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Assessment of physicians' proficiency concerning antibiotic use for upper respiratory tract infections in children: a cross-sectional study

Bessan Badran[1], Donya Nawahda[1], Banan M. Aiesh[2], Maysa Alawneh[1,3]✉, Adham Abu Taha[4,5]✉ & Sa'ed H. Zyoud[6,7]

Since most upper respiratory tract infections (URTIs) are caused by viruses, treatment with antibiotics is considered nonbeneficial and futile. Nonetheless, antibiotic misuse remains a concern that has a profound impact on global health, owing to the possible development of antibiotic resistance. Therefore, understanding the factors influencing physicians' practices and attitudes and assessing their level of knowledge regarding antibiotic prescriptions for children with URTIs is advisable to determine the factors that lead to the emergence of antibiotic resistance. A cross-sectional study was conducted among pediatricians and pediatric residents in the northern West Bank, Palestine, from December 2021 to the end of January 2022. Data were collected via a validated self-administered questionnaire with four sections: demographic details, knowledge (scored 0–1), attitudes (11-item Likert scale, maximum 55), and prescribing behavior for pediatric URTIs (scored 1–5, maximum 55). Statistical analysis was performed via SPSS v21, with nonparametric tests (Mann–Whitney U, Kruskal–Wallis) applied for nonnormal variables ($p < 0.05$). Demographics, knowledge, attitudes, and behaviors were summarized using frequencies, percentages, medians, and interquartile ranges. A total of 108 questionnaires were collected and returned, yielding a response rate of 90%. The overall level of knowledge among the respondents was commendable but concerning, as 22% of them mistakenly believed that antibiotics functioned as anti-inflammatory drugs. T The participants' attitudes ranged from 29 to 52 points, with a maximum possible score of 55. The average score was 41.1 ± 3.6, reflecting generally favorable attitudes toward antibiotic usage among the participants. However, 6.5% of the respondents expressed a preference for the use of broad-spectrum antibiotics for most cases of acute URTIs. The practice score also followed a normal distribution, with an average score of 35.4 ± 7.7 out of 55. Some respondents identified challenges in properly prescribing antibiotics, such as the time required to explain antibiotics to parents, parental requests for antibiotics, and uncertainty regarding the illness. The age of the respondents was significantly positively correlated with their behavioral state ($p = 0.037$), with older respondents exhibiting better behavioral patterns. Pediatric residents and female respondents had comparatively lower perceptions of antibiotic behavior and practices ($p = 0.004$ and $p = 0.03$, respectively). Additionally, the results revealed positive correlations between participants' attitudes and practices ($rs = 0.434$, $p < 0.001$) and between their knowledge and practices ($rs = 0.355$, $p < 0.001$). Several factors influencing physicians' practices, as well as factors related to parents, were identified. Thus, enhancing knowledge alone may not be sufficient. Possible recommendations were examined, with a focus on improving the doctor–patient relationship and implementing essential educational interventions to increase awareness of antibiotic resistance and promote better prescribing and purchasing behaviors for both physicians and the general public.

Keywords Upper respiratory tract infections, Pediatricians, Children, Antibiotics, Knowledge

Abbreviations

IRB	Institutional Review Board
NICE	National Institute for Health and Care Excellence

SPSS	Statistical Package for Social Sciences
UNRWA	United Nations Relief and Works Agency
URTIs	Upper respiratory tract infections

[1]Department of Medicine, College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine. [2]Infection Control Department, An-Najah National University Hospital, Nablus 44839, Palestine. [3]Department of Pediatrics, An-Najah National University Hospital, Nablus 44839, Palestine. [4]Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine. [5]Department of Pathology, An-Najah National University Hospital, Nablus 44839, Palestine. [6]Department of Clinical and Community Pharmacy, College of Medicine and Health Sciences, An-Najah National University, Nablus 44839, Palestine. [7]Clinical Research Center, An-Najah National University Hospital, Nablus 44839, Palestine. ✉email: maysa.alawneh@najah.edu; aabutaha@najah.edu

Antibiotic resistance is undoubtedly one of the greatest ever-developing challenges to global health, and children are becoming increasingly affected[1,2], probably due to the immature immune system[3], easy availability of antibiotics, and overuse and misuse of antibiotics, which can increase infection-related mortality and morbidity and financial burdens worldwide[4].

In Palestine, many practices performed by either pharmacists or physicians can contribute to the development of antibiotic resistance[5–7]. Recent studies have shown that the vast majority of antibiotics consumed are not prescribed, with the main contributors being health care workers and parents, in addition to self-treatment with antibiotics, with community pharmacies being the primary source for the consumed antibiotics[5,8]. These studies evaluate the extent of storage and wastage of antibiotics in Palestinian households[9], self-medication with antibiotics[10], patterns of antibiotic prescription among pediatric patients and parental knowledge, attitudes and practices regarding antibiotic use[11].

The upper respiratory tract extends from the nares to the larynx and includes the nose, the epiglottis, the pharynx and the larynx[12]. Upper respiratory tract infections (URTIs) are any infection involving any of those parts of the respiratory tract. URTIs are considered the most common and frequent illness in all age groups worldwide, and children are at increased risk of developing these infections, especially in developing countries[13]. Additionally, URTIs are regarded as a major cause of morbidity in children, ranging from mild to some occasionally serious sequelae. Furthermore, they are responsible for the high cost of treatment to society[14].

Signs and symptoms of URTIs in children start with coughing, congestion, and runny nose, which are the most common signs and symptoms that may continue for the first week. However, fever, vomiting, diarrhea, and headache are not very common[13].

URTIs are caused mostly by families of viruses, including rhinovirus, coronavirus, influenza, parainfluenza, respiratory syncytial virus, adenovirus, and enterovirus[14]. However, physicians continue to prescribe antibiotics[15] for several reasons, such as diagnostic uncertainty, parental expectations of antibiotics, and sociocultural and economic pressures[14].

A previous study conducted in Palestine reported that pharyngitis was the most commonly diagnosed infection, followed by other respiratory tract infections, with a greater percentage of patients in the public sector. Relevantly, public healthcare providers used to prescribe cheaper and older antibiotics than the antibiotics prescribed in the private sector. As evidence, amoxicillin was by far the most common antibiotic prescribed for all infections, and pharyngitis accounts for more than half of amoxicillin prescriptions in Palestine[15].

The use of antibiotics in the treatment of URTIs is highly limited, and as respiratory infections become more resistant to antibiotics, a self-reinforcing vicious cycle is set in motion, whereby broad-spectrum drugs are promoted and selection pressure is increased to induce increased resistance[16]. A multidisciplinary panel of experts from the Infectious Diseases Society of America (IDSA) developed evidence-based guidelines for the diagnosis and initial treatment of suspected acute bacterial rhinosinusitis in children as well as group A streptococcal pharyngitis. Diagnostic, laboratory, and empirical antimicrobial and adjuvant therapy recommendations were created[17,18].

Resistance is not a disease in itself. This means that the long-term consequences of antibiotic use are not always visible or known to people outside the medical field. As a result, the short-term benefits of antibiotics for patients and healthcare workers usually outweigh concerns about the risks of antibiotic resistance[19]. Increased mortality and morbidity are considered serious consequences of antibiotic resistance[4], and the management of drug-resistant infections can be challenging in developing countries, such as Palestine, since many second- and third-line therapies are not quite affordable or are expensive[19].

Thus, this study is the first of its kind in Palestine to evaluate pediatricians' and pediatric residents' knowledge, attitudes, and practices regarding antibiotic use in pediatrics. Therefore, the aim of this study was to assess the knowledge, attitudes, and practices related to antibiotic prescriptions for children with URTIs among pediatric specialists and residents of the northern West Bank, Palestine.

Methods

Study design and setting

A cross-sectional survey was conducted among pediatricians and pediatric residents in the northern part of the West Bank, Palestine, utilizing a self-administered, four-part questionnaire between December 2021 and the end of January 2022.

Sampling methods and sample size calculation

The sample size was determined via a Raosoft sample size calculator, with considerations for a 50% response distribution, a 5% margin of error, and a 95% confidence interval. The rationale behind assuming a 50% response

rate stemmed from the absence of prior similar studies from Palestine, rendering both responses and response rates entirely unknown. Consequently, the calculated sample size was 109. To mitigate the potential impact of missing data or nonresponses, the sample size was increased to 120. Physicians were chosen via a convenience sampling method because of its efficiency in terms of time, cost, and accessibility.

Sampling method

A list of all pediatric specialists and residents working north of the West Bank was obtained from the Palestine Medical Association. The list was classified into categories taking into consideration the geographic area and the place in which they work (governmental and nongovernmental). The total number of pediatric specialists and residents in the northern cities of the West Bank was 150; 113 (75%) were specialists, and 37 (25%) were residents. The majority of specialists worked in the nongovernmental sector (70 (62%)).

Study tool

A validated self-administered questionnaire with four sections was utilized for data collection[20–22]. The first section captured the demographic information of the participants, such as their age, sex, education, level of practice, years in practice, setting area, and attendance of antibiotic-related training.

The second section assessed participants' knowledge of antibiotic use and resistance via a three-point scale (yes/no/uncertain), with eight statements measuring their understanding of indications for antibiotic use, treatment duration, and resistance. Each correct response was scored as 1, whereas incorrect or uncertain responses were scored as 0. This section also included questions on the sources of antibiotic knowledge and training.

The third section uses an 11-item Likert scale (ranging from "strongly disagree" to "strongly agree") to evaluate participants' attitudes toward antibiotic selection, with a maximum score of 55. The fourth section examined participants' antibiotic-prescribing behavior in various scenarios involving children with URTIs via a scale ranging from "always" to "never". Each answer was given a score from 1 to 5, with a maximum score of 55.

Statistical analysis

The data were analysed via the Statistical Package for Social Sciences (SPSS) version 21. For variables that did not follow a normal distribution, medians with lower and upper quartiles were used for expression. The normality of the variables was tested via the Kolmogorov–Smirnov test. Nonparametric tests were used to assess the significance of differences between variables. The Kruskal–Wallis test was employed for variables with more than two categories, whereas the Mann–Whitney test was used for variables with two categories. A significance level of $p < 0.05$ was set. For the assessment of physicians' demographic characteristics (gender, age, education, level of practice, setting area, setting, and attendance of antibiotic-related training), frequency and percentages were calculated. To evaluate physicians' knowledge, each statement had three options (yes/no/uncertain), and the frequency, percentage, and rate of correct answers (%) were calculated. As the knowledge scores were expected to have a skewed distribution, medians and interquartile ranges were calculated, and their relationships with demographic characteristics were assessed via the Mann–Whitney U test. The frequency and percentages of participants' responses to attitude statements about antibiotic selection were calculated. Additionally, the frequency and percentages of participants who reported antibiotic-prescribing behavior were determined. To assess the correlation between participants' knowledge, attitudes, and practices, we utilized Spearman's correlation.

Ethical consideration

Prior to commencing the data collection, approval was obtained from the *Institutional Review Board* (IRB) of An-Najah National University. Verbal consent was obtained from all participants. The confidentiality of the collected information was ensured, as no names were collected, and the data were solely used for research purposes.

Results

Demographic characteristics of the participants

Overall, 108 questionnaires were collected and returned from 120 participants, for a 90% response rate. Among the 108 participants, 63 (58.3%) were male, and 82 (75.9%) were specialists. Among them, 52 (52.8%) had less than 10 years of experience, and 97 (89.8%) were working in cities. Approximately 58 (53%) participants worked in private settings, and 42 (38.9%) had received training specifically related to antibiotics. The details are presented in Table 1.

Physicians' knowledge about antibiotics

The overall knowledge score was 8, with 91 respondents scoring 7 or above, indicating an excellent level of knowledge regarding antibiotics. The statement with the highest percentage of correct responses (98.1%) among respondents was "Antibiotics are the preferred treatment for influenza". A significant majority, accounting for 90.7% of the respondents, accurately acknowledged the limited efficacy of antibiotics in treating most URTIs and that influenza-like symptoms are relieved faster by antibiotics (90.7%). However, 22% of the respondents erroneously perceived antibiotics as anti-inflammatory medications. Only 2.8% of the respondents agreed with the statement "Stop taking antibiotics when symptoms begin to improve". The details are listed in Table 2.

As shown in Table 3, no significant associations were observed between knowledge and demographic characteristics.

Characteristics	Frequency ($N = 108$)	Percentage %
Gender		
Male	63	58.3
Female	45	41.7
Age (years)		
≤ 30	29	26.9
31–40	29	26.9
41–50	22	20.4
>50	28	25.9
Level of practice		
Pediatrician	82	75.9
Resident	26	24.1
Years in practice		
≤ 10	57	52.8
11–20	19	17.6
21–30	23	21.3
≥ 31	9	8.3
Setting area		
City	97	89.8
Village	11	10.2
Type setting		
Private	58	53.7
Governmental	46	42.6
UNRWA	1	9
Nongovernmental organization	3	2.8
Receive training related to antibiotics		
Yes	42	38.9
No	66	61.1

Table 1. Demographic characteristics of the participants. UNRWA: United Nations Relief and Works Agency.

Item #	Yes *N* (%)	No *N* (%)	Uncertain *N* (%)	Correct *N* (%)
Antibiotics are anti-inflammatory drugs.	24 (22.2)	82 (75.9)	2 (1.9)	82 (75.9)
It is okay to stop taking an antibiotic when symptoms begin to improve.	3 (2.8)	104 (96.3)	1 (0.9)	104 (96.3)
Antibiotics are the preferred treatment for influenza.	2 (1.9)	106 (98.1)	0	106 (98.1)
Most acute upper respiratory illnesses are caused by viral infections.	103 (95.4)	5 (4.6)	0	103 (95.4)
Antibiotics are effective for most acute upper respiratory infections.	7 (6.5)	98 (90.7)	3 (2.8)	98 (90.7)
Influenza-like symptoms in children can be relieved faster with antibiotics.	7 (6.5)	98 (90.7)	3 (2.8)	98 (90.7)
Antibiotic resistance is a major public health problem in Palestine.	98 (90.7)	6 (5.6)	4 (3.7)	98 (90.7)
Unnecessary use of antibiotics can lead to bacterial resistance.	107 (99.1)	1 (0.9)	0	107 (99.1)

Table 2. Knowledge level about antibiotics among the participants. #These questions were adapted from previous studies[20–22].

Physicians' attitudes regarding antibiotic prescription

The participants' scores ranged from 29 to 52 points, with a maximum possible score of 55. The average score was 41.1 ± 3.6, indicating generally favorable attitudes toward antibiotic usage among the participants. Nearly all the respondents (98.2%) agreed that antibiotics should not be prescribed immediately for treating the common cold. However, a smaller proportion (6.5%) of respondents agreed with the utilization of broad-spectrum antibiotics for most cases of acute URTIs. Some respondents identified barriers to proper antibiotic prescription, such as the time taken to explain antibiotics to parents (11.1%), parents' requests (5.5%), and uncertainty about illnesses (18.6%). Only 11.1% of the respondents acknowledged difficulties in choosing appropriate antibiotics, and 64.9% of them believed that their knowledge about antibiotics needed improvement. Furthermore, 95.4% of the respondents believed that antibiotics are overused in Palestine, and most of them (80.6%) considered antibiotic prescription to be a factor contributing to the emergence of antibiotic-resistant bacteria. Approximately 70.3%

Characteristics	Median [Q1-Q3]	*P* value
Gender		
Male	8.0[7.0–8.0]	0.468
Female	8.0[7.0–8.0]	
Age		
≤ 30	8.0 [7.0–8.0]	0.285
31–40	8.0 [7.0–8.0]	
41–50	8.0 [6.75-8.0]	
>50	8.0 [6.25-8.0]	
Level of practice		
Pediatrician	8.0 [7.0–8.0]	0.724
Resident	8.0 [7.0–8.0]	
Years in practice		
≤ 10	8.0 [7.0–8.0]	0.878
11–20	8.0 [7.0–8.0]	
21–30	8.0 [7.0–8.0]	
≥ 31	7.0 [6.0–8.0]	
Setting area		
City	8.0 [7.0–8.0]	0.053
Village	7.0 [6.0–8.0]	
Type setting		
Private	8.0 [7.0–8.0]	0.33
Governmental	8.0 [7.0–8.0]	
Nongovernmental organization	8.0 [7.5-8.0]	
Receive training		
Yes	7.0 [7.0–8.0]	0.059
No	8.0 [7.0–8.0]	

Table 3. Median knowledge scores based on demographic characteristics.

Items #	Strongly agree *N* (%)	Agree *N* (%)	Neutral *N* (%)	Disagree *N* (%)	Strongly disagree *N* (%)
Bacterial resistance mainly occurs in medical institutions	17(15.7)	59(54.6)	17(15.7)	12(11.1)	3(2.8)
Giving antibiotics to children can lead to the emergence of resistant bacteria	31(28.7)	56(51.9)	10(9.3)	11(10.2)	0(0)
I think antibiotics are overused in our country.	72(66.7)	31(28.7)	3(2.8)	1(0.9)	1(0.9)
My knowledge of antibiotics needs to be improved	10(9.3)	60(55.6)	23(21.3)	14(13)	1(0.9)
It is very difficult to choose appropriate antibiotics during treatment	1(0.9)	11(10.2)	25(23.1)	66(61.1)	5(4.6)
Sometimes I prescribe antibiotics as I do not have time to explain it to parents	1(0.9)	11(10.2)	20(18.5)	51(47.2)	25(23.1)
I often prescribe antibiotics at the request of parents	1(0.9)	5(4.6)	15(13.9)	50(46.3)	37(34.3)
I often prescribe antibiotics prophylactic when the patient's condition is uncertain.	2(1.9)	18(16.7)	22(20.4)	44(40.7)	22(20.4)
I prefer broad-spectrum antibiotics for most acute upper respiratory infections.	0(0.0)	7(6.5)	5(4.6)	48(44.4)	48(44.4)
I think amoxicillin is effective for most acute upper respiratory infections	6(5.6)	22(20.4)	9(8.3)	46(42.6)	25(23.1)
I agree you that antibiotics should be taken immediately for the common cold.	1(0.9)	0(0.0)	1(0.9)	38(35.2)	68(63.0)

Table 4. Attitudes toward antibiotic prescription among participants. #These questions were adapted from previous studies[20–22].

of the respondents agreed that bacterial resistance occurs mainly in medical institutions. The details are listed in Table 4.

As shown in Table 5, no significant associations were detected between attitudes and demographic characteristics.

Physicians' practices regarding the indications for antibiotic prescription

Eleven questions were utilized to evaluate the criteria for prescribing antibiotics for URTIs, with scores ranging from 18 to 49, representing a maximum total score of 55. The scores obtained followed a normal distribution, with an average score of 35.35 ± 7.7. The initial segment of this section aimed to elucidate the rationale behind prescribing antibiotics to patients exhibiting symptoms of URTIs. Almost half (49.1%) of the respondents consistently or frequently opted to prescribe antibiotics when a child presented with a fever lasting more than

Characteristics	Median [Q1-Q3]	*P* value
Gender		
Male	43.0 [41.0–46.0]	0.244
Female	44.0 [41.0–48.0]	
Age		
≤ 30	43.0 [41.0–46.0]	0.668
31–40	44.0 [42.0-47.5]	
41–50	43.0 [41.0–46.0]	
>50	43.0 [38.0–47.0]	
Level of practice		
Pediatrician	43.0 [41.0–47.0]	0.934
Resident	43.0 [41.0-46.25]	
Years in practice		
≤ 10	44.0 [41.0–46.0]	0.671
11–20	44.0 [41.0–47.0]	
21–30	43.0 [38.0–46.0]	
≥ 31	46.0 [38.5–48.0]	
Setting area		
City	43.0 [41.0–47.0]	0.476
Village	42.0 [41.0–46.0]	
Type setting		
Private	43.0 [40.75–46.25]	0.611
Governmental	44.0 [41.0-46.25]	
Nongovernmental organization	47.0 [40.0–48.0]	
Receive training		
Yes	43.0 [39.75-46.0]	0.298
No	43.5 [41.0–47.0]	

Table 5. Median attitude scores based on demographic characteristics.

Items#	Always 95–100%	Often 70–95%	Sometimes 30–70%	Seldom 5–30%	Never 0–5%
Reasons to prescribe antibiotics:					
1. To avoid secondary bacterial infection	5(4.6)	15(13.9)	28(25.9)	30(27.8)	30(27.8)
2. Not sure if the infection is of viral or bacterial origin	5(4.6)	17(15.7)	43(39.8)	29(26.9)	14(13.0)
3. The child has been feverish for > 5 days	11(10.2)	42(38.9)	23(21.3)	17(15.7)	15(13.9)
4. The child has yellowish / greenish nasal discharge	9(8.3)	22(20.4)	34(31.5)	22(20.4)	21(19.4)
5. There is a history of recurrent upper respiratory tract infections	4(3.7)	14(13.0)	23(21.3)	34(31.5)	33(30.6)
6. The child looks very uncomfortable, although she/he lacks the typical symptoms of upper respiratory infection.	5(4.6)	19(17.6)	31(28.7)	27(25.0)	26(24.1)
7. The caregiver asks for their child to receive antibiotics	2(1.9)	6(5.6)	20(18.5)	34(31.5)	46(42.6)
Prescribing habits for special indications:					
1. Common cold	0(0)	3(2.8)	4(3.7)	19(17.6)	82.(75.9)
2. Acute sinusitis	20(18.5)	42(38.9)	28(25.9)	15(13.9)	3(2.8)
3. Otitis media	38(35.2)	48(44.4)	15(13.9)	5(4.6)	2(1.9)
4. Tonsillitis	27(25)	48(44.4)	28(25.9)	4(3.7)	1(0.9)

Table 6. Indications for antibiotic prescription to children with upper respiratory tract infections. #These questions were adapted from previous studies[20–22].

five days. Approximately one-third (28.7%) of respondents routinely or frequently prescribed antibiotics when patients exhibited yellowish or greenish nasal discharge. A portion of respondents consistently or frequently prescribed antibiotics to prevent secondary bacterial infections (18.5%) or upon parental request (7.5%). Additionally, half of the respondents refused to prescribe antibiotics when the patient lacked signs and symptoms of URTIs, even if they appeared very uncomfortable. As shown in Table 6, nearly 80% of the respondents consistently or frequently prescribed antibiotics for otitis media, whereas 69.4% and 57.4% of the respondents prescribed antibiotics for tonsillitis and acute sinusitis, respectively.

The nonparametric test results indicated a positive correlation between participants of different ages and their behavioral states, with a p value of 0.019. Pediatric residents also had a relatively poorer perception of antibiotic

Characteristics	Median [Q1-Q3]	*P* value	Mean rank
Gender			
Male	37.0 [35.0–41.0]	0.033	59.92
Female	35.0 [30.50–40.0]		46.91
Age			
≤ 30	33.0 [28.50–39.0]	0.019	39.31
31–40	37.0 [35.0–40.0]		60.50
41–50	37.0 [34.0-39.75]		56.02
>50	39.0 [35.25–41.75]		62.82
Level of practice			
Pediatrician	37.5 [34.75–40.25]	0.002	59.72
Resident	32.0 [27.75–38.25]		38.04
Years in practice			
≤ 10	36.0 [32.0–40.0]	0.251	49.15
11–20	37.0 [34.0–42.0]		56.34
21–30	39.0 [36.0–41.0]		63.59
≥ 31	39.0 [30.0–45.0]		61.28
Setting area			
City	37.0 [33.0–40.0]	0.458	55.25
Village	35.0 [32.0–40.0]		47.86
Type setting			
Private	37.0 [34.0-40.25]	0.692	53.54
Governmental	37.0[32.0–40.0]		51.18
Nongovernmental organization	40.0 [40.0-41.50]		87.0
Receive training			
Yes	35.0 [32.75-39.00]	0.254	50.20
No	37.50 [34.0-40.25]		57.23

Table 7. Median practice scores based on demographic characteristics.

	Knowledge	Attitude	Practice
Knowledge	-	*rs* = 0.184 *p* = 0.056	*rs* = 0.355 *p* < 0.001
Attitude	*rs* = 0.184 *p* = 0.056	-	*rs* = 0.434 *p* < 0.001
Practice	*rs* = 0.355 *p* < 0.001	*rs* = 0.434 *p* < 0.001	-

Table 8. Correlations between participants' knowledge, attitudes, and practices. *rs* : The Spearman's rank correlation coefficient.

behavior and practice than did specialists did, as indicated by a p value of 0.002. Similarly, females had a lower score for the perception of antibiotic behavior and practice (p value = 0.033). Details can be found in Table 7.

As shown in Table 8, there was a positive correlation between participants' attitudes and practices, with a correlation coefficient of 0.434 and a p value < 0.001. Similarly, there was a positive correlation between knowledge and practice, with a correlation coefficient of 0.355 and a p value < 0.001.

Discussion

This is the first study of its kind in the West Bank of Palestine that examines the knowledge, attitudes, and practices of pediatricians and residents. The results of this study could be used to develop important interventions aimed at improving the behavior of both pediatric specialists and residents. These interventions could include implementing policies that prohibit over-the-counter sales of antibiotics, expanding antibiotic stewardship programs to outpatient settings, and raising public awareness about appropriate antibiotic use and prescription.

The study results revealed that the overall knowledge scores were excellent. However, 22% of the respondents believed that antibiotics are anti-inflammatory drugs. A similar study conducted in China revealed that approximately one-third of participants shared this misconception[23]. Therefore, it is important to address this issue in future educational programs to promote a better understanding of the role of antibiotics in bacterial infections rather than prescribing them for any inflammatory condition.

A study conducted in China revealed that 90% of pediatricians believe that antibiotics have limited effectiveness on influenza-like symptoms[23], which is similar to our results. Additionally, 99.1% of the participants

believed that the misuse of antibiotics can lead to bacterial resistance. However, a previous study conducted among pharmacists in Palestine revealed that almost half of them believed that antibiotic misuse was harmless[24]. Two studies conducted in Saudi Arabia and Ghana revealed that one-third of public residents had not heard of antibiotic resistance or whether it can lead to resistance[25,26].

A study conducted in Ghana also revealed that public residents living in rural areas had less knowledge about the effectiveness of antibiotics on viral illness, although there was no significant difference in overall knowledge regarding the place of residence[26]. Our results also revealed that respondents who worked in villages had lower knowledge scores than did those who lived in cities did, although the difference was not statistically significant.

The majority of participants in a study conducted in Palestine agreed that antibiotic resistance is a significant public health issue in their country and is caused mainly by the misuse of antibiotics. Similarly, a study in Greece revealed that most participants were aware of the problem of antibiotic resistance in their country and globally[27]. Antibiotic resistance is also perceived as a significant issue by doctors at all levels, including juniors, seniors, and specialists, in France, Scotland, and Spain[28,29]. In Thailand, a study revealed that doctors-in-training had higher knowledge scores concerning antibiotic indications and infection control. They also had a greater perception that antibiotic resistance is a worldwide issue compared with that of final-year medical students[30]. Our study revealed that participants had a positive attitude toward antibiotic use, with an average score of 43.4. The majority of respondents did not approve of the use of antibiotics for common colds. Additionally, 88.8% of the participants agreed that broad-spectrum antibiotics should not be used for most acute URTIs because they are not effective against viral infections. This finding aligns with a study conducted in China, which revealed that only 22.7% of pediatricians preferred broad-spectrum antibiotics[23], as did another study from Palestine, which revealed that 92.4% did not prescribe two or three antibiotics to control the disease[31]. Several studies have shown that the use of broad-spectrum antibiotics contributes significantly to the development of antibiotic resistance[27,29].

A study conducted in Palestine revealed that despite the knowledge that antibiotics can cause resistance, parents still agreed to use antibiotics for their children's URTIs in 79.7% of cases. However, nearly two-thirds of parents did not believe that most URTIs were of viral origin[5]. According to our research, 11% of the participants stated that they did not have sufficient time to explain the proper use of antibiotics to parents. While this percentage may seem small, it is vital that physicians take the time to educate parents about antibiotics, as they are considered the primary source of information for 61% of parents[5]. Raising awareness about the appropriate use of antibiotics can help prevent the misuse or overuse of these drugs. The duration of time available to explain antibiotics to parents was not influenced by the type of healthcare setting, as there was no significant difference observed between private and governmental hospitals. Although governmental departments had more patients visiting them, as many of them had medical insurance, this did not affect the duration of the explanation time. Furthermore, there was no correlation between the selection of broad-spectrum antibiotics or amoxicillin and the type of hospital setting, whether private or governmental.

In the practice section of our study, several reasons for prescribing antibiotics to children with URTIs were examined, including fever lasting for more than 5 days and yellow or greenish nasal discharge. Unfortunately, nearly half of the participants agreed to prescribe antibiotics in these situations, even though they were not justified according to the guidelines from the National Institute for Health and Care Excellence (NICE)[32]. Furthermore, approximately one-fifth of the participants considered factors such as uncertainty in diagnosis, history of recurrent URTIs, and attempts to avoid secondary bacterial infections as potential reasons for prescribing antibiotics. However, URTIs are self-limited and do not require antibiotics.

The majority of participants (80%) agreed on prescribing antibiotics for patients with otitis media, as well as for patients with tonsillitis (70%), in contrast to the findings of a Jordanian study, in which 16.9% of participants prescribed antibiotics for otitis media and 15% for tonislitis[33]. Another study in Palestine reported that antibiotics were prescribed for acute otitis media in 13.5% of cases and for tonsillitis in 56.9% of cases[34]. However, these conditions alone are not indications for antibiotics unless specific circumstances are present. For pharyngitis, antibiotics can only be used if they are confirmed by a positive rapid antigen test, which is not recommended for patients with acute pharyngitis with clinical features that strongly suggest a viral etiology (e.g., cough, rhinorrhea, hoarseness, and oral ulcers)[18]. On the other hand, bacterial sinusitis can be diagnosed and treated with antibiotics if symptoms worsen "double-sickening", persist for more than 10 days, or if symptoms are severe since onset[17,35,36]. Finally, antibiotics are never an indication for the common cold[36].

The results of our study regarding the practices of participants were not consistent with their level of knowledge, indicating that good knowledge does not necessarily translate into appropriate practice. This is partially supported by the weak correlation between knowledge and practice. Therefore, educational interventions and continuous surveillance are recommended to ensure that antibiotics are prescribed in a more professional manner. Our study highlights a persistent and troubling issue: antibiotics are still being overprescribed for URTIs. Comparing our findings with studies from Palestine and neighboring countries provides a clearer picture of how antibiotics are being prescribed in real-world settings for URTIs.

In Palestine, Maraqa et al. (2023) reported that antibiotics are still commonly used for URTIs in primary care, even though guidelines advise against them for viral infections. This aligns with our findings, where many patients were prescribed antibiotics for viral illnesses—cases where these medications simply do not work[31]. Similarly, AbuMohsen and Abusheikha (2022) highlighted a troubling pattern of unnecessary antibiotic prescriptions in the West Bank-Palestine, pointing to what may be a national challenge in following international guidelines[34].

The issue is not limited to Palestine. In Jordan, Al-Alkhaldi et al. (2021) reported that antibiotics are often prescribed for mild URTIs. They noted that this overuse is partly driven by patient pressure and physicians' reluctance to deny treatment—a dynamic that we also observed in our study[33]. Moreover, in Saudi Arabia, Al Munjem et al. (2022) reported frequent misuse of antibiotics for likely viral URTIs, underscoring the urgent need for better antibiotic stewardship[37].

These findings collectively highlight a shared challenge across the region: the need to bridge the gap between clinical practice and established guidelines to ensure that antibiotics are used responsibly.

Limitations of the study

As with other self-administered studies, social desirability bias may result in differences in understanding the meaning of specific questions. Therefore, we cannot guarantee that all the participants provided true and honest answers. For example, participants may have responded on the basis of what they believe to be the appropriate behavior or what they think should be done in a particular scenario rather than reflecting their actual practice with patients. Importantly, this cross-sectional study assessed the knowledge, attitudes, and practices of participants at a single point in time without considering the time before or after the study was conducted. As a result, it may not capture changes in practice over time.

Conclusions and recommendations

While pediatricians generally have a good understanding of antibiotics and are positive about prescribing them, some still hold misconceptions, such as believing that antibiotics have anti-inflammatory effects and misuse them for treating URTIs. Factors such as time pressures, parental requests, and uncertainty about diagnoses also impact their prescribing behavior. To improve antibiotic use, it is not enough to provide more knowledge; we need to take a broader approach that includes raising public awareness, enforcing policies on over-the-counter antibiotic sales, and expanding stewardship programs. Pediatricians also need support in taking the time to explain treatments to parents. Given their close relationships with families, pediatricians are in a unique position to help reduce antibiotic misuse and promote better practices, and future research should involve general practitioners in primary care as well.

Data availability

Additional datasets collected and analyzed for this research can be obtained from the corresponding authors upon reasonable request.

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Author contributions

The literature search, data collection, analysis, and initial manuscript draft were completed by BB and DN. BMA ensured the integrity of the data and results, participated in writing and analysis, and provided valuable intellectual contributions. AAT and MA provided logistical support, coordinated on-site studies, and significantly revised the manuscript to strengthen its intellectual content. SHZ and AAT established the study concept and design, supervised the survey team, led the data analysis, and contributed to the final manuscript. All authors reviewed and approved the final version.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The Institutional Review Board (IRB) of An-Najah National University approved this study. They issued appropriate permission documents for the study. The participants were free to agree or reject participation in the study. Verbal informed consent to agree to participate in the study was obtained from each participant. The confidentiality of the data was ensured. The IRB *of* An-Najah National University approved only verbal informed consent. The reason for verbal informed consent is that the questionnaire was the only data collection tool, and participants were not subjected to any harm. All methods were performed as per the relevant guidelines and regulations.

Consent for publication

Not applicable.

Additional information

Correspondence and requests for materials should be addressed to M.A. or A.A.T.