

# Parental Knowledge, Attitudes and Practices Regarding Antibiotic Use for Upper Respiratory Tract Infections in Children

\*Asma S. Al Hashmi,<sup>1</sup> Abir S. Al Shuhumi,<sup>2</sup> Rahma M. Al Kindi<sup>3</sup>

**ABSTRACT: Objectives:** This study aimed to assess parental knowledge, attitudes and practices regarding antibiotic use for children with upper respiratory tract infections (URTIs). **Methods:** A multi-centre cross-sectional study was conducted from September 2018 to April 2019 at 15 randomly selected primary health centres in Muscat, Oman. A total of 384 parents with children under 12 years old were recruited. A validated questionnaire was utilised to determine knowledge, attitudes and practices regarding antibiotic use for children with URTIs. **Results:** All 384 parents participated in the study (response rate: 100%). Almost half of the participants (n = 173; 45.1%) agreed that antibiotics were the first and best treatment for URTIs in children, with 184 parents (47.9%) reporting that influenza symptoms in children improved more rapidly after the administration of antibiotics and 203 (52.9%) believing that antibiotics prevented complications. The majority (n = 219; 57.0%) of parents never gave their children antibiotics without a prescription, and 291 (75.8%) never used leftover antibiotics. Most participants (n = 233; 60.7%) stated that it was the doctor's decision to prescribe antibiotics, 192 (50.0%) had never asked a physician to prescribe antibiotics for their child and 256 (66.7%) had never changed doctors because they did not prescribe antibiotics. **Conclusion:** This study found that parents had confidence in their healthcare providers; however, it also showed the extent of their lack of knowledge regarding the use of antibiotics for children with URTIs. There is a need for both public- and healthcare professional-oriented educational initiatives to promote rational antibiotic usage in Oman.

**Keywords:** Practice, Attitudes and Health Knowledge; Antibiotics; Drug Utilization; Parents; Children; Upper Respiratory Tract Infections; Oman.

## ADVANCES IN KNOWLEDGE

- This study found moderate knowledge, attitudes and practices regarding antibiotic use in children with upper respiratory tract infections (URTIs) among Omani parents. This finding indicates an increased need for health education campaigns on this topic in order to improve parental awareness and knowledge.
- Results showed great confidence among parents in their treating doctors. Therefore, this trust should be used wisely in the interest of health education campaigns towards the appropriate use of antibiotics.
- To the best of the authors' knowledge, this study is the first to be conducted in Oman to explore parental knowledge, attitudes and practices regarding antibiotic use for children with URTIs.

## APPLICATION TO PATIENT CARE

- This study provides data which could form the basis for educational campaigns and initiatives focusing on antibiotic usage to address the public's misconceptions regarding antibiotic use. Greater public awareness would result in better health outcomes and lower the risk of antibiotic resistance.

IN CHILDREN, UPPER RESPIRATORY TRACT infections (URTIs) are the most common presenting diagnosis in primary healthcare and the most frequent reason for visits to emergency departments and outpatient clinics.<sup>1</sup> URTIs are also a major cause of absenteeism from school and unnecessary medical care, affecting both the child and their parents as well as imposing a financial burden on the healthcare system.<sup>2,3</sup> It is estimated that a preschool-aged child has an average of 6–8 common colds per year, with approximately 10–15% having 12 or more colds each year.<sup>2–4</sup> Moreover, the majority of URTIs in children are viral in origin and

therefore require only symptomatic treatment.<sup>2–4</sup> As such, antibiotics are not frequently recommended as they should be used only for very specific indications.<sup>5</sup>

It is well-known that the inappropriate prescription and use of antibiotics is a main contributor to rising rates of antibiotic resistance as well as increased antibiotic-related side-effects, mortality rates and medical resource waste.<sup>6–8</sup> This situation is likely to worsen considering that no new major antibiotic groups have been discovered in the last decade.<sup>9</sup> Nevertheless, it is estimated that 33% of general practitioners in the UK prescribe antibiotics for children with URTIs, despite such prescriptions not being clinically indicated.<sup>10</sup>

<sup>1</sup>Department of Family Medicine, Ministry of Health, Muscat, Oman; <sup>2</sup>Department of Family Medicine, Oman Medical Specialty Board, Muscat, Oman;

<sup>3</sup>Department of Family Medicine and Public Health, Sultan Qaboos University Hospital, Muscat, Oman

\*Corresponding Author's e-mail: [asmaalhashmi180@gmail.com](mailto:asmaalhashmi180@gmail.com)

According to the World Health Organization, URTIs represented the most common reason for antimicrobial use.<sup>5</sup> Although irrational antibiotic use is a global problem, it is more prevalent in developing countries such as China.<sup>11</sup> A systematic review from China revealed that 83.7% of outpatients presenting with URTIs received antibiotics.<sup>12</sup>

Previous studies have identified several factors present worldwide linked to antibiotic misuse including antibiotic availability, diagnostic uncertainty as well as the age and socioeconomic status of the child in question.<sup>13–15</sup> One important additional factor is parents' lack of knowledge, appropriate practices and understanding of indications for antibiotic use in children with URTIs; studies conducted in different countries have reported variable levels of parental knowledge regarding antibiotic use.<sup>16–20</sup> Studies from Palestine, Jordan, Saudi Arabia and the United Arab Emirates (UAE) have all highlighted parents' poor knowledge of antibiotic use in relation to URTIs.<sup>19–22</sup> In contrast to this finding, a study in Cyprus linked antibiotic overuse to doctors' decisions and not to a lack of parental knowledge.<sup>17</sup> A similar finding was observed in Greece in which physicians' over-prescription was the main cause of antibiotic misuse.<sup>18</sup>

In Oman, only one previous study has been performed to assess general knowledge of, and attitudes and behaviours towards antibiotic use among the public.<sup>23</sup> However, to the best of the authors' knowledge, no study has yet targeted parents to assess their knowledge, attitudes and practices with regards to antibiotic use for children with URTIs. This study, therefore, aimed to assess knowledge of, attitudes towards and practices among Omani parents regarding antibiotic use for URTIs in children.

## Methods

This multicentre cross-sectional study was carried out from September 2018 to April 2019 in randomly selected primary healthcare centres in Muscat, Oman. Muscat Governorate is the largest in Oman in terms of population density. Approximately 32% of Oman's population lives within the Muscat Governorate, which comprises six *wilayats* (counties) and 29 governmental primary healthcare centres which are distributed according to the size of the target population within each *wilayat*.<sup>24</sup> The current study included a total of 15 healthcare centres randomly selected from each *wilayat* in the Muscat Governorate including three centres which were selected from among the most populated *wilayat* and one centre chosen from among the least populated *wilayat*.

According to the Omani Ministry of Health, children less than 12 years old are considered members of the paediatric age group and receive medical treatment under the Department of Child Health. After 12 years of age, individuals are considered adolescents and receive their medical treatment together with adults.<sup>24</sup> However, according to the Omani Child Law, a child is defined as any person who has not completed 18 years of age.<sup>25</sup> In the current study, all adults with children under 12 years old who were attending the selected healthcare centres during the study period were invited to participate in the study. The participants were selected for eligibility during registration at the reception. Both fathers and mothers were selected for inclusion; however, parents who did not speak Arabic or English, those with learning disabilities/dementia and those who did not have the time to complete the questionnaire were excluded from the study. The necessary sample size was calculated using an online sample size calculator (Raosoft Inc., Seattle, Washington, USA) based on an estimated response distribution of 50%, a 5% margin of error and a 95% confidence interval. Based on the assumption that the response rate would be 100% due to data being collected through face-to-face interviews, the final sample size was calculated to be 384 participants.

Data were collected using a pre-tested questionnaire and face-to-face interviews were carried out with individual participants in the waiting area. The questionnaire was previously validated for use in a similar study conducted in Palestine.<sup>19</sup> In the current study, the Arabic version of the questionnaire was used with questions tailored to ensure their applicability to the local population. The final questionnaire was composed of four main sections. The first section focused on sociodemographic data including participant age, gender, education level, monthly income, occupational field and the number and age of their children.

The second part of the questionnaire assessed parents' knowledge of causes of URTIs and antibiotic use in children with URTIs and included: (1) specific antibiotic names and their use for treating specific symptoms of URTIs in children (i.e. fever and influenza-like symptoms); (2) whether antibiotics are the first and best option for treating URTIs; (3) the source of parents' antibiotic-related information; (4) parents' understanding of the course of URTIs, indications for antibiotic use and antibiotic-related side-effects; (5) whether the inappropriate use of antibiotics reduces their efficacy and drives bacterial resistance; (6) whether antibiotics prevent URTI complications; and (7) if scientists could produce new antibiotics for resistant bacteria.

The third section of the questionnaire focused on parents' practices regarding antibiotic use in children with URTIs. Parents were asked about: (1) the average length of time they waited before seeking medical advice; (2) symptoms that drove them to seek medical help; (3) different treatment options for URTIs; (4) their expectations regarding antibiotic prescriptions in terms of specific URTI symptoms; (5) if they had ever given their children antibiotics without a prescription; (6) their reasons for giving their children antibiotics in the absence of medical advice; (7) their beliefs as to why a doctor would prescribe antibiotics; (8) whether they had ever questioned physicians as to the necessity of an antibiotic prescription; (9) whether they had ever demanded their physician prescribe or avoid prescribing antibiotics; (10) whether an antibiotics prescription should be based on parental demand; and (11) whether they followed medical instructions and advice with regards to antibiotic administration.

Finally, the fourth part of the questionnaire was designed to determine parental attitudes regarding antibiotic use for children with URTIs. The parents were asked if: (1) they thought that antibiotics are overused or unnecessarily prescribed; (2) whether they would change doctors because of prescribing or not prescribing antibiotics; (3) whether they ever administered leftover antibiotics to their child; (4) if URTIs can resolve without antibiotics; and (5) whether they thought that parents and doctors should be educated regarding judicious antibiotic use. All items on the questionnaire were scored on a 5-point Likert scale, with potential responses scored from 1–5 either according to agreement (i.e. from strongly agree to strongly disagree) or frequency of occurrence (i.e. from never to always).

Data were analysed using Statistical Package for the Social Sciences (SPSS), Version 22 (IBM Corp., Armonk, New York, USA). Descriptive statistics were used to describe the sample characteristics, with frequencies and percentages reported for categorical variables and means  $\pm$  standard deviation for continuous variables. In addition, median scores were calculated based on the participants' responses to the knowledge, attitude and practice questionnaire items. When scoring items, correct or expected answers were given a score of one, while incorrect or unexpected answers were scored as zero. Median scores were calculated out of maximum possible scores of seven, five and five for the knowledge, attitude and practice sections, respectively, while the minimum score was zero for all three categories. For quantitative representations, scores  $>70\%$  of the possible maximum score were considered good,  $30\text{--}70\%$  was considered moderate and  $<30\%$  was considered poor.

Participation was voluntary and informed consent was obtained prior to data collection. All participants were informed about their right to withdraw from the study at any time and their anonymity and confidentiality were assured and emphasised. Ethical approval for this study was granted by the regional Research and Ethics Committee of the Directorate General of Health Services, Ministry of Health, Oman (#MH-DGPS/24/2018).

## Results

All 384 parents selected for inclusion participated in the study (response rate: 100%). The majority were female ( $n = 293$ ; 76.3%) and the mean age was  $32.7 \pm 5.8$  years old (range: 20–49 years). The vast majority ( $n = 383$ ; 99.7%) had children under six years of age, with only one parent (0.3%) having a child between 6–12 years old. In terms of parental education, most fathers had been educated to the secondary level ( $n = 178$ ; 46.4%) or higher ( $n = 162$ ; 42.2%). This educational level was similar among mothers ( $n = 178$ ; 46.4% and  $n = 173$ ; 45.1%, respectively). More than half of the participants ( $n = 206$ ; 53.6%) had an average monthly income of 500–1,000 Omani Rials. Only 16.4% ( $n = 63$ ) of the participants worked in the medical field [Table 1].

The majority of participants ( $n = 312$ ; 81.3%) reported that doctors constituted their main source of information regarding antibiotics followed by pharmacists ( $n = 62$ ; 16.1%). Other reported sources of information included radio/television ( $n = 4$ ; 1%), family and friends ( $n = 2$ ; 0.5%), newspapers ( $n = 1$ ; 0.3%) and other sources ( $n = 3$ ; 0.8%). In terms of their knowledge regarding antibiotic use for children with URTIs, most parents ( $n = 268$ ; 69.8%) were unable to name any specific antibiotics, while the remainder mentioned Augmentin<sup>®</sup> (GlaxoSmithKline PLC, Brentford, UK) and amoxicillin together ( $n = 47$ ; 12.2%), Augmentin<sup>®</sup> (GlaxoSmithKline PLC) alone ( $n = 16$ ; 4.2%), amoxicillin alone ( $n = 32$ ; 8.3%) or other antibiotics ( $n = 21$ ; 5.5%).

Almost half of the participants ( $n = 173$ ; 45.1%) agreed that antibiotics are the first and best treatment for URTIs in children. Although more than half of the parents ( $n = 208$ ; 54.2%) believed that most URTIs are viral in origin, 184 (47.9%) believed that influenza-like symptoms improved more rapidly with antibiotics. Most of the participants were aware that antibiotics have side-effects ( $n = 233$ ; 60.7%) and that the inappropriate use of antibiotics decreases their efficacy and increases bacterial resistance ( $n = 233$ ; 60.7%). Only 90 parents (23.4%) were under the impression that antibiotics have no side-effects. Approximately half ( $n = 203$ ; 52.9%) believed that antibiotics prevent

**Table 1:** Sociodemographic characteristics of Omani participants with children under 12 years old (N = 384)

Characteristic	n (%)
<b>Gender</b>	
Male	91 (23.7)
Female	293 (76.3)
Mean age ± SD in years	32.7 ± 5.8
<b>Paternal education level</b>	
Primary	44 (11.5)
Secondary	178 (46.4)
Higher	162 (42.2)
<b>Maternal education level</b>	
Primary	33 (8.6)
Secondary	178 (46.4)
Higher	173 (45.1)
<b>Monthly family income in OMR</b>	
<500	68 (17.7)
500–1,000	206 (53.6)
>1,000	110 (28.6)
<b>Employed in the medical field</b>	
Yes	63 (16.4)
No	321 (83.6)
<b>Age of children in years</b>	
<6	383 (99.7)
6–12	1 (0.3)

SD = standard deviation; OMR = Omani rial.

complications from URTIs. The majority (n = 190; 49.5%) thought that scientists would be able to develop new antibiotics to counteract antibiotic-resistant bacteria [Table 2]. Reported side-effects of antibiotic use included decreased immunity (n = 222; 57.8%), antibiotic resistance (n = 142; 37%), kidney injuries (n = 112; 29.2%), allergies (n = 111; 28.9%), liver injuries (n = 99; 25.8%), stomachaches (n = 89; 23.2%) and others (n = 21; 5.5%).

Approximately half of the participants (n = 188; 49%) reported that they would wait for two days before taking a child with URTI symptoms to the hospital; fever (n = 269; 70.1%) and ear pain (n = 235; 61.2%) were the most common reasons for seeking medical advice. More than half (n = 219; 57%) stated that they never gave their children antibiotics without a prescription. Among those who did, reported reasons for doing so included having siblings who had been previously prescribed antibiotics for similar conditions (n = 102; 26.6%), believing that the child's condition was not serious enough to be seen by a doctor (n = 44; 11.5%) and other reasons (n = 19; 4.9%). In addition, 163 parents (42.4%) agreed or strongly agreed that antibiotics are often used without clear indications, while 169 (44%) disagreed or strongly disagreed and 52 (13.5%) were uncertain.

Parental expectations regarding treatment options for children with URTIs included analgaesics (n = 257; 66.9%), antibiotics (n = 161; 41.9%), antihistamines (n = 137; 35.7%), nasal sprays (n = 132; 4.4%) and cough syrups (n = 96; 25%). Parents were more likely, however, to expect an antibiotic prescription if their child had symptoms of earache (n = 215; 56%) and fever (n = 211; 54.9%) compared

**Table 2:** Knowledge regarding antibiotic use for pediatric upper respiratory tract infections among Omani participants with children under 12 years old (N = 384)

Item	Response, n (%)				
	Strongly agree	Agree	Disagree	Strongly disagree	Uncertain
Antibiotics can be used to treat any feverish child	44 (11.5)	103 (26.8)	134 (34.9)	71 (18.5)	32 (8.3)
Children with influenza-like symptoms get better faster when antibiotics are used	40 (10.4)	144 (37.5)	93 (24.2)	57 (14.8)	50 (13)
Most URTIs are viral in origin and are self-limiting; thus, there is no need for antibiotic use	76 (19.8)	132 (34.4)	84 (21.9)	34 (8.9)	58 (15.1)
Antibiotics do not have any side-effects	33 (8.6)	57 (14.8)	112 (29.2)	121 (31.5)	61 (15.9)
The inappropriate use of antibiotics reduces their efficacy and increases bacterial resistance	150 (39.1)	83 (21.6)	35 (9.1)	48 (12.5)	68 (17.7)
Antibiotics can prevent complications from URTIs	59 (15.4)	144 (37.5)	53 (13.8)	45 (11.7)	83 (21.6)
Scientists can produce new antibiotics for resistant-bacteria	65 (16.9)	125 (32.6)	37 (9.6)	22 (5.7)	135 (35.2)

URTIs = upper respiratory tract infections.

**Table 3:** Knowledge, practice and attitude scores with parents working in medical and non-medical fields

Variable	Mean score ± SD		P value*
	Are parents working in the medical field?		
	Yes (n = 63)	No (n = 321)	
Knowledge	3.98 (1.77)	2.91 (1.59)	<0.001
Practice	2.54 (1.39)	2.40 (1.39)	0.435
Attitude	1.51 (1.28)	1.66 (1.17)	0.266

SD = standard deviation.

\*Using Mann-Whitney U test

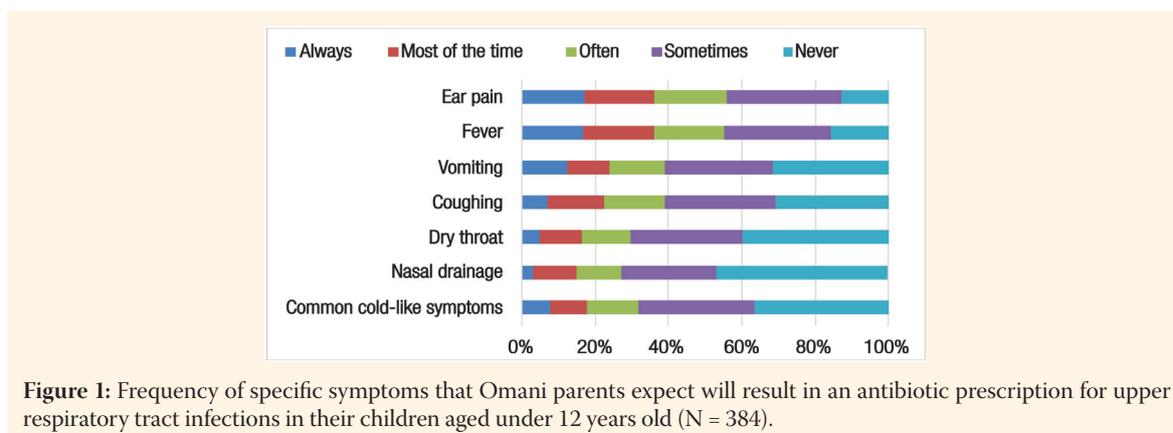
to symptoms such as vomiting or coughing (n = 149 each; 38.8% each), common cold-like symptoms (n = 122; 31.8%), a sore throat (n = 114; 29.7%) or nasal drainage (n = 104; 27.1%) [Figure 1].

Only 29 participants (7.6%) reported that they never asked the doctor whether an antibiotic prescription for their child was necessary, while 184 (47.9%) always inquired, 72 (18.8%) questioned it most of the time, 37 (9.6%) often inquired and 62 (16.1%) sometimes questioned the decision. Moreover, half of the parents (n = 192; 50%) never asked the physician to prescribe antibiotics for their child, and 64 parents

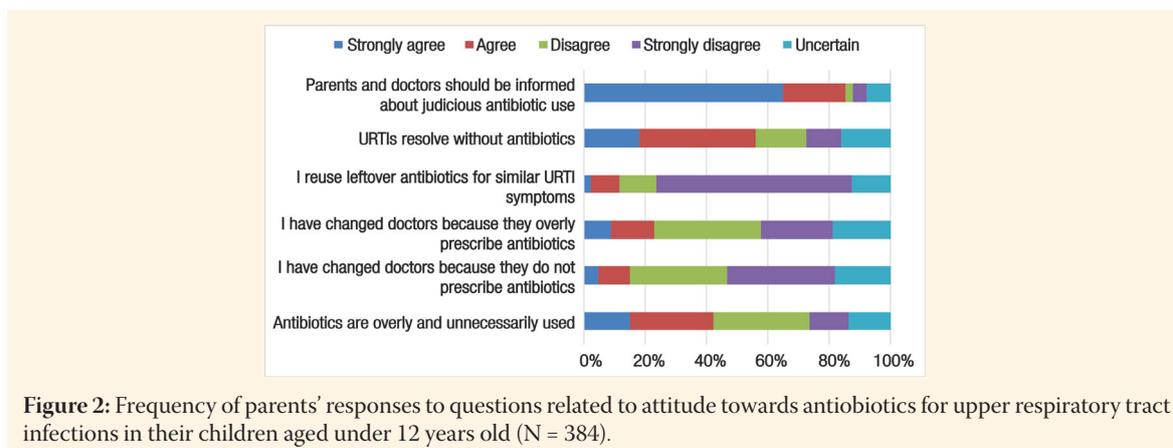
(16.7%) always asked the doctor to avoid prescribing antibiotics to their children. Overall, 258 parents (67.2%) reported that they always followed instructions for proper antibiotic use as directed. Most of the participants (n = 233; 60.7%) affirmed that the decision to prescribe antibiotics is based solely on the doctor’s opinion and not at the parent’s request.

Nevertheless, 58 parents (15.1%) admitted to changing physicians because of not prescribing antibiotics, although 256 (66.7%) had never changed doctors for this reason, and 70 (18.2%) were uncertain whether they had ever done so. On the other hand, 88 parents (22.9%) reported having changed their treating physician because of overly frequent antibiotic prescriptions for their children. The majority of parents (n = 291; 75.8%) had never used leftover antibiotics for their children, despite them developing similar symptoms. More than half of the parents (n = 215; 56%) agreed that URTIs usually resolve without antibiotic administration. The vast majority of parents (n = 327; 85.2%) believed that both doctors and parents should be informed of how to wisely use antibiotics [Figure 2].

Overall, the median knowledge score of the parents was 3 (42.8%), indicating a moderate level of parental knowledge regarding antibiotic use for URTIs



**Figure 1:** Frequency of specific symptoms that Omani parents expect will result in an antibiotic prescription for upper respiratory tract infections in their children aged under 12 years old (N = 384).



**Figure 2:** Frequency of parents’ responses to questions related to attitude towards antibiotics for upper respiratory tract infections in their children aged under 12 years old (N = 384).

in children. With regards to attitudes and practices, the median scores were 3 (60%) and 2 (40%), respectively, indicating moderate parental attitudes and practices. On further analysis, parents working in the medical field had significantly better knowledge scores ( $P < 0.001$ ) compared to those not working in the medical field. However, there was no significant difference between the two groups in terms of attitudes ( $P = 0.266$ ) or practices ( $P = 0.435$ ) [Table 3].

## Discussion

To the best of the authors' knowledge, this study is the first in Oman to assess parental knowledge, attitudes and practices regarding antibiotic use for URTIs in children. Such findings provide important baseline data which may aid the development of national health strategies. Overall, the respondents demonstrated a high degree of confidence in their local doctors and healthcare providers. Most participants reported doctors and pharmacists to be their main sources of antibiotic information. In addition, the majority were of the opinion that doctors were the primary decision-makers when it came to prescribing antibiotics, with few parents changing physicians due to a lack of antibiotic prescriptions. This level of trust in healthcare practitioners supports the application of educational initiatives to raise public awareness of judicious antibiotic usage.

Although the current study found that Omani parents demonstrated a moderate level of knowledge regarding antibiotic use for URTIs in children, over two-thirds of the parents were unable to name any specific types or brands of antibiotics. A lack of knowledge of medications such as antibiotics can greatly influence the likelihood of their misuse and poor compliance.<sup>26</sup> Consequently, it is imperative that the health sector take action to educate this group. Much of this responsibility is likely to fall on the attending physician who is required to provide detailed information to parents regarding the antibiotic prescribed to their child, including its indications, instructions for use and possible side-effects. Pharmacists may also play a role in terms of reminding consumers of how medications should be administered. Regardless, all healthcare professionals should seek to maintain appropriate channels of communication and education during the consultation and follow-up process.

In the present study, many participants agreed that antibiotics were the first and best treatment for URTIs in children, even though more than half were aware that most URTIs are viral in origin and self-limiting. Similarly, other studies have shown that members of the public worldwide believe that antibiotics can be used

for all types of common colds and coughs, irrespective of their exact cause.<sup>27-29</sup> Furthermore, although the vast majority of participants in the current study were aware that antibiotics have side-effects and that their inappropriate use decreases their effectiveness and leads to bacterial resistance, approximately half nevertheless believed that antibiotics prevented complications from URTIs and that scientists would be able to develop new antibiotics.

The prevalence of these misconceptions indicates Omani parents' lack of knowledge about and awareness of antibiotic use and its limitations. Indeed, reports worldwide have demonstrated a general lack of knowledge and awareness regarding the basic principles of antibiotic use as well as their indications for treatment.<sup>28,30</sup> Other studies have also reported common misconceptions regarding antibiotic use specifically for URTIs, with many individuals believing that their use results in more rapid recovery and prevents more serious illness.<sup>28,31,32</sup> These findings signify an urgent need for health awareness campaigns targeting individuals of all ages, genders and education levels, perhaps by incorporating popular social networking sites to disseminate information. Emphasis on patient awareness regarding appropriate antibiotic usage could help to dispel unsubstantiated beliefs and expectations concerning the use of antibiotics for minor or viral illnesses.<sup>29</sup>

In terms of parental practices and attitudes regarding antibiotic use for paediatric URTIs, earache and fever were the symptoms for which parents in the present study most commonly expected antibiotics to be prescribed. This finding is similar to those previously reported in Palestine, Jordan, Saudi Arabia and UAE.<sup>19-22</sup> Interestingly, nearly half of the parents in the current study stated that they always asked their doctors about the necessity of prescribing antibiotics, and approximately two-thirds claimed that they always followed medical advice. Most respondents stated clearly that it was the doctor's decision to prescribe antibiotics and that antibiotics should not be prescribed at the parents request. Moreover, the majority reported that they had never changed their treating physician if they did not prescribe antibiotics for their children. Importantly, the majority of parents never administered antibiotics to their children without a prescription or used leftover antibiotics.

In contrast, conflicting findings have been reported from other studies. Several researchers have reported that parents and other members of the public often believe that leftover antibiotics can be stored and used for similar symptoms without a doctor's prescription.<sup>21,29,32</sup> While the prevalence of these behaviours appears to be less frequent among Omani parents, there is

nevertheless an urgent need for educational initiatives to avoid serious health consequences, such as increasing rates of bacterial resistance and complications due to antibiotic side-effects and the usage of expired drugs. In particular, the emergence of antibiotic-resistant organisms puts the entire community at risk as it increases the prevalence of serious infections that are difficult to treat, as well as associated increases in mortality rates and hospital admissions.<sup>33–35</sup>

In Oman, a local policy implemented by the Ministry of Health prohibits pharmacies from selling and dispensing antibiotics without an official prescription.<sup>36</sup> It is likely that this policy influenced the attitudes of the respondents, thereby resulting in fairly good antibiotic practices. Nevertheless, the vast majority of parents in the current study believed that both parents and doctors would benefit from further information regarding the judicious use of antibiotics. In addition, although parents working in the medical field had better knowledge compared to the rest, there was no significant difference in attitudes and practices. Thus, introducing additional educational campaigns targeting healthcare professionals, perhaps consisting of multidisciplinary workshops, courses and training sessions, is important to reinforce rational antibiotic prescription practices and attitudes in Oman.

This study had strengths as well as limitations. While the response rate was 100%, likely due to collecting data through face-to-face interviews which may have helped to build a stronger rapport with the respondents, the study was conducted solely at health centres in Muscat; therefore, the findings might not be representative of other regions in Oman. In addition, the study targeted parents attending governmental primary healthcare centres, thus limiting the generalisability of the results for those attending other types of facilities (i.e. private, secondary and tertiary care facilities) or those in the general community. Finally, the inclusion of questions referring to the parents' past experiences with antibiotics and the face-to-face interview format may have led to recall or response biases.

## Conclusion

Overall, this study found that Omani parents have a high degree of confidence in their doctors and healthcare providers when it comes to antibiotic prescription for their children. However, they also demonstrated insufficient levels of knowledge regarding the use of antibiotics in children with URIs. There is an urgent need for educational initiatives and health campaigns to raise awareness and promote rational antibiotic use in Oman.

## ACKNOWLEDGEMENT

The authors would like to thank the respondents for their participation in this study. In addition, the authors extend their sincere gratitude to Mr. Sathiya Muthi, statistician at the Oman Medical Specialty Board, for his continuous support and guidance.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## FUNDING

No funding was received for this study.

## References

1. Nadeem Ahmed M, Muyot MM, Begum S, Smith P, Little C, Windemuller FJ. Antibiotic prescription pattern for viral respiratory illness in emergency room and ambulatory care settings. *Clin Pediatr (Phila)* 2010; 49:542–7. <https://doi.org/10.1177/0009922809357786>.
2. West JV. Acute upper airway infections. *Br Med Bull* 2002; 61:215–30. <https://doi.org/10.1093/bmb/61.1.215>.
3. Cotton M, Innes S, Jaspan H, Madide A, Rabie H. Management of upper respiratory tract infections in children. *S Afr Fam Pract* (2004) 2008; 50:6–12. <https://doi.org/10.1080/20786204.2008.10873685>.
4. Simasek M, Blandino DA. Treatment of the common cold. *Am Fam Physician* 2007; 75:515–20.
5. World Health Organization. WHO model prescribing information: Drugs used in bacterial infections. From: [www.apps.who.int/iris/handle/10665/42372](http://www.apps.who.int/iris/handle/10665/42372) Accessed: Jul 2020.
6. Bell BG, Schellevis F, Stobberingh E, Goossens H, Pringle M. A systematic review and meta-analysis of the effects of antibiotic consumption on antibiotic resistance. *BMC Infect Dis* 2014; 14:13. <https://doi.org/10.1186/1471-2334-14-13>.
7. Aryee A, Price N. Antimicrobial stewardship - Can we afford to do without it? *Br J Clin Pharmacol* 2015; 79:173–81. <https://doi.org/10.1111/bcp.12417>.
8. Silverman M, Povitz M, Sontrop JM, Shariff SZ. Antibiotic prescribing for nonbacterial acute upper respiratory infections in elderly persons. *Ann Intern Med* 2017; 167:758–9. <https://doi.org/10.7326/L17-0438>.
9. World Health Organization. Antimicrobial resistance: Global report on surveillance 2014. From: [www.who.int/antimicrobial-resistance/publications/surveillancereport/en/](http://www.who.int/antimicrobial-resistance/publications/surveillancereport/en/) Accessed: Jul 2020.
10. Easton G, Saxena S. Antibiotic prescribing for upper respiratory tract infections in children: How can we improve? *London J Prim Care (Abingdon)* 2010; 3:37–41. <https://doi.org/10.1080/17571472.2010.11493294>.
11. Currie J, Lin W, Zhang W. Patient knowledge and antibiotic abuse: Evidence from an audit study in China. *J Health Econ* 2011; 30:933–49. <https://doi.org/10.1016/j.jhealeco.2011.05.009>.
12. Li J, Song X, Yang T, Chen Y, Gong Y, Yin X, et al. A systematic review of antibiotic prescription associated with upper respiratory tract infections in China. *Medicine (Baltimore)* 2016; 95:e3587. <https://doi.org/10.1097/MD.0000000000003587>.
13. Fletcher-Lartey S, Yee M, Gaarslev C, Khan R. Why do general practitioners prescribe antibiotics for upper respiratory tract infections to meet patient expectations: A mixed methods study. *BMJ Open* 2016; 6:e012244. <https://doi.org/10.1136/bmjopen-2016-012244>.

14. Md Rezal RS, Hassali MA, Alrasheedy AA, Saleem F, Md Yusuf FA, Godman B. Physicians' knowledge, perceptions and behaviour towards antibiotic prescribing: A systematic review of the literature. *Expert Rev Anti Infect Ther* 2015; 13:665–80. <https://doi.org/10.1586/14787210.2015.1025057>.
15. Wong CK, Liu Z, Butler CC, Wong SY, Fung A, Chan D, et al. Help-seeking and antibiotic prescribing for acute cough in a Chinese primary care population: A prospective multicentre observational study. *NPJ Prim Care Respir Med* 2016; 26:15080. <https://doi.org/10.1038/nnpjcr.2015.80>.
16. Kumar S, Little P, Britten N. Why do general practitioners prescribe antibiotics for sore throat? Grounded theory interview study. *BMJ* 2003; 326:138. <https://doi.org/10.1136/bmj.326.7381.138>.
17. Rousounidis A, Papaevangelou V, Hadjipanayis A, Panagakou S, Theodoridou M, Syrogiannopoulos G, et al. Descriptive study on parents' knowledge, attitudes and practices on antibiotic use and misuse in children with upper respiratory tract infections in Cyprus. *Int J Environ Res Public Health* 2011; 8:3246–62. <https://doi.org/10.3390/ijerph8083246>.
18. Panagakou SG, Spyridis N, Papaevangelou V, Theodoridou KM, Goutziana GP, Theodoridou MN, et al. Antibiotic use for upper respiratory tract infections in children: A cross-sectional survey of knowledge, attitudes, and practices (KAP) of parents in Greece. *BMC Pediatr* 2011; 11:60. <https://doi.org/10.1186/1471-2431-11-60>.
19. Zyoud SH, Abu Taha A, Araj KE, Abahri IA, Sawalha AF, Sweileh WM, et al. Parental knowledge, attitudes and practices regarding antibiotic use for acute upper respiratory tract infections in children: A cross-sectional study in Palestine. *BMC Pediatr* 2015; 15:176. <https://doi.org/10.1186/s12887-015-0494-5>.
20. Hammour KA, Jalil MA, Hammour WA. An exploration of parents' knowledge, attitudes and practices towards the use of antibiotics in childhood upper respiratory tract infections in a tertiary Jordanian Hospital. *Saudi Pharm J* 2018; 26:780–5. <https://doi.org/10.1016/j.jsps.2018.04.006>.
21. Alrafiah AS, Alqarny MH, Alkubedan HY, AlQueflie S, Omair A. Are the Saudi parents aware of antibiotic role in upper respiratory tract infections in children? *J Infect Public Health* 2017; 10:579–85. <https://doi.org/10.1016/j.jiph.2017.01.023>.
22. Hammour KA, Al-Saleh S, Hammour WA. Parental views on antibiotic use in children with upper respiratory tract infections in Dubai. *Eur J Integr Med* 2019; 29:100917. <https://doi.org/10.1016/j.eujim.2019.05.003>.
23. Jose J, Jimmy B, Alsabahi AG, Al Sabei GA. A study assessing public knowledge, belief and behavior of antibiotic use in an Omani population. *Oman Med J* 2013; 28:324–30. <https://doi.org/10.5001/omj.2013.95>.
24. Oman Ministry of Health. Department of Health Information and Statistics. Directorate General of Planning and Studies. Annual Health Report 2018. From: [www.moh.gov.om/en/web/statistics/annual-reports](http://www.moh.gov.om/en/web/statistics/annual-reports) Accessed: Jul 2020.
25. Oman Ministry of Social Development. Child law. Issued by the Royal Decree No. 22/2014. Official Gazette No. (-1058). From: <https://www.mosd.gov.om/images/rules/Childs%20Law%20en.pdf> Accessed: Jul 2020.
26. Kandakai TL, Price JH, Telljohann SK, Holiday-Goodman M. Knowledge, beliefs, and use of prescribed antibiotic medications among low-socioeconomic African Americans. *J Natl Med Assoc* 1996; 88:289–94.
27. Shehadeh M, Suaifan G, Darwish RM, Wazaify M, Zaru L, Aljafari S. Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan: A pilot study. *Saudi Pharm J* 2012; 20:125–33. <https://doi.org/10.1016/j.jsps.2011.11.005>.
28. Curry M, Sung L, Arroll B, Goodyear-Smith F, Kerse N, Norris P. Public views and use of antibiotics for the common cold before and after an education campaign in New Zealand. *N Z Med J* 2006; 119:U1957.
29. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. The public's attitudes to and compliance with antibiotics. *J Antimicrob Chemother* 2007; 60 Suppl 1:i63–8. <https://doi.org/10.1093/jac/dkm161>.
30. KC AR, N SK, J R. Students' knowledge of antibiotics: A cross-sectional study of students in Tamil Nadu. *Int J Pharm Pharm Sci* 2011; 3:232–3.
31. Vanden Eng J, Marcus R, Hadler JL, Imhoff B, Vugia DJ, Cieslak PR, et al. Consumer attitudes and use of antibiotics. *Emerg Infect Dis* 2003; 9:1128–35. <https://doi.org/10.3201/eid0909.020591>.
32. Pechère JC, Hughes D, Kardas P, Cornaglia G. Non-compliance with antibiotic therapy for acute community infections: A global survey. *Int J Antimicrob Agents* 2007; 29:245–53. <https://doi.org/10.1016/j.ijantimicag.2006.09.026>.
33. Carlet J, Jarlier V, Harbarth S, Voss A, Goossens H, Pittet D, et al. Ready for a world without antibiotics? The Pensières antibiotic resistance call to action. *Antimicrob Resist Infect Control* 2012; 1:11. <https://doi.org/10.1186/2047-2994-1-11>.
34. Ganguly NK, Arora NK, Chandy SJ, Fairoze MN, Gill JP, Gupta U, et al. Rationalizing antibiotic use to limit antibiotic resistance in India. *Indian J Med Res* 2011; 134:281–94.
35. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: Systematic review and meta-analysis. *BMJ* 2010; 340:c2096. <https://doi.org/10.1136/bmj.c2096>.
36. Oman Ministry of Health. Directorate general of disease surveillance and control. Antimicrobial guidelines 2016. From: [www.moh.gov.om/documents/236878/0/national+antimicrobial+guidelines/c82511c5-63e9-4205-8f49-0f60df4d7aa4](http://www.moh.gov.om/documents/236878/0/national+antimicrobial+guidelines/c82511c5-63e9-4205-8f49-0f60df4d7aa4) Accessed: Jul 2020.