immunoprophylaxis with palivizumab during the RSV season in infants born at ≤ 32 weeks of gestational age are not a prevention method for RSV illness, respectively. According to the responses of pediatricians, the most effective immunization strategies for preventing complications of RSV infection were; maternal RSV vaccination as an active immunization, passive immunization with monoclonal antibodies, and being naturally infected with RSV with a rate of 59.4%, 33.4%, and 7.2%, respectively.

39.7% of pediatricians who participated in the survey had information regarding the bivalent RSV vaccine during pregnancy to prevent RSV illness in the infancy period. There was no statistically significant relationship between the knowledge of this vaccine and professional experience of the pediatricians (>10 years vs <10 years, p = 0.061). It was seen that the pediatricians working in the private sector were more knowledgeable about maternal vaccination against RSV during pregnancy than the pediatricians working in the public sector (p = 0.007). Only 20.9% of pediatricians stated that they were aware of the maternal vaccination schedule.

58.1% of the pediatricians stated that they would recommend the maternal RSV vaccination to pregnant women who have willingness to be vaccinated, 25.9% stated that they would recommend the vaccine to every pregnant individual, and 16% stated that they would not recommend the vaccine during the pregnancy period. There was no statistically significant relationship between the recommendation of the maternal vaccination and the professional experience of the pediatricians (>10 years vs <10 years, p = 0.084) or the type of affiliated

institutions of the pediatricians (private or public, p = 0.719).

Most of the pediatricians (61.8%) who participated the study stated that they have administrated palivizumab to at least one child in their practice. While 79.8% of pediatricians have knowledge about nirsevimab as a monoclonal antibody recently approved against RSV, 14% stated that it was not approved in children worldwide. A significant proportion of pediatricians (49.1%) thought that it is more effective than palivizumab as passive immunization. While the rate of the correct answers about the recommended nirsevimab administration timing (younger than 8 months of age who were born during or are entering their first RSV season) and route (intramuscularly as a single dose regardless of infants' age) was 61%, the rate of the correct answers about the recommended dosage of nirsevimab was 30.7%.

The most important determinants for the pediatricians who participated in the survey for recommending nirsevimab were as follows: the studies and literature data (51.6%), the recommendations of experts and trustworthy organizations (41.6%), the product's cost (4%), families' requests (2.2%), and their physician colleagues (0.5%). While a significant proportion of pediatricians (37.9%) stated that they would immediately start administrating nirsevimab after its approval by the Ministry of Health and availability in the market in their country, 30.2% indicated that they would wait for the literature on local experiences before adopting its use.

Discussion

According to our study, it was observed that most pediatricians lacked sufficient knowledge of the RSV vaccine and its vaccination schedule. In addition, while the majority of pediatricians were aware of nirsevimab, a monoclonal antibody against RSV, their knowledge of the correct dosing regimen was insufficient.

In our study, intriguingly, 11% of physicians routinely ordered CXR's to diagnose RSV infection. While 44.4% of pediatricians stated that they ordered a CXR if there were lung auscultation findings, the use of routine CXR rate was 22.7% in RSV-positive patients. It was observed that physicians working in private practice and with more professional experience had statistically significant lower rates of CXR requirement ($p < 0.01$ and $p = 0.015$, respectively). According to the guidelines, CXR should be performed only in patients with severe bronchiolitis with signs of pulmonary complications (i.e., pneumothorax) and leading to PICU admission.[13,14] It is important to consider that CXR in children with RSV illness may be completely normal or have non-specific findings such as perihilar opacities, atelectasis, hyperinflation, and rarely consolidation or air-leak which are also encountered in other viral infections.[15] Instead of routine CXR in cases of RSV bronchiolitis, it is more appropriate to perform CXR in children with respiratory distress or suspected pulmonary complications.

Our findings indicate that 81.5% of pediatricians diagnosed at least one case of RSV illness, and 75.8% reported hospitalizing at least one patient with RSV. Additionally, 42.6% of physicians had at least one RSV-positive patient requiring PICU admission, while 54.6% had at least one patient requiring HFNC oxygen therapy in the past year. Of pediatricians, 3.2% stated that they had lost at least one patient secondary to RSV illness during their whole career. In a survey from Italy applied to pediatricians from February to May 2023[16], nearly 97.5% of pediatricians stated that they had managed RSV-positive bronchiolitis cases. Of these, 53.1% managed more than 10 patients in the past season. In that study, 93.8% of family pediatric practitioners had hospitalized patients secondary to RSV bronchiolitis. The pediatricians in that study mentioned RSV as the leading cause of hospitalization for respiratory infections between November and March in infants <1 year old in 90% of cases.[16]

According to a recent cohort study of 7998 hospitalized adults before the RSV vaccine was introduced in the United States, it was concluded that RSV illness was at least as severe

as influenza or COVID-19 among unvaccinated patients and considerably more severe than influenza or COVID-19 among vaccinated patients hospitalized with those diseases.[17] Among 847 hospitalized pediatric patients, it was revealed that RSV illness was the leading cause and required higher oxygen support and non-invasive ventilation compared with children with COVID-19 and influenza in a season with respiratory pathogen co-circulation between October 1, 2021, and April 30, 2022.[18] Our results were compatible with these recent studies as the most of pediatricians stated that the hospitalization requirement and mortality of RSV was substantially higher than influenza or COVID-19 (Table II).

According to the current evidence-based guidelines[13,19], there is high-level evidence indicating no benefit of nebulized beta-2 agonists, epinephrine, and corticosteroids in infants with bronchiolitis for the outcomes of admission to hospital, oxygenation, hospitalization, or length of stay. When we compare our results with these up-to-date guidelines[13,19], we found excessive use of nebulized salbutamol and/or corticosteroid (74.8%) and also relatively overuse of nebulized epinephrine (22.7%) and antibiotics (11.5%) in our study. Although the recommendations in the bronchiolitis guidelines do not recommend routine use of nebulized hypertonic saline[13,19], it was revealed that 43.4% of physicians in our study preferred it as a treatment option. Intriguingly, 27.2% of pediatricians stated that they use cool mist for the treatment of RSV illness in spite of the fact that it is not advised in the recent bronchiolitis guidelines.[13,19]

Another key objective of our study was to assess the knowledge and attitudes of pediatricians in our country regarding the recently approved maternal RSV vaccine and the monoclonal antibody nirsevimab. Our results showed that there is a gap in knowledge concerning the bivalent RSV vaccine in pregnancy. A majority of pediatricians (60.3%) had no information about this vaccine with no statistically significant relationship between the knowledge and professional experience of the pediatricians. It was also found that awareness of the vaccine among pediatricians working in the private sector was statistically higher than among those working in the public sector ($p = 0.007$). According to recent literature[20-22], the maternal RSV vaccine has the potential to reduce both all-cause LRTIs and RSV-related illnesses, while also having long-term benefits for lung health. Although the approval of the maternal RSV vaccine is groundbreaking, considerable additional effort to guide decision-making and implementation is paramount.[20] Healthcare professionals are the most trusted consultants and influencers in vaccination decisions according to the current literature.[23,24] The majority of pediatricians (58.1%) in the present study stated that they would recommend the maternal RSV vaccine to only willing women, while 16% stated that they would not recommend this vaccine to pregnant individuals. Only about one-quarter of pediatricians (25.9%) indicated that they would recommend the vaccine to every pregnant individual. In a survey study[16]from Italy in which pediatricians participated, 25% of pediatricians thought that, at the time, the RSV vaccine was available for active immunization; 69.6% thought that the vaccine was not yet available and 5.5% had no opinion. Nevertheless, this study was conducted between February and May 2023, before the approval of the vaccine by the Food and Drug Administration (FDA).[16] The lack of knowledge regarding RSV vaccination restricts its widespread use, resulting in infants losing the protective benefits against RSV infection. Furthermore, when infants contract RSV, they face an increased risk of morbidity and potentially mortality.

While a substantial majority of pediatricians (79.8%) had knowledge about nirsevimab, 14% indicated that it was not approved in children worldwide. Nearly one-half of pediatricians (49.1%) stated that it is more effective than palivizumab as a passive immunization. Of pediatricians, 61% correctly answered the recommended timing and route of

administration of nirsevimab. A considerable majority of pediatricians (69.3%) did not know the recommended dosage of nirsevimab. Only 37.9% of pediatricians indicated that they would start using nirsevimab immediately after its approval and availability in Türkiye. In the study mentioned above[16], while 69.6% of physicians stated that nirsevimab is designed to prevent RSV infection in all infants and children in their first season, 25.5% had no thought. While 76.2% of pediatricians indicated that nirsevimab has demonstrated significant efficacy in reducing hospitalizations and outpatient healthcare visits for RSV illness, 22.3% remained neutral in the same study.[16]As mentioned above, the study was conducted between February and May 2023, before the approval of nirsevimab by the FDA.[16] To the best of our knowledge, there is no published English study, conducted after the approval of maternal RSV vaccine and nirsevimab, regarding the knowledge and awareness towards this vaccine and nirsevimab among pediatricians, obstetricians, or gynecologists who have a crucial impact on parents and pregnant individuals' decision-making. It is essential to enhance the level of knowledge regarding the vaccine and monoclonal antibody, which are effective in protecting against RSV, as well as to ensure their accessibility. Therefore, organizing training programs for healthcare professionals working with infants will be of paramount importance.

Although the present study provides information regarding the knowledge and attitudes towards RSV infection and awareness of its current immunization strategies among Turkish pediatricians, it does not include all pediatricians in our country and the demographic data could not be completely homogenized as the major limitation of our study.

In conclusion, this study revealed that pediatricians lack sufficient knowledge and awareness about the RSV vaccine and nirsevimab. Furthermore, CXR usage and administration of non-evidence-based therapies in the diagnosis and management of RSV illness were at a relatively high rate among the pediatricians who participated in the present study. There is a gap in knowledge and awareness regarding the maternal RSV vaccine and nirsevimab, which may pose a significant obstacle to reducing RSV-related hospitalizations and outpatient healthcare utilization. Improving the knowledge towards RSV infection and the awareness of its current immunization strategies among parents, family practitioners, pediatricians, and obstetricians are suggested to reduce RSV morbidity and mortality in children especially under 2 years of age in Türkiye and throughout the world. To address the existing knowledge gaps regarding RSV immunization, it is essential to design and implement targeted educational programs for pediatricians and healthcare professionals. These programs should focus on the latest scientific evidence, provide detailed information on vaccination, and cover the correct timing, administration route, and dosing regimen for nirsevimab.

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Ethical approval

This study was approved by Ataşehir Memorial Hospital Ethics Committee (date: 15.02.2024, number: 2024/8).

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: AS, İY, EG; data collection: AS, İY, EG, EZ, SY, OY; analysis and interpretation of the results: AS, EG, İY, EZ, SY; draft manuscript preparation: İY, OY, EG, AS All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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