



# Knowledge and Awareness of Pediatricians About Rotavirus Infection and Vaccine

Pediyatristlerin Rotavirüs Enfeksiyonu ve Aşısı Hakkında Bilgi ve Farkındalıkları

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**Cite this article as:** Dilen MF, Sucu A, Tolunay O, Celiloğlu C, Uzgelir S, Özdemir U, et al. Knowledge and awareness of pediatricians about rotavirus infection and vaccine. J Pediatr Inf 2022;16(1):e6-e12.

## Abstract

**Objective:** Rotavirus is the leading cause of diarrhea and, in particular, severe gastroenteritis in infants and young children, resulting in hospitalizations and infant deaths around the world. Rotavirus vaccine is the most effective way to prevent rotavirus diarrhea. This study aims to assess the knowledge of pediatricians and pediatric residents about rotavirus infection and vaccine and their approach to the rotavirus vaccine.

**Material and Methods:** The researchers provided a 39-item questionnaire to the participants. The questionnaire included questions about the demographic characteristics of the participants (n= 13), rotavirus infection (n= 7), rotavirus vaccine (n= 10), and the participants' approach to the vaccine (n= 9). In addition to true-false and yes-no questions, there were also multiple-choice questions allowing participants to choose more than one option.

**Results:** One hundred twelve physicians agreed to fill out the questionnaire and participate in the study. Forty (35.7%) participants were specialists and 72 (64.3%) were residents. The mean age of the participants was 31.83 ± 6.82 years. Thirty-five (31.3%) participants were working in a university hospital and 77 (68.8%) were working in a training and research hospital. 94.6% of the participants were aware that there are two different types of rotavirus vaccines in our country. When the participants were asked whether they recommend the rotavirus vaccine to their patients, 88.4% said they would recommend the vaccine, while this rate increased to 89.3% when asked whether they would immunize their children against rotavirus. When the participants were asked why they did not recommend the rotavirus vaccine to their patients or immunize their children, the responses were: 13.4-6.3% cost, 4.5-3.6% side effects, and 5.4-4.5% considered the vaccine ineffective. 86.6% of the partici-

## Öz

**Giriş:** Rotavirüs, tüm dünyada bebek ve küçük çocuklarda görülen ishal-lerin, özellikle hastane yatışlarına ve bebek ölümlerine neden olan ağır gastroenteritin en önde gelen nedenidir. Rotavirüs ishalinin önlenmesinde en etkili yöntem rotavirüs aşılmasıdır. Bu çalışmada pediatri uzmanları ve pediatri asistanlarının rotavirüs enfeksiyonu ve aşısı hakkındaki bilgi düzeyi ile rotavirüs aşısına yaklaşımlarını ölçmek amaçlanmıştır.

**Gereç ve Yöntemler:** Katılımcılara araştırmacılar tarafından hazırlanmış 39 soruluk bir anket uygulandı. Ankette katılımcıların demografik özellikleri ile ilgili sorular (n= 13), rotavirüs enfeksiyonu ile ilgili sorular (n= 7), rotavirüs aşısı ile ilgili sorular (n= 10) ve katılımcıların aşıya yaklaşımı ile ilgili sorular (n= 9) bulunmaktaydı. Ankette doğru-yanlış, evet-hayır cevabı istenen sorular yanında katılımcıların birden çok seçenek işaretleyebilecekleri çok seçenekli sorularda bulunmaktaydı.

**Bulgular:** Anket formunu doldurup çalışmaya katılmayı 112 hekim kabul etti. Katılımcıların 40 (%35.7)'i uzman, 72 (%64.3)'si uzmanlık öğrencisi hekimdi. Katılımcıların yaş ortalaması 31.83 ± 6.82 yıldır. Katılımcıların 35 (%31.3)'i üniversite hastanesi, 77 (%68.8)'si eğitim araştırma hastanesinde çalışmaktaydı. Katılımcıların %94.6'si ülkemizde iki farklı tipte rotavirüs aşısı olduğunu bilmekteydi. Katılımcılara rotavirüs aşısını hastalarına önerip önermedikleri sorulduğunda %88.4'ü aşıyı önerdiklerini söylemekteyken, çocuklarına yaptırıp yaptırmayacakları sorulduğunda bu oran %89.3'e çıkmaktaydı. Katılımcılara rotavirüs aşısını hastalarına ya da çocuklarına neden önermedikleri sorulduğunda sırasıyla; %13.4-6.3 maliyet, %4.5-3.6 yan etki, %5.4-4.5 aşının etkin olmadığı düşünülmesi cevabı alınmıştı. Katılımcılara "Rotavirüs aşısı ulusal aşı şemasına girmeli mi?" diye sorulduğunda %86.6'sı girmesi gerektiği yönünde görüş bildirmişti. Katılımcılardan rotavirüs aşısının ulusal aşı şemasına girmesi-

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Received: 23.12.2019

Accepted: 23.04.2021

Available Online Date: 09.06.2022

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Available online at www.cocukenfeksiyon.org

pants responded “yes” to the question asking whether the rotavirus vaccine should be included in the national vaccination schedule. When the participants were asked why they did not want the rotavirus vaccine to be included in the national vaccination schedule, the responses were: 15.2% cost, 4.5% side effects, and 4.5% considered the vaccine ineffective. 97.3% of participants believed that lowering the cost of the rotavirus vaccine will boost immunization rates.

**Conclusion:** Regardless of a physician’s level of knowledge, preconceptions about high cost, vaccination ineffectiveness, and side effects seem to contribute to a negative attitude towards the rotavirus vaccine. Better informing physicians about newly introduced vaccines, as well as boosting the level of knowledge and awareness of pediatricians working at the forefront of rotavirus infections and immunization, will have a positive impact on vaccination practices.

**Keywords:** Awareness, rotavirus vaccine, pediatrician

## Introduction

Rotavirus is the most common cause of severe gastroenteritis in infants and young children worldwide (1,2). It is estimated that 138 million rotavirus-related diarrhea cases and 215.000 deaths occur in the world every year (3,4). Rotavirus was found to be the causative agent in 40% of all children hospitalized for acute gastroenteritis worldwide. A multicenter study conducted in Turkey between 2005 and 2006 found rotavirus to be the causative agent in 32.4-67.4 percent of children aged five and younger, who were hospitalized for gastroenteritis (5).

Only group A, B, and C rotavirus infections are seen in humans. Among the human group A rotavirus strains, there are at least 10 G genotypes (G1-G6, G8-G10, G12) and 9 P genotypes (P[3], P[4], and P[8]) (6-9). In studies conducted in different regions of our country, G1P(8) and G9P(8) were found to be the most common genotype combinations (7-9). Rotavirus is transmitted by the fecal-oral route, and even a very small amount of virus can cause an infection (10).

Previous rotavirus infections protect from subsequent rotavirus gastroenteritis. The frequent occurrence of rotavirus infections and the fact that successive infections have a milder course and protect the person from severe infections have prompted the start of immunization efforts in early childhood (11). Rotavirus infection occurs at a similar rate in developed and developing countries, regardless of sanitary circumstances (12). The fact that rotavirus infection rates are similar across societies demonstrates that enhancing personal and social hygiene and sanitation practices is insufficient to prevent rotavirus infection. Therefore, the main method of protection against rotavirus infection is vaccination (13).

The monovalent attenuated human rotavirus vaccine (RV1, HRV, Rotarix®), produced via serial passage in the cell culture from the most common human serotype combination (GP [8]), and the pentavalent human-bovine reassortant rotavirus vaccine (RV5, PRV, RotaTaq®) which combines a sin-

ni istemeyenlere neden istemedikleri sorulduğunda; %15.2 maliyet, %4.5 yan etki, %4.5 aşının etkin olmadığı düşünülmesi cevabı alınmıştır. Katılımcıların %97.3’ü rotavirüs aşısının maliyetinin düşürülmesinin aşılamaya oranlarını arttıracacağını düşünmekteydi.

**Sonuç:** Hekimlerin bilgi düzeylerinden bağımsız olarak yüksek maliyet, aşının etkin olmadığı ve yan etki gibi önyargıların da rotavirüs aşısına karşı olmakta etkili olduğu görülmüştür. Hekimlerin yeni uygulamaya girmiş aşılar ile ilgili daha iyi bilgilendirilmeleri, özellikle rotavirüs enfeksiyonları ve aşılamasında ön saflarda çalışan pediyatristlerin rotavirüs aşısı konusunda bilgi düzeylerinin ve farkındalıklarının artmasıyla aşı uygulamaları olumlu yönde etkilenecektir.

**Anahtar Kelimeler:** Farkındalık, rotavirüs aşısı, pediyatrist

gle gene encoding an outer capsid protein (VP7 or VP4) from the most common human serotypes (G1, G2, G3, G4 and P [8]) with a bovine strain (WC3), have been approved for use in many countries including ours (Figure 1) (17, XX). There are also monovalent and pentavalent vaccines such as Rotavac®, Rotasiil®, and POLYVAC, which are not available in our country but are used in other parts of the world (4).

This study aims to assess the knowledge of pediyatristicians and pediyatristic residents about rotavirus infection and vaccine and their approach to the rotavirus vaccine.

## Materials and Methods

The researchers provided a 39-item questionnaire to the participants. The questionnaire included questions about the demographic characteristics of the participants (n= 13), rotavirus infection (n= 7), rotavirus vaccine (n= 10), and the participants’ approach to the vaccine (n= 9). The questionnaire was prepared by the researchers, by taking into consideration similar studies in the literature and the factors that may prevent the broader use of the rotavirus vaccine. Participants were informed that the questionnaire was for a scientific study and that no information that could reveal their identity would be collected. The researchers and volunteers distributed the questionnaires to the participants, and they were gathered without intervention. In addition to true-false and yes-no questions, there were also multiple-choice questions allowing participants to choose more than one option.

The study was approved by the “Adana Numune Training and Research Hospital Non-Interventional Clinical Research Ethics Committee” (Date: 02/10/2015, Decision No: 195).

## Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences’ version 20 (IBM Corp., Armonk, NY, USA) software. Descriptive statistics (number, percentage, mean and standard deviation) of the variables in the study group were calculated. The significance threshold was set to  $p < 0.05$ .

## Results

### Participant Demographics

112 physicians agreed to fill out the questionnaire and participate in the study. Forty (35.7%) participants were specialists and 72 (64.3%) were residents. Sixty-nine (61.6%) were female, 43 (38.4%) were male. The mean age of the participants was  $31.83 \pm 6.82$  years. Sixty-eight (61.6%) were married and 44 (38.4%) were single. 53 (47.3%) participants had children, 59 (52.7%) had no children. Thirty-five (31.3%) participants were working in a university hospital and 77 (68.8%) were working in a training and research hospital (Table 1). When the specialists were divided into groups based on their professional experience, 30% (12) had worked as a specialist for 0-5 years, 45% (18) for 6-10 years, and 25% (10) for more than 10 years. When the residents were divided into groups based on years of education, 72% (47) had 0-2 years and 28% (18) 3-4 years.

### Participants' level of knowledge about rotavirus infection

The statement "Rotavirus diarrhea is most common in winter and under the age of two" was marked as correct by 57 (50.9%) participants (specialists 60%, residents 45.8%,  $p=0.107$ ).

When asked which factors increased the risk of rotavirus transmission (oral-fecal, close contact, crowded living conditions, contaminated water, food and droplets); 90.2% of the participants responded with oral-fecal, 68% with close contact, 62.5% with crowded living conditions, 67.9% with contaminated water and 26% with droplets (specialists 95%, % 67.5%, 72.5%, 70%, 40%, residents 87.5%, 56.9%, 57%, 66.7%, 13.9%,  $p=0.173, 0.316, 0.153, 0.834, 0.002$ ).

20.5% of the participants believed that rotavirus infection resulted in lifelong permanent immunity (17.5% specialists, 22.2% residents,  $p=0.631$ ).

When asked which strains most frequently cause rotavirus infections; 56.3% said G1, 31.3% G2, 32.1% G3, 21.4% G4 and 21.4% P1 (specialists 72.5%, 45%, 42.5%, 30%, 32.5%, residents 47.2%, 23.6%, 26.4%, 16.7%, 15.3%,  $p=0.011, 0.032, 0.094, 0.148, 0.053$ ).

When asked whether the rotavirus vaccine could be administered with other vaccines, 86.6% of the participants said: "yes" (95% specialist, 88.9% residents,  $p=0.08$ ).

When the participants were asked which methods (breast milk, hand washing, vaccine, droplet isolation, contact isolation and post-exposure prophylaxis) are effective in preventing rotavirus infections, the answers were: 69.6% breast milk, 90.2% hand washing, 80.4% vaccine, 25.9% droplet isolation, 63.4% contact isolation and 8.9% post-exposure prophylaxis (specialists 87.5%, 95%, 90%, 45%, 70%, 15%, residents 59.7%, 87.5%, 75%, 15.3%, 59.7%, 5.6%,  $p=0.002, 0.322, 0.081, 0.001, 0.312, 0.163$ ). When the residents were compared based on years of education, handwashing response was significantly higher in the group with 0-2 years of education compared to the other group (93.6%/72.2%) ( $p=0.032$ ).

When specialists were compared based on their professional experience, no difference was found in terms of the level of knowledge about rotavirus infection.

### Participants' level of knowledge about rotavirus vaccine

38.4% of the participants stated that the rotavirus vaccine should be re-administered if vomited or spit out (specialists 52.5%, residents 30.6%,  $p=0.027$ ).

When asked about the type of rotavirus vaccine (live, non-live or inactivated), 83.9% of the participants stated that it was a live vaccine, 15.2% a non-live vaccine and 0.9% an inactivated vaccine (specialists 87.5%, 15%, 0%, residents 88.9%, 15.3%, 1.4%,  $p=0.593, 1, 1$ ).

**Table 1.** Participant demographics

	Overall	Specialist	Resident
Age mean $\pm$ standard deviation	31.83 $\pm$ 6.82	38.77 $\pm$ 4.86	27.97 $\pm$ 4.2
Gender	n (%)	n (%)	n (%)
*Female	69 (61.6%)	21 (52.5%)	48 (66.7%)
*Male	43 (38.4%)	19 (47.5%)	24 (33.3%)
Institution	n (%)	n (%)	n (%)
*University Hospital	35 (31.2%)	2 (5%)	33 (45.8%)
*Training and Research Hospital	77 (68.8%)	38 (95%)	39 (54.2%)
Marital Status	n (%)	n (%)	n (%)
*Married	68 (60.7%)	38 (95%)	30 (41.7%)
*Single	44 (39.3%)	2 (5%)	42 (58.3%)
Children	n (%)	n (%)	n (%)
*Yes	53 (47.3%)	36 (90%)	17 (23.6%)
*No	59 (52.7%)	4 (10%)	55 (76.4%)

**Table 2.** Comparison of the approaches to Rotavirus vaccine. specialists vs. residents

	Specialist	Resident	Overall	p
Recommend rotavirus vaccine to their patients	87.5%	88.9%	88.4%	1
Will vaccinate their children against rotavirus	87.5%	90%	89.3%	0.752
The reason for not recommending rotavirus vaccine to patients/not vaccinating their children				
Cost	22.5%	8.3%	13.4%	<b>0.045</b>
Side effects	2.5%	5.6%	4.5%	0.653
Considering the vaccine ineffective	7.5%	4.2%	5.4%	0.660
Other	0%	1.4%	1%	1
Participants who think rotavirus vaccine should be included in the national vaccine schedule	85%	87.5%	86%	0.775
Which vaccine should be included in the national vaccine schedule as a priority?				
Rotavirus vaccine	77.5%	62.5%	67.9%	0.140
Meningococcal vaccine	80%	80.6%	80.4%	1
HPV	67%	55.6%	59.8%	0.235

6.3% of the participants stated that the rotavirus vaccine would provide 100% protection from rotavirus gastroenteritis (10% specialists, 4.2% residents,  $p=0.246$ ).

When asked about the possible complications of the rotavirus vaccine, the answers were: 66.1% diarrhea, 53.6% allergic reaction, 77.7% invagination and 53.6% fever (specialists 72.5%, 55%, 77.5%, 52.5%, residents 62.5%, 52.8%, 77.8%, 54.2%,  $p=0.306, 0.846, 1, 1$ ).

When asked about the strains included in the rotavirus vaccines, the answers were: 67.9% G1, 38.4% G2, 47.3% G3, 23.2% G4 and 21.4% P1 (specialists 75%, 47.5%, 55%, 27.5%, 40%, residents 63.9%, 33.3%, 43.1%, 20.8%, 11.1%,  $p=0.292, 0.159, 0.242, 0.486, 0.001$ ).

While 94.6% of the participants knew that there were two different types of rotavirus vaccines in Turkey, 5.4% thought that there was only one type of vaccine (100% specialists, 91.7% residents,  $p=0.087$ ).

When the participants were asked about the lower limit (4, 6, 8, 10, 12, 14 weeks?) for the first dose of rotavirus vaccine, the answers were: 20% four weeks, 38% six weeks, 30% eight weeks, 1% 10 weeks, 11% 12 weeks, and no one selected 14 weeks (specialists 22.5%, 35%, 40%, 0.55%, 100%, residents 19.4%, 38.9%, 23.6%, 1.4%, 13.9%, 100%,  $p=0.808, 0.839, 0.085, 1, 0.207, 1$ ).

When the participants were asked about the upper limit (6, 8, 12, 14, 18, 20 weeks?) for the first dose of rotavirus vaccine, the answers were 7.1% 6 weeks, 10% 8 weeks, 27% 12 weeks, 22% 14 weeks, 19% 18, 15.2% 20 weeks (specialists 5%, 12.5%, 37.5%, 25%, 7.5%, 15%, residents 8.3%, 8.3%, 20.8%, 19.4%, 25%, 15.3%,  $p=0.709, 0.518, 0.075, 0.631, 0.024, 1$ ).

When the participants were asked how many weeks min. (4, 6, 8, 12 weeks?) they should wait between the rotavirus vac-

cine doses, the answers were: 76% four weeks, 9% six weeks, 13% eight weeks, 2% 12 weeks (specialists 70%, 7.5%, 20%, 2.5%, residents 76.4%, 8.3%, 8.3%, 1.4%,  $p=0.504, 1, 0.133, 1$ ).

When the participants were asked about the upper limit (12, 16, 20, 24, 32, 36 weeks?) for the last dose of rotavirus vaccine, the answers were: 7% 12 weeks, 10% 16 weeks, 4% 20 weeks, 34% 24 weeks, 30% 32 weeks, 15% 36 weeks (specialists 10%, 10%, 5%, 45%, 22.5%, 2.5%, residents 4.2%, 8.3%, 2.8%, 25%, 31.9%, 19.4%,  $p=0.246, 0.743, 0.616, 0.036, 0.383, 0.018$ ).

When the participants were asked whether the vaccines in Turkey were monovalent or pentavalent, 74% knew that one of the vaccines in our country was monovalent and the other was pentavalent (specialists 2.5%, 0% 5%, 80%, residents 5.6%, 6.9%, 9.7%, 6.8%,  $p=0.653, 0.158, 0.486, 0.194$ ).

When the specialists were divided into groups based on their professional experience, no difference was found in terms of the level of knowledge about the rotavirus vaccine. When the residents were divided into groups based on years of education, no difference was found in terms of the level of knowledge about the rotavirus vaccine.

#### Participants' approach to the rotavirus vaccine

When the participants were asked whether they recommend the rotavirus vaccine to their patients, 88.4% said they would recommend the vaccine, while this rate increased to 89.3% when asked whether they would immunize their children against rotavirus (specialists 87.5%, 87.5%, residents 88.9%, 90.3%,  $p=1, 0.752$ ).

When asked why they did not recommend the rotavirus vaccine to their patients or immunize their children (cost, side effects, lack of efficacy, and other), the responses were: 13.4% cost, 4.5% side effects; 5.4% considered the vaccine ineffec-

tive, and %1 selected "other" (specialists 22.5%, 2.5%, 7.5%, 0%, residents 8.3%, 5.6%, 4.2%, 1.4%,  $p=0.045$ , 0.653, 0.66, 1). Among the specialists, the group with 0-5 years of experience attached more significance to cost as the reason for not recommending the vaccine ( $p=0.031$ ).

When asked why the rotavirus vaccine is not widely used (cost, side effects, lack of efficacy, and other) the responses were: 71.4% cost, 14.3% side effects; 25.9% considered the vaccine ineffective, and 22.3% parents' refusal (specialists 95%, 22.5%, 22.5%, 15%, 2.5%, residents 58.3%, 9.7%, 27.8%, 26.4%, 2.8%,  $p<0.001$ , 0.090, 0.654, 0.237, 1).

86.6% of the participants responded "yes" to the question asking whether the rotavirus vaccine should be included in the national vaccination schedule (specialists 85%, residents 87.5%,  $p=0.775$ ).

When the participants were asked why they did not want the rotavirus vaccine to be included in the national vaccination schedule, the responses were: 15.2% cost 4.5% side effects, and 4.5% considered the vaccine ineffective (specialists 22.5%, 2.5%, 5%, 100%, residents 11.1%, 5.6%, 4.2%, 100%,  $p=0.168$ , 0.653, 1, 1).

When asked which vaccines should primarily be included in the national vaccination schedule, the responses were: conjugated meningococcal vaccine (80.4%), rotavirus vaccine (67.9%), and HPV vaccine (59.8%) (specialists 80%, 77.5%, 67.5%, residents 80.6%, 62.5%, 55.6%,  $p=1$ , 0.140, 0.235).

97.3% of the participants believed that lowering the cost of the rotavirus vaccine will boost immunization rates (97.5% specialists, 97.2% residents,  $p=1$ ).

There was no difference among residents in terms of their approach to the rotavirus vaccine based on years of education.

## Discussion

According to research conducted in Turkey, although rotavirus gastroenteritis is observed throughout the year, it is more common in the winter, and more than 70% of cases are seen in children under the age of two (5,15-18). In our study, 50.9% of the participants marked the statement "rotavirus infection occurs in winter months and under the age of 2" as correct.

The first rotavirus infection (symptomatic or asymptomatic) is 73-87% protective against subsequent rotavirus gastroenteritis (19). In our study, 20.5% of the participants believed that the rotavirus infection results in lifelong permanent immunity.

Since there is no publication in the literature on the knowledge and awareness of pediatricians about rotavirus infection and vaccines, we could not exactly compare the level of

knowledge about the causative agent and the disease itself. However, in a recent study conducted in Turkey by Özdemir et al., pediatricians were asked about the strains of *Neisseria meningitidis*, which cause invasive meningococcal disease, and the most common type was correctly identified by pediatricians as we have seen in our study (20).

While 94.6% of the participants knew that there were two different types of rotavirus vaccines in Turkey, 5.4% thought that there was only one type of vaccine. When the participants were asked whether the vaccines in Turkey were monovalent or pentavalent, 74% knew that one of the vaccines in our country was monovalent and the other was pentavalent.

When asked whether the rotavirus vaccine could be administered with other vaccines, 86.6% of the participants said "yes". Rotavirus vaccines can be administered concomitantly with parenteral vaccines. While the US Advisory Committee on Immunization Practices (ACIP) states that a specific time interval is not required between the rotavirus and the oral polio vaccine, the European Society for Pediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) and the European Society for Pediatric Infectious Diseases (ESPID) state that they should not be concurrently administered (21).

The use of rotavirus vaccines at Months 2, 4, and 6, requires it to be administered in the same months as live vaccines such as BCG and Oral polio vaccine (OPV) included in the routine vaccination schedule. Procurement of the vaccine externally for a fee, ordering vaccines to be delivered to pharmacies and warehouses, cost concerns, and the financial situation of families in a given month, have an impact on the day of the rotavirus vaccine administration. Therefore, it is necessary to reconsider the intervals between rotavirus vaccines and other vaccines.

When the participants were asked whether they recommend the rotavirus vaccine to their patients, 88.4% said they would recommend the vaccine, while this rate increased to 89.3% when asked whether they would immunize their children against rotavirus. When the participants were asked why the rotavirus vaccine is not widely used, the responses were: 71.4% cost, 25.9% lack of efficacy, 22.3% parents' refusal of the vaccine, and 14.3% side effects. Our survey revealed that the cost of vaccination was the most important reservation the physicians had when recommending vaccination. In case-control studies conducted in the United States, the rotavirus vaccines were found 80% to 90% protective against rotavirus disease resulting in hospitalization, and vaccination was also found to be highly effective against rotavirus infection resulting in emergency care. These results have led to a significant reduction in the cost burden of the disease (22).

In our study, 86.6% of the participants suggested that the rotavirus vaccine be included in the national vaccination sche-

dule. In studies conducted with pedyatricians in Turkey, this rate was reported to be 81.8% for conjugated meningococcal vaccine and 60-70% for the HPV vaccine (20,23).

When the participants were asked why they did not want the rotavirus vaccine to be included in the national vaccination schedule, the most common answer was the high cost (64.9%). A study investigating the cost-effectiveness of the rotavirus vaccine in Turkey revealed that a national rotavirus immunization program would result in budget savings and be cost-effective when all costs (direct medical, indirect medical, and non-medical) were considered (24).

The rotavirus vaccine, which is included in the national vaccination schedules of 94 nations throughout the world, was highlighted as a priority to be added to the vaccination schedule, during the Ministry of Health's national immunization workshop. In a study by Özdemir et al., 79.3% of the participants stated that they wanted the rotavirus vaccine to be included in the national vaccination schedule as a priority. In our study, 80.4% of the participants preferred that the conjugated meningococcal vaccine be introduced to the national vaccination schedule as a priority, whereas 67.9% preferred the rotavirus vaccine and 59.8% preferred the HPV vaccine (20).

97.3% of the participants believed that lowering the cost of the rotavirus vaccine will boost immunization rates. In numerous studies conducted in Turkey, however, the majority of parents of hospitalized children with rotavirus gastroenteritis said that they had not vaccinated their children because they had not heard of the rotavirus vaccine (25,26).

## Conclusion

In our study, we discovered that the level of knowledge and awareness of pedyatricians working in positions to counsel families regarding rotavirus infection and rotavirus vaccines is inadequate, the rate of those recommending vaccines is high, but cost worries persist. Measures should be taken to improve the knowledge and awareness of pedyatricians working at the forefront of rotavirus infections and vaccination.

**Ethics Committe Approval:** The study was approved by the "Adana Numune Training and Research Hospital Non-Interventional Clinical Research Ethics Committee" (Date: 02/10/2015, Decision No: 195).

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - MFD, ÜÇ, OT; Design - MFD, OT, AS, CC; Supervision - OT, AS, ÜÇ, CC; Data Collection and/or Processing - SU, UÖ, CC, AS; Analysis and/or Interpretation - MFD, ÜÇ, OT, AS, CC, SU, UÖ; Literature Review - SU, UÖ, CC, A.S.; Writing - MFD, ÜÇ, OT; Critical Review - MFD, ÜÇ, OT.

**Conflict of Interest:** All authors declare that they have no conflicts of interest or funding to disclose.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## References

1. Cortese MM, Parashar UD, Centers for Disease Control and Prevention (CDC). Prevention of rotavirus gastroenteritis among infants and children: recommendations of the Advisory Commite on Immunization Practices (ACIP). *MMWR Recomm Rep* 2009;58(RR-2):1-25.
2. World Health Organization. Rotavirus vaccines. WHO position paper. Available on: <http://www.who.int/wer/2013/wer8805.pdf> (Published January 2013.) Accessed date: 19 December 2019.
3. Woyessa AB, Abebe A, Beyene B, Tefera M, Assefa E, Ketema H, et al. Rotavirus-associated acute diarrhea outbreak in West ShewaZone of Oromia Regional State, Ethiopia 2017. *Pan Afr Med J* 2019;32:202.
4. Soares-Weiser K, Bergman H, Henschke N, Pitan F, Cunliffe N. Vaccines for preventing rotavirus diarrhoea: vaccines in use. *Cochrane Database Syst Rev* 2019 Oct 28;2019(10). [CrossRef]
5. Ceyhan M, Alhan E, Salman N, Kurugöl Z, Yıldırım I, Çelik Ü, et al. Multicenterprospectivestudy on theburden of rotavirusgastroenteritis in Turkey, 2005-2006: a hospital-basedstudy. *J Infect Dis* 2009;200 (Suppl 1):234-8. [CrossRef]
6. Parez N. Rota virus gastroenteritis: why to back up the development of new vaccines? *Comp Immunol Microbiol Infect Dis* 2008;31:253-69. [CrossRef]
7. Durmaz R, Kalaycıoğlu AT, Acar S, Bakkaloğlu Z, Karagöz A, Korukluoğlu G, et al. Turkish Rotavirus Surveillance Network. Prevalence of Rotavirus Genotypes in Children Younger than 5 Years of Age before the Introduction of a Universal Rotavirus Vaccination Program: Report of Rotavirus Surveillance in Turkey. *PLoS One* 2014;9:e113674. [CrossRef]
8. Bozdayı G, Doğan B, Dalgıç B, Bostancı I, Sarı S, Battaloğlu NO, et al. Diversity of human rotavirus G9 among children in Turkey. *J Med Virol* 2008;80:733-40. [CrossRef]
9. Çataloluk O, Iturriza M, Gray J. Molecular characterization of rotaviruses circulating in the population of Turkey. *Epidemiol Infect* 2005;133:673-8. [CrossRef]
10. Staat MA, McNeal MM, Bernstein DI. Rotaviruses. In: Cherry JD, Harrison GJ, Kaplan SL, Steinbach WJ, Hotez PJ (eds) *Textbook of Pediatric Infectious Diseases*. 7<sup>th</sup> ed. Philadelphia, Saunders; 2014, pp.2176-92.
11. Bishop RF, Barnes GL, Cipriani E, Lund JS. Clinical immunity after neonatal rotavirus infection: a prospective longitudinal study in young children. *N Engl J Med* 1983;309:72-6. [CrossRef]
12. Glass RI, Bresee J, Jiang B, Parashar UD, Yee E, Gentsch J. Rota virus and rota virusv accines. *Adv Exp Med Biol* 2006;582:45-54. [CrossRef]
13. De Vos B, Han HH, Bbouckenoooghe A, Debrus S, Gillard P, Ward R, et al. Live attenuated human rotavirus vaccine, RIX4414, provides clinical protection in infants againts rotavirus strains with and without shared G and P genotypes: integrated analysis of randomized controlled trials. *Pediatr Infect Dis J* 2009;28:261. [CrossRef]
14. RotaTaq (Rotavirus vaccine, live, oral, pentavalant). United States Prescribing Information. Revised February 2017, US Food&Drug Administration. Available on: <https://www.fda.gov/BiologicsBloodVaccines/ approvedProducts/ucm094063.htm> Accessed date: 21 December 2019.
15. Kurugöl Z, Geylani S, Karaca Y, Umay F, Erensoy S, Varfar F, et al. Rotavirus gastroenteritis among children under five years of age in Izmir, Turkey. *Turk J Pediatr* 2003;45:290-4.
16. Tapisız A, Karahan ZC, Çiftççi El, Doğru U. Changing patterns of rotavirus genotypes in Turkey. *Curr Microbiol* 2011;63:517-22. [CrossRef]

17. Özdemir S, Delialioğlu N, Emekdaş G. Investigation of rotavirus, adenovirus and astrovirus frequencies in children with acute gastroenteritis and evaluation of epidemiological features. *Mikrobiyol Bul* 2010;44:571-8.
18. Gündeşlioğlu OO, Kocabaş E, Haytoğlu Z, Timurtaş Dayar G, Kılıç Çil M, Durmaz R. Rotavirus prevalence and genotype distribution in children with acute gastroenteritis in Adana province. *Mikrobiyol Bul* 2018;52:156-65. [\[CrossRef\]](#)
19. Velazquez F. R. Protective effects of natural rotavirus infection. *Pediatr Infect Dis J* 2009;28:554-6. [\[CrossRef\]](#)
20. Özdemir U, Çelik T, Tolunay O, Celiloğlu C, Sucu A, Reşitoğlu S, Aydın F, Başpınar H, Kazgan T, Çelik Ü. Pediatrician's Meningococcal infection rates and vaccination rates with related information levels and attitudes. *J Pediatr Inf* 2018;12:58-64. [\[CrossRef\]](#)
21. Kocabaş E, Dayar GT. Rotavirus vaccines. *J Pediatr Inf* 2015;9:166-74.
22. Red Book: 2018 Report of the committee on infectious diseases, 31<sup>st</sup> edition. Rotavirus Infection 700-4. [\[CrossRef\]](#)
23. Tolunay O, Çelik U, Karaman SS, Çelik T, Reşitoğlu S, Dönmezer Ç, et al. Awareness and attitude relating to the human papilloma virus and its vaccines among pediatricians, obstetricians and gynecology specialists in Turkey. *Asian Pac J Cancer Prev* 2014;15:10723-8. [\[CrossRef\]](#)
24. Köksal T, Akelma AZ, Köksal AO, Kutukoğlu I, Özdemir O, Yüksel ÇN, et al. Cost-effectiveness of rotavirus vaccination in Turkey. *J Microbiol Immunol Infect* 2017;50:693-6. [\[CrossRef\]](#)
25. Köksal AO, Köksal T. Ankara'da ebeveynlerin rotavirüs hakkında bilgi düzeyleri ve çocukların rotavirüs aşılanma oranları. *Gaziantep Med J* 2012;18:15-154.
26. Kaçmaz Ersü N, Ersü A, Kılıç Öztürk Y, Helvacı M, Öngel K. Gastroenterit tanısı ile hastanede yatan çocukların özellikleri ve ebeveynlerin rotavirüs aşısı hakkındaki bilgi düzeyleri. *İzmir Dr. Behçet Uz Çocuk Hastalıkları Dergisi* 2016;6:203-8.