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Knowledge, attitude, perception and practice regarding antimicrobial use in upper respiratory tract infections in Qatar: a systematic review

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Abstract

Objective: To explore the knowledge, attitude, perception and practice towards antimicrobial use in upper respiratory tract infections in patients visiting healthcare settings in Qatar.

Design: Systematic review was performed using a predetermined protocol and in accordance with standardized reporting guidelines. MEDLINE, PubMed, EMBASE, Global Health and PsycINFO were searched for relevant published studies using relevant MESH terms and keywords.

Setting: All healthcare settings in Qatar including both inpatient and ambulatory care.

Participants: All published articles exploring the antimicrobial use in upper respiratory tract infections at any health setting in Qatar were considered for inclusion in the study. No age, gender or population were excluded.

Main Outcome Measure(s): The outcome of interest was antimicrobial use in upper respiratory tract infections in Qatar. We included all related studies to explore the knowledge, attitude, perception and practice for patients visiting all health care settings.

Results: Three articles were included, one in a primary care setting, one in a secondary care setting and one in the private sector. Overprescribing was noted in all settings. Our findings demonstrate low expectations to receive antibiotics, among the Qatari population, in primary care (28.1%). In fact, the majority of patients would be satisfied with reassurance rather than receiving antimicrobials. Many patients were satisfied with explanation from physicians and counselling. Private sector registered high prevalence of antimicrobial misuse for respiratory tract infections in which 85% deemed inappropriate. This finding was also noted at a medical intensive care unit which showed high antimicrobial use (76%) and respiratory tract infections accounted for 57% of prescriptions.

Conclusion: Studies are needed to determine factors and population-based rates of antimicrobial use in all healthcare settings. There is also a need for interventional programs for both physicians and public on appropriate use of antimicrobials to combat global antimicrobial resistance.

Keywords

Knowledge, attitude, perception, practice, antibiotic use, antimicrobial resistance, Qatar

Background

In the past decade, the worldwide consumption of antimicrobial drugs has increased substantially. In many countries, antimicrobials are either legally available without a prescription, or existing regulations are not uniformly enforced. Studies indicate that in countries with little regulation, substantial misuse takes place.[1] A study reported that 77% of Greek pharmacists offered antibiotics without a medical prescription. Antimicrobials were most frequently offered for treatment of patients with symptoms that were suggestive of a common cold.[2] Data from a variety of countries suggest that self-medication is common and frequently inappropriate; antimicrobials are often purchased without proper indication, in insufficient quantities, or when contraindicated.[3] Physician visits for respiratory tract infection commonly result in an antimicrobial prescription,[4,5] despite the fact that most upper respiratory tract infections are viral in nature. In these cases, antimicrobials provide no benefit; thus, guidelines limit their recommended use to certain situations where the aetiology is likely bacterial.[6]

According to our knowledge, this is the first known systematic review study to be conducted about this topic in Qatar. These findings would establish a baseline for knowledge, attitude and perception towards antimicrobials use for respiratory tract infection. This will assist stakeholders in the assessment of the adequacy of the current strategies on antibiotics. In addition, this would help in implementing multidimensional interventions to combat antimicrobial overprescribing.

Acute respiratory tract infections (ARTIs) account for a large proportion of community antimicrobial use in many countries.[7] Worldwide, antimicrobial overprescribing is a major health problem which contributes to the rise of antimicrobial-resistant bacteria.[8] In places with greater prescribing of broad-spectrum antibiotics, specifically extended-spectrum cephalosporins and macrolides, rates of multidrug-resistant pneumococcal disease are higher.[9] Differences in prescribed antimicrobials among the countries can partly be explained by availability of antimicrobials and differences in guidelines. Quality indicators (QIs) have already been developed within the context of the European Surveillance of Antimicrobial Consumption (ESAC) project[10] based on outpatient use data. Antimicrobials are frequently prescribed for the management of upper respiratory tract infections, even though most of these infections are viral in origin.[4] A recent report has documented that most respiratory tract infections are caused by viruses, and the probability of their resolution without the administration of antimicrobials is high.[11]

The relationship between antimicrobial use and resistance development is strong and supported by several studies.[12,13] Countries with the highest per capita antimicrobials consumption have the highest prevalence of resistant pathogens. Overuse of antimicrobials can lead to resistance, increased cost and increased incidence of adverse effects, including anaphylaxis.[14] Outpatient antimicrobial use represents around 90% of total antimicrobial use, with more than half of these prescriptions being either unnecessary or inappropriate.[15] Between 20 and 50% of all antimicrobial use is inappropriate.[16] In the USA, antibiotics are prescribed for more than 100 million adult ambulatory care visits annually, and 41% of these prescriptions are for respiratory conditions.[17] At least two million antibiotic-resistant illnesses and 23,000 deaths occur each year, at a cost to the U.S. economy of at least $30 billion.[18] Ambulatory antimicrobial consumption accounted for between 85% and 95% of total antimicrobial use in 2012 in the European Union, according to countries contributing data on both ambulatory and intra-hospital antibiotic use to the European Centre for Disease Prevention and Control (ECDC).[19]

The use of over the counter antimicrobials is common in many countries, and non-prescription use accounts for 19–100% of antimicrobial use outside Northern Europe and North America. Even when prescriptions are needed to obtain antimicrobials, physicians might not adequately screen for appropriate use.[20] Similarly, in the six countries of the Gulf Cooperation Council (GCC), two studies[21,22] reported the emergence of antimicrobials resistance which was mainly attributed to the inappropriate prescribing of antimicrobials and overuse of antimicrobials including self-medication. Other factors included the lack of policies for restricting and auditing antimicrobial prescriptions in many GCC countries.

The inappropriate use of antimicrobials may arise from a complex interaction between factors such as prescribers' knowledge and experiences, diagnostic uncertainty, perceptions of patients in relation to the patient–prescriber interaction, and insufficient patient education by physicians. Additional factors that can influence prescribing include patients' knowledge, beliefs and attitudes towards antimicrobial use, self-medication, patients' expectations, and patients' experience with antimicrobials.[23–25] Knowledge of and attitudes towards antimicrobial use have been shown to be a good predictor of the appropriate use of antimicrobials by patients.[26,27] The interventions that are most successful at reducing inappropriate antimicrobial prescribing tend to be multifaceted and combine physician, patient and public education.[28]

Antimicrobial misuse is a global concern and stakeholders in Qatar have made advances to combat antimicrobial resistance. A National Action Plan was developed to support a collaborative and integrated effort to change practices which lead to reduce the inappropriate antimicrobial usage that causes resistance. The National Action Plan is expected to improve antimicrobial stewardship in all healthcare settings. This stewardship aims to improve practice through various interventional strategies which include increasing awareness, effective communication, strengthening knowledge, etc. Data regarding antimicrobial use are deficient and a few studies have been conducted to explore people's knowledge about antimicrobial use for respiratory tract infection in the State of Qatar. As such, the aim of this research is to generate an evidence base of the knowledge, attitude and practice regarding antimicrobial use in upper respiratory tract infections among patients visiting healthcare settings in Qatar to support the evidence-informed policy decisions to curb antimicrobial resistance (AMR).

Methods

This systematic review was performed using a predetermined protocol and in accordance with standardised reporting guidelines. A search of published literature investigating knowledge, attitude, perception and practice regarding antimicrobial use in upper respiratory tract infections attending healthcare settings in Qatar and including both inpatient

and ambulatory care which is mostly utilised was conducted. Databases such as MEDLINE, PubMed, EMBASE, Global Health and PsycINFO were searched for relevant published studies using the following MESH terms and keywords: antibiotic use, antimicrobial resistance, Qatar. The search was performed on 31 May 2017, and was not restricted by language or date. In addition, reference lists of prior review papers and all identified research articles were hand searched.

Study selection

Articles were evaluated for eligibility in a two-stage procedure. In stage one, titles and abstracts were identified and reviewed. In stage two, a full review was performed to identify articles that met the eligibility and inclusion criteria. Two reviewers (FS and SH) independently reviewed each selected article.

Inclusion criteria

All published articles exploring the antimicrobial use in upper respiratory tract infections at any health setting in Qatar were considered for inclusion in the study. No specific age, gender or population were excluded.

Exclusion criteria

Studies that did not measure knowledge, attitude, perception and practice regarding antimicrobial use or were published in abstract only form, or not original, were excluded.

Data extraction

Two reviewers (FS and SH) independently extracted data from included studies. Data were extracted for knowledge, attitude, perception and practice regarding antimicrobial use. Data were arranged into categories that emerged from extraction: patients' expectations, knowledge, attitude, perception, practice and prevalent use of antimicrobials.

Quality assessment

Included articles were assessed for quality using the Newcastle and Ottawa Scale tool.[29] The two reviewers (FS and SH) independently performed data abstraction and quality appraisal. Abstractions and appraisals were compared for each study, and any disagreements were resolved by discussion. Both reviewers extracted all the data from each study.

Results

We identified 11 articles through database searches. Of these, we excluded two duplicated papers. We assessed nine non-duplicated papers and excluded six on the basis of title and abstract screening. Full text papers of the remaining three were obtained and assessed. They met our eligibility criteria and were considered relevant and determined to be of good quality; therefore, they were included in our review (Figure 1).

The three included studies were conducted in different settings, one was conducted in a primary care setting, the second one was conducted in a secondary care setting and the third study was conducted in the private sector.

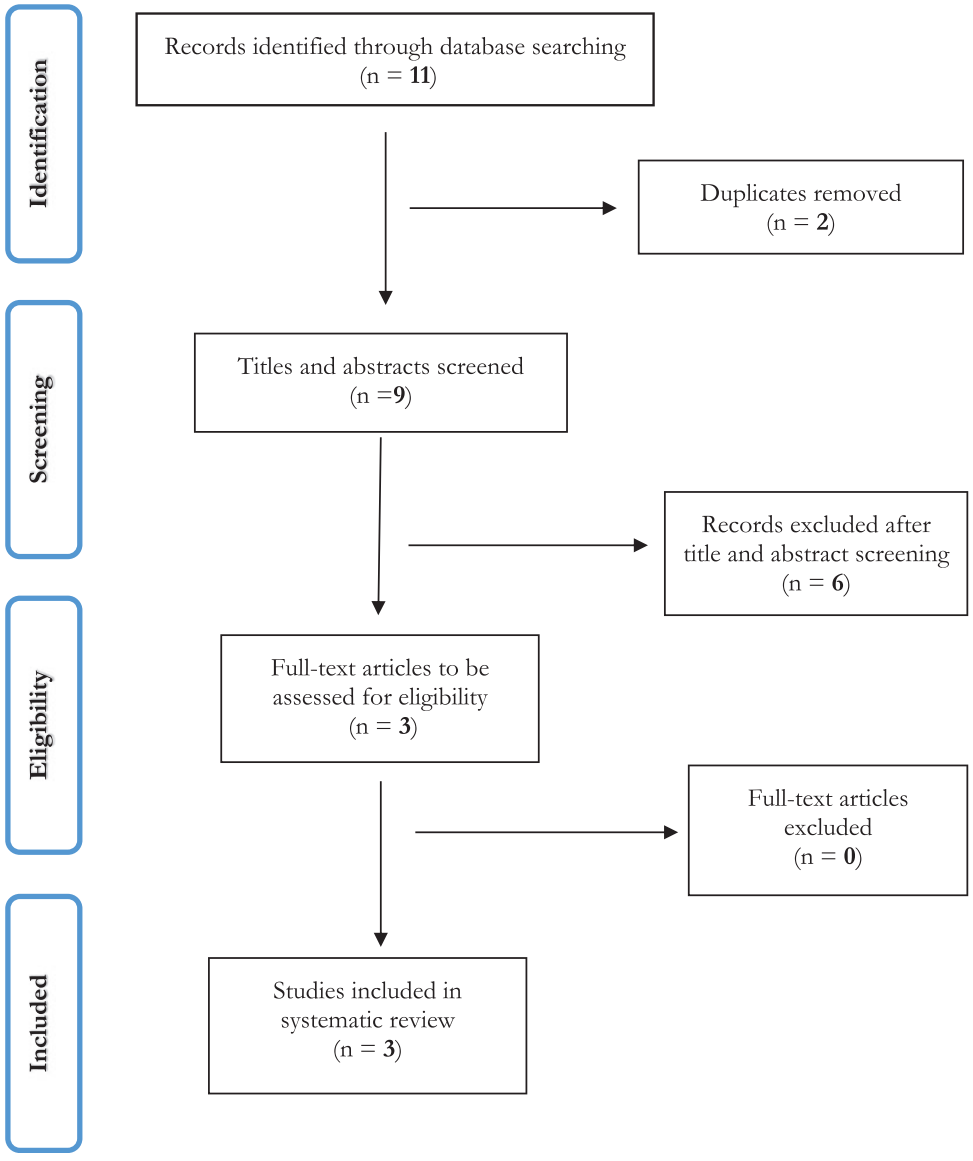
Said and co-workers[30] asked 1111 participants in a primary health setting about the most common causes for URIs. About 40% of the participants answered 'viruses' as the most common cause of upper respiratory tract infection, while 24.2% considered that both viruses and bacteria were the most common cause. In a multinomial logistic regression in the same study, younger participants were more likely to 'know' than older participants ($p < 0.0001$). Also, 40.9% of the participants did not know about the least common cause of upper respiratory tract infection, and about a fifth of the participants thought bacteria was the least common cause.

Moreover, 14.74% of the participants expecting antibiotics chose bacteria as the most common cause of upper respiratory tract infection compared to 6.13% of those participants who were not. On the other hand, a higher percentage (17.31%) of those expecting antibiotic prescription identified viruses as the least common cause compared to the participants who did not (11.14%).

The study revealed that antibiotics were expected by 28.1% of the participants, and 64.9% did not expect any specific treatment. Also, 5.4% stated that they expected treatment other than antibiotics. In addition, 70.9% of the participants consulted a physician, 13.6% reported that they used antipyretics and fluids as a first course of action, and 2.7% consulted a pharmacist when asked about their practices upon acquiring upper respiratory tract infection. Older participants were more likely to use antipyretics ($p = 0.02$) and males were less likely to use antipyretics and fluids ($p = 0.02$), respectively.

The study also showed that 49.6% of the participants were dissatisfied with the physician not giving any treatment, and 31.6% of them would seek antibiotic prescription. Older participants were significantly more likely to seek antibiotic prescription if

Figure 1. Study selection: PRISMA chart.



it was not provided by physician ($\beta = 0.134$, $p < 0.029$). Also, 27.4% cited severity of symptoms, 19.4% cited previous experience and 14.7% cited duration of their illness as factors leading them to believe that antibiotic treatment is needed. A higher percentage of those expecting antibiotic treatment cited a previous experience compared to those who are not (21.79% and 18.40%), respectively.

The majority of participants wanted information and discussion during counselling. Around 98% of them preferred physician explanation about causes of URI before recommending treatment. In addition, 97.3% of the participants reported that the physician's explanation and education would help them and 88.2% would feel more comfortable regarding treatment if the physician discussed treatment options prior to writing a prescription.

A study conducted by Adeel et al.[31] between May 2014 and December 2015 for 75,733 claims for non-topical antibiotics in the private sector showed that 45% of the antibiotics were deemed inappropriate based on the accompanying diagnosis. The most common diagnosis associated with inappropriate antibiotic prescription was acute upper respiratory tract infections (28,898 claims; 85% of inappropriate prescription).

The largest number of prescriptions was provided by general/family practice physicians, accounting for 52.7% of the prescriptions (50% inappropriate), followed by paediatrics (18.6% of prescriptions; 36% inappropriate) and internal medicine (14.1% of prescriptions; 44% inappropriate). Although emergency medicine physicians accounted for only 2% of the prescriptions, they registered the highest number of inappropriate prescriptions (74%) with >1000 claims.

Cephalosporins were the most common antibiotic classes prescribed (43% of claims; 44% inappropriate), followed by penicillins (28% of claims; 44% inappropriate), macrolides (19% of claims; 52% inappropriate), and fluoroquinolones (9% of claims; 40% inappropriate). Nearly 5% of antibiotics were prescribed in intravenous formulations.

Hanssens et al.[32] conducted a study among 71 eligible patients out of 159 admitted to the medical intensive care unit. Seventy six per cent were treated for presumed or proven infections and received antibiotics in which respiratory infections accounted for 57%. A total of 159 antibiotics were administered to those patients during their stay in the medical intensive care unit, with an average of almost three antibiotics per patient. In these 54 patients, a total of 385 microbiology samples for culturing were taken throughout the study period, corresponding with more than one sample per patient per day. Twelve per cent of the samples were mainly from the respiratory tract. However, no antibiotic was discontinued due to negative result. Ceftriaxone was prescribed in 57% of patients as initial therapy. Further detail on the data extracted from the study are found in Table 1.

Discussion

Knowledge regarding antimicrobial use in upper respiratory infections

A higher percentage of participants expecting to be prescribed an antimicrobial, who thought the most common cause of respiratory tract infections is bacteria, were evident in the Said and co-workers's study. Yet, approximately half of the participants in the study revealed no dissatisfaction if the physician did not provide any prescription.[30] Doctors could help address perceptions that common symptoms do not warrant antimicrobials, and that these could be due to viral infections. Also, they could reassure concerned patients about their illness, where appropriate, to ease unnecessary worries and thus avoid the demand for antimicrobials.

Moreover, the study revealed that the majority of participants favoured discussion with the physician about upper respiratory tract infection aetiology and management.[30] Studies[32–35] reported that patients were satisfied with proper examination and reassurance, regardless of whether an antimicrobial was prescribed or not, and that they need to know that their illnesses are not serious. In addition, previous findings identified that physicians are the main source of information and it seems that spending more time with patients may reduce the prescribing of antimicrobials.[36] This would result in a decrease in the number of future visits for respiratory tract infections and workload on clinics.[37] Therefore, explaining that antimicrobial treatment would not modify symptoms and is associated with side effects might be more useful in influencing patients' expectations and views regarding antimicrobials.

Socio-demographic factors and past experience pertaining antimicrobials

Perception of the need for antimicrobials can be affected by different factors, such as past experience and age. Said and co-workers reported that being older and having past experience are factors affecting the perception of the need for antimicrobials.[30] This study seems to suggest that the more patients used antimicrobials in the past, the more likely they were to desire antimicrobials when presenting for care, and the more likely they were to actually receive antimicrobials again. Prior experience may have verified to patients that antimicrobials work. Also, the rate of self-medication in Qatar cannot be determined and is limited because antibiotics cannot be dispensed without a prescription. However, findings from other studies were contradictory as self-medication was common among those with negative attitudes towards antimicrobial use, and is not associated with knowledge in Kuwait,[38] unlike in the UK.[39] Physicians should be involved in public education campaigns, to strengthen them, since it has been shown that effective doctor–patient communication and patient empowerment reduced inappropriate antimicrobial use.[40]

Symptoms and perception of illness severity

With regard to presenting symptoms and self-perceived illness severity, patients presenting with respiratory symptoms were significantly more likely to demand antimicrobials. It was reported that patients who were concerned that their illness was serious were 1.7 times more likely to want antimicrobials,[41] whereas those who considered their symptoms as severe were twice as likely to want antimicrobials.

Table 1. Data extracted from studies.

Paper	Aim of study	Participants/tool	Setting	Results	Quality assessment
Said and co-workers[30]	Explore the knowledge, attitudes and practices of the public with regard to upper respiratory tract infections.	Attendees of health centre 18 years and above. Questionnaire.	West Bay Health centre	Antibiotic was expected by 28.1% of the participants. Older participants were significantly less likely to expect antibiotics. Around 98% preferred physician's explanation about causes of URI before recommending treatment.	7/10
Adeel A et. al.[31]	Determine the rate of inappropriate antibiotic prescription in the outpatient private sector for upper respiratory tract infections.	A total of 75,733 claims. Health insurance claims for all antibiotics prescribed for upper respiratory tract infections.	Private sector	Antibiotics deemed inappropriate (45%). The most common diagnosis associated with inappropriate antibiotic prescription were acute upper respiratory tract infections. Emergency medicine physicians registered the highest number of inappropriate prescriptions (74%) with >1000 claims. Cephalosporins were the most common antibiotic classes prescribed (43% of claims; 44% inappropriate).	7/10
Hanssens et al.[32]	Evaluate the current usage of anti-microbial agents in the Medical Intensive Care Unit (MICU).	During the study period, a total of 159 patients were admitted to the medical intensive care unit. Seventy-one eligible patients admitted/DUR clinical, demographic data and cultural.	HMC ICU	Seventy-six per cent of patients treated received antibiotics for presumed or proven infections of which respiratory infections accounted for 57%.	6/10

Attitude towards antimicrobial use in upper respiratory infections

Regarding participants who expect antimicrobials, Said and co-workers showed that 70.9% of the participants consult a physician when they develop upper respiratory tract infection, while only 28.1% reported expecting antimicrobials in a primary healthcare setting.[30] These results are in agreement with internationally published studies[42–44] and lower than those of other studies[44,45] in Hong Kong and Boston, where the proportion who requested antimicrobials ranged from 36 to 39%, respectively.

Demanding antimicrobial is strongly associated with belief, e.g. patients who knew that upper respiratory tract infection resolves on its own were significantly less likely to demand antibiotics. Many reports have revealed that patient's expectation is an important factor for antimicrobial prescribing and that antimicrobials are more likely to be prescribed under patient pressure.[46–48] In addition, physicians often prescribe antimicrobials because they perceive that patients demand them despite their view that antimicrobials are not needed.[49]

Physicians, generally, overestimate patients' expectations of antimicrobials and thus overprescribe antimicrobials thinking that they are doing that in the interest of the patient–physician relationship and patient satisfaction.[50,51] Overprescribing by physicians even in the absence of proper indications due to diagnostic accuracy, patient's demand and lack of knowledge with regard to best therapies are factors contributing to the increase of antimicrobial resistance.[52,53]

Practice related to antimicrobial use in upper respiratory infections

upper respiratory tract infections are by far the most common diagnosis for which antibiotics are prescribed in the outpatient setting, accounting for nearly 80% of all such prescriptions.[54,55] A study conducted locally by Adeel et al. found that 45% of the patients had an inappropriate indication for antimicrobials for upper respiratory tract infection in private clinics in Qatar.[31] The reason for this is unclear, but it could be because of awareness of the emergence of antibiotic resistance or physicians being more responsive to the patient's expectation for antimicrobials. A study in India revealed that antimicrobial prescriptions for acute, uncomplicated respiratory tract infections were common in primary care settings, less so in the public sector (45%) than in the private sector (57%).[56] Similarly, the antimicrobial-prescribing rate for upper respiratory tract infection was 57.7% in private primary care which also is of higher rate than in public in Malaysia. Moreover, private clinics in Malaysia contributed 87% of the total antimicrobials prescribed (in primary care), and upper respiratory tract infection accounted for half of these prescriptions.[57] This goes in agreement with surveys undertaken in Pakistan, India and several African countries which have pointed to antibiotic overprescribing which happened more in private than in public clinics.[58–60]

Studies in middle and low-income countries reported minimal adherence to guidelines and diagnosis accuracy in private compared with the public sector.[61–63] However, lower rates were found in the Netherlands and Hong Kong.[64,65] Behavioural interventions and peer comparison reports can lead to a decrease in improper antimicrobial prescriptions, even when prescriptions are not restricted and regardless how physicians are being paid.[32] Moreover, it was reported that educational interventions were associated with a decrease in inappropriate prescriptions in two-thirds of the studies reviewed.[66] Application of such programs may be beneficial in the State of Qatar to reduce inappropriate antimicrobial use.

Adeel et al. found that emergency medicine physicians registered the highest number of inappropriate prescriptions (74%).[31] Emergency physicians may have fewer adherences to guidelines given the high-volume nature of the emergency department. Relationships in the emergency department between patients and doctors are episodic, and hence patients may be less willing to accept advice on antimicrobial consumption.

Broad-spectrum antibiotics are used too often when a narrow-spectrum antibiotic would have been just as effective.[64] This misuse of antimicrobials has led to the development of antibiotic-resistant bacteria. Adeel et al. reported that cephalosporins were the most commonly prescribed group of antimicrobials in the private sector, followed by penicillins, macrolides and fluoroquinolones. Also, nearly 5% of prescriptions were for intravenous antimicrobials and about a quarter of the intravenous prescriptions were for inappropriate indications.[31] However, the reasons were unclear. It could be the prescribers' belief that the illness was more serious, or it could be a perception that intravenous antimicrobials are more potent or effective. Whether patients had such options with regard to prescriptions was not known. Also, a survey at private clinics in India reported that cephalosporins were mostly prescribed, followed by levofloxacin, ofloxacin, and others for acute, uncomplicated respiratory tract infections. However, in the Netherlands, tetracyclines and amoxicillin were mostly used, followed by macrolides and

amoxicillin/clavulanate among prescriptions for all respiratory infections.[65] Also, studies from Ireland[67] and Poland[68] have shown a different pattern of antibiotic use for respiratory tract infections. In comparison with Adeel et al.'s study,[31] excessive use of those types of antimicrobials in private settings highlights the need for more interventions targeting prescribers and guidelines adherence.

There have been few initiatives so far to assess quality of outpatient antimicrobial prescribing.[69] These patterns were most easily observed and evaluated using two simple quality indicators of childhood community-based antimicrobial prescribing, the Amoxicillin Index and the Amoxicillin to Broad-spectrum Antibiotic Ratio.[70] In Qatar, application of such quality indicators as total antimicrobial prevalence of use and the two new paediatric-specific quality indicators may assess in optimising antimicrobial-prescribing policies, and set national interventions to reduce and improve antimicrobial prescribing.

Regarding practice of antibiotic use at medical intensive care unit, a local study conducted by Hanssens et al. reported respiratory infections were the most common ones. In addition, it was revealed that 76% of the patients admitted for more for >48 h at medical intensive care unit and clinically suspected of having an infection were prescribed antimicrobials.[32] A European study in an medical intensive care unit setting revealed a more than 25% lower rate (62%) of antimicrobial usage for presumed or proven infections.[71] Prevalence studies on the use of antimicrobials in ICU over the last decade revealed similar findings.[72,73] Data from other countries showed 60%–75% rates of antimicrobial prescription in the ICU.[32,74] Moreover, other studies from Europe revealed an average antimicrobial use of 58%–61%.[73,75] The number of antimicrobials prescribed per patient (2.09 per prescription) was similar to that described in other studies.[76] As in other studies, Hanssens et al. showed that respiratory infections were the most frequently observed microbiologically proven infections (68%).[32] Similarly, respiratory infections were the most common and accounted for almost 50% of all the antimicrobials prescribed in intensive care unit. Hence, preventing respiratory tract infections is considered to be the most cost-effective method of reducing antimicrobial use.[73]

Studies have also shown that the prescription of antimicrobials was inappropriate in 22% to 65% of the patients that received treatment.[77] It was pointed out that the threshold of suspicion of infection was much lower in Hanssens et al.'s study population.[32] Furthermore, consistent with an European study,[71] observations suggested that despite the many microbiological cultures taken, and regardless of the isolated pathogen and its sensitivity pattern, results barely had any impact on the antimicrobial treatment at the medical intensive care unit, and the empirical therapy was continued. This could be due to a low potential for microbiological diagnostic procedures by itself, or inappropriate microbiological investigations requested by the medical intensive care unit team. Further evaluation is needed to determine the reasons. Factors contributing to this phenomenon are the absence of any proven cultured pathogen, and the short stay at medical intensive care unit for the majority of patients. These findings clearly highlight the need for a review of antimicrobial-prescribing policies as well as the monitoring of the use of antimicrobials.

Hanssens et al. reported that ceftriaxone was the main antimicrobial prescribed, and this antimicrobial is considered the commonest drug upon admission in this medical intensive care unit. Over half of patients received ceftriaxone.[32] In comparison, 44% of patients on antimicrobials received cephalosporins in the European Prospective Investigation into Cancer and Nutrition (EPIC) study as compared with only 8% in another study.[73] Several conditions are known to mimic the signs of infection, especially in seriously ill patients.[78] Therefore, antimicrobials will often be prescribed inappropriately. A more widely accessible strategy to limit the antibiotic use in medical intensive care unit is to initiate a broad-based empirical therapy, which is subsequently scaled-down upon availability of the microbiological cultures. An appreciable reduction in antibiotic consumption could be achieved either by preventing infection or by shortening the duration of antimicrobial treatment.

Limitations

A number of limitations of the present review should be highlighted. Studies were each derived from one centre in Doha, which may affect the generalisability. Under- or over-estimation of inappropriate use was expected as a result of exclusion of non-Qatari nationals. However, national outpatient data in the private sector with a large number of claims was used which enhanced the strength of the study.

The review explored all published papers at different settings. This showed the practice of antibiotic prescribing among different physicians and population groups. There is a need for further and more recent published studies. Also, as there was limited data about potential associations between patients' factors and antimicrobial prescribing at the individual level, more studies are needed to explore the effect of different factors on providers and patients for antimicrobial prescribing.

Recommendations

The following recommendations are suggested:

National policies and guidelines for antimicrobial resistance

Findings clearly highlight the need for a review of antimicrobial policies and guidelines adherence as well as monitoring of antimicrobial use in all healthcare settings. Guidelines adherence by physicians especially those who work at private clinics will contribute to a decrease in the number of prescriptions.

Healthcare settings and providers

Physicians should focus on providing reassurance and information and reduce unwarranted antimicrobial prescribing. This will lead to reducing the problem of antimicrobial resistance. Also, this will result in a decrease in the number of future revisits for upper respiratory tract infections and a decrease in the workload on healthcare settings without jeopardising patient satisfaction and quality of care.

Strengthening communication between medical teams and microbiologists to enhance antimicrobial strategies and ensure appropriate antimicrobial prescribing to limit unnecessary antimicrobial use is imperative. This step should be implemented in all units within healthcare facilities such as medical intensive care unit, emergency department, etc.

Promoting public education is an important tool against inappropriate antimicrobial prescriptions. Patient education could be conducted through brochures, pamphlets, videos and counselling at clinics. Moreover, studies to measure effectiveness of both clinic and community-wide health education programmes on appropriate use of antimicrobials for upper respiratory tract infections are needed.

Quality indicators

As a tool for referencing the antimicrobial-prescribing trend, especially at the ambulatory care settings, this would aim to highlight those prescribing patterns and practice that deviate from the guideline indications.

Public health communication

Health programmes to promote public education about antimicrobials by public media such as TV, radio and social media can be quite useful in connecting more closely with the public and disseminating correct knowledge about the need for antibiotics.

School- and community-level engagement

It has been proven that school-based health education programmes significantly increase knowledge among middle school children in different countries. Implementing such programmes into the school syllabus will promote best use of antimicrobials from a young age.

Further research

There is a need for further studies to determine population-based rates as well as knowledge and practice regarding antimicrobial use for upper respiratory tract infections across the country.

Conclusion

This is the first systematic review conducted exploring the topic and a number of key findings were highlighted in the review. It can be concluded that overprescribing is common in all settings. The review will assist policy makers in Qatar to establish future effective interventions in order to improve the inappropriate use of antimicrobials. There is a need for further studies in the field to explore the public's knowledge, rates and factors associated with antimicrobials prescribing.

Declarations

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Guarantor: FS

Contributorship: FS and SH developed the concept for the research and the paper. FS conducted the literature search. FS and SH filtered through the literature and conducted quality appraisal. FS performed the analysis. FS drafted the manuscript. FS, SH, AM and SR finalised the text.

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References

1. Drug Utilization Group. Latin America. Multi-center study on self-medication and self-prescription in six Latin American countries. *Clin Pharmacol Ther* 1997; 61: 488–493.
2. Contopoulos-Ioannidis DG, Koliofoti ID, Koutroumpa IC, Giannakakis IA and Ioannidis JP.

Pathways for inappropriate dispensing of antibiotics for rhinosinusitis: a randomized trial. *Clin Infect Dis* 2001; 33: 76–82.
3. McKee M, Mills L and Mainous A. Antibiotic use for the treatment of upper respiratory infections in a diverse community. *J Fam Pract* 1999; 48: 993–996.
4. Hersh AL, Shapiro DJ, Pavia AT and Shah SS. Antibiotic prescribing in ambulatory pediatrics in the United States. *Pediatrics* 2011; 128: 1053–1061.
5. Lee GC, Reveles KR, Attridge RT, Lawson KA, Mansi IA, Lewis JS, et al. Outpatient antibiotic prescribing in the United States: 2000 to 2010. *BMC Med* 2014; 12: 96.
6. Kenealy T and Arroll B. Antibiotics for the common cold and acute purulent rhinitis. *Cochrane Database Syst Rev* 2014; 6: CD000247.
7. Grijalva CG, Nuorti JP and Griffin MR. Antibiotic prescription rates for acute respiratory tract infections in US ambulatory settings. *JAMA* 2009; 302: 758–766.
8. Carl L and Lars B. Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem. *Ther Adv Drug Saf* 2014; 5: 229–241.
9. Hicks LA, Chien YW, Taylor TH Jr, Haber MK and Lugman KP. Active Bacterial Core Surveillance (ABCs) Team. Outpatient antibiotic prescribing and nonsusceptible Streptococcus pneumoniae in the United States, 1996–2003. *Clin Infect Dis* 2011; 53: 631–639.
10. Coenen S, Ferech M, Haaijer-Ruskamp FM, Butler CC, Vander Stichele RH, Verheij TJ, et al. European Surveillance of Antimicrobial Consumption (ESAC): quality indicators for outpatient antibiotic use in Europe. *Qual Saf Health Care* 2007; 16: 440–445.
11. Butler CC, Hood K, Verheij T, Little P, Melbye H and Nuttall J. Variation in antibiotic prescribing and its impact on recovery in patients with acute cough in primary care: prospective study in 13 countries. *BMJ* 2009; 338: b2242.
12. Costelloe C, Metcalfe C, Lovering A, Mant D and Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ* 2010; 340: c2096.
13. Yagupsky P. Selection of antibiotic-resistant pathogens in the community. *Pediatr Infect Dis J* 2006; 25: 974–976.
14. Centor RM, Allison JJ and Cohen SJ. Pharyngitis management: defining the controversy. *J Gen Intern Med* 2007; 22: 127–130.
15. Dyar OJ, Beović B, Vlahović-Palčevski V, Verheij T and Pulcini C. How can we improve antibiotic prescribing in primary care? *Expert Rev Anti Infect Ther* 2016; 14: 403–413.
16. 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: 3246–3262.
17. Shapiro DJ, Hicks LA, Pavia AT and Hersh AL. Antibiotic prescribing for adults in ambulatory care in the USA, 2007–09. *J Antimicrob Chemother* 2014; 69: 234–240.
18. Centers for Disease Control and Prevention. *Antibiotic resistance threats in the United States, 2013*. Atlanta, GA: Author, 2014.
19. Weist K, Muller A, Monnet D and Heuer O. European Centre for Disease Prevention and Control (ECDC). 2012. Available from: http://ecdc.europa.eu/en/activities/surveillance/ESAC-Net/Pages/index.aspx [last accessed on 2 May 2017].
20. Morgan D, Okeke I, Laxminarayan R, Perencevich E and Weisenberg S. Non-prescription antimicrobial use worldwide: a systematic review. *Lancet Infect Dis* 2003; 11: 692–701.
21. Aly M and Balkhy HH. The prevalence of antimicrobial resistance in clinical isolates from Gulf Corporation Council countries. *Antimicrob Resist Infect Control* 2012; 1: 26.
22. Memish ZA, Ahmed QA, Arabi YM, Shibl AM and Niederman MS. Microbiology of community-acquired pneumonia in the Gulf Corporation Council states. *J Chemother* 2007; 19: 17–23.
23. Md Rezal RS, et al. Physicians' knowledge, perceptions and behaviour towards antibiotic prescribing: a systematic review of the literature. *Expert Rev Anti-infect Ther* 2015; 13: 665–680.
24. Franco BE, Altagracia Martinez M, Sanchez Rodriguez MA and Wertheimer AI. The determinants of the antibiotic resistance process. *Infect Drug Resist* 2009; 2: 1–11.
25. Hulscher ME, van der Meer JW and Grol RP. Antibiotic use: how to improve it? *Int J Med Microbiol* 2010; 300: 351–356.
26. You JHS, Yau B, Choi KC, Chau CTS, Huang QR and Lee SS. Public knowledge, attitudes and behavior on antibiotic use: a telephone survey in Hong Kong. *Infection* 2008; 36: 153–157.
27. Holloway KA, Ivanovska V, Wagner AK, Vialle-Valentin C and Ross-Degnan D. Prescribing for acute childhood infections in developing and transitional countries, 1990–2009. *Paediatr Int Child Health* 2015; 35: 5–13.
28. Arnold SR and Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Database Syst Rev* 2005; 4: CD003539.
29. Wells GA, Shea B, O'Connell D, Peterson J, Welch, V, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. 2012. Available from: http://wwwohrica/programs/clinical_epidemiology/oxfordasp.
30. Bashwar Z, Malik MA, Fawaz M and Said H. Knowledge, attitudes and practices of patients attending West Bay Health Center towards upper respiratory tract infections. *Qatar Med J* 2006; 15: 39–43.
31. Butt A, Navasero C, Thomas B, Al Marri S, Al Katheeri H, Al Thani A, et al. Antibiotic prescription patterns for upper respiratory tract infections in the

outpatient Qatari population in the private sector. *Int J Infect Dis* 2017; 55: 20–23.
32. Hanssens Y, Bassam I, Ahmed K, Sittana E, Fathia A and Thoraya S. Antibiotic prescribing pattern in a Medical Intensive Care Unit in Qatar. *Saudi Med J* 2005; 26: 1269–1276.
33. Welschen I, Kuyvenhoven MM, Hoes AW and Verheij TJ. Effectiveness of a multiple intervention to reduce antibiotic prescribing for respiratory tract symptoms in primary care: randomised controlled trial. *BMJ* 2004; 329: 431.
34. van Duijn HJ, Kuyvenhoven MM, Tiebosch HM, Schellevis FG and Verheij TJ. Diagnostic labelling as determinant of antibiotic prescribing for acute respiratory tract episodes in general practice. *BMC Fam Pract* 2007; 8: 55.
35. Fischer T, Fischer S, Himmel W, et al. Family practitioners' diagnostic decision-making processes regarding patients with respiratory tract infections: an observational study. *Med Decis Making* 2008; 28: 810–818.
36. Lundkvist J, Akerlind I, Borgquist L and Mölstad S. The more time spent on listening, the less time spent on prescribing antibiotics in general practice. *Fam Pract* 2002; 19: 638–640.
37. Little P, Gould C, Williamson I, Warner G, Gantley M and Kinmonth AL. Reattendance and complications in a randomised trial of prescribing strategies for sore throat: the medicalising effect of prescribing antibiotics. *BMJ* 1997; 315: 350–352.
38. Abdelmoneim IA and Esraa AA. Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PLoS One* 2015; 10: e0117910.
39. McNulty CA, Boyle P, Nichols T, Clappison P and Davey P. Don't wear me out – the public's knowledge of and attitudes to antibiotic use. *J Antimicrob Chemother* 2007; 59: 727–738.
40. Napolitano F, Izzo MT, Di Giuseppe G and Angelillo IF. Public knowledge, attitudes, and experience regarding the use of antibiotics in Italy. *PLoS One* 2013; 8: e84177.
41. Braun BL and Fowles JB. Characteristics and experiences of parents and adults who want antibiotics for cold symptoms. *Arch Fam Med* 2000; 9: 589.
42. Braun BL and Fowles JB. Characteristics and experiences of parents and adults who want antibiotics for cold symptoms. *Arch Earn Med* 2000; 9: 589–595.
43. Welschen I, Kuyvenoven M, Hoes A and Verheij T. Antibiotics for acute respiratory tract symptoms: patients' expectations, GPs' management and patient satisfaction. *Fam Pract* 2004; 21: 234–237.
44. Vinker S, Ron A and Kitai E. The knowledge and expectations of parents about the role of antibiotic treatment in upper respiratory tract infection – a survey among parents attending the primary physician with their sick child. *BMC Fam Pract* 2003; 4: 20.
45. Linder JA and Singer DE. Desire for antibiotics and antibiotic prescribing for adults with upper respiratory tract infections. *J Gen Intern Med* 2003; 18: 795–801.
46. Lam T and Lam K. What are the non-biomedical reasons which make family doctors over-prescribe antibiotics for upper respiratory tract infection in a mixed private/public Asian setting? *J Clin Pharm Ther* 2003; 28: 197–201.
47. Moro ML, Marchi M, Gagliotti C, Di Mario S and Resi D. Why do paediatricians prescribe antibiotics? Results of an Italian regional project. "Progetto Bambini a Antibiotici [ProBA]" Regional Group. *BMC Pediatr* 2009; 9: 69.
48. Rodrigues AT, Roque F, Falcão A, Figueiras, Herdeiro MT, et al. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrob Agents* 2013; 41: 203.
49. Stephanie FL. Why do general practitioners prescribe antibiotics for upper respiratory tract infections to meet patient expectations: a mixed methods study. *BMJ Open* 2016; 6: e012244.
50. Steinman MA, Landefeld CS and Gonzales R. Predictors of broad-spectrum antibiotic prescribing for acute respiratory tract infections in adult primary care. *JAMA* 2003; 289: 719–725.
51. Little P, Dorward M, Warner G, Stephens K, Senior J and Moore M. Importance of patient pressure and perceived pressure and perceived medical need for investigations, referral, and prescribing in primary care: nested observational study. *BMJ* 2004; 328: 444.
52. Knobler SL, Lemon SM, Najafi M, Burroughs T. The resistance phenomenon in microbes and infectious disease vectors: implications for human health and strategies for containment: workshop summary, /www.ncbi.nlm.nih.gov/books/NBK97126/ (accessed 11 July 2018).
53. World Health Organization. WHO global strategy for containment of antimicrobial resistance, www.who.int/csr/resources/publications/drugresist/en/EGlobal_Strat.pdf (2001, accessed 11 July 2018).
54. Ivanovska V, Hek K, Mantel Teeuwisse AK, Leufkens HG, Nielen MM and van Dijk L. Antibiotic prescribing for children in primary care and adherence to treatment guidelines. *J Antimicrob Chemother* 2016; 71: 1707–1714.
55. Petersen I and Hayward AC. Antibacterial prescribing in primary care. *J Antimicrob Chemother* 2007; 60(Suppl 1): i43–i47.
56. Anita K and Kathleen H. Antibiotic prescribing practice for acute, uncomplicated respiratory tract infections in primary care settings in New Delhi, India. *Trop Med Int Health* 2014; 19: 761–768.
57. Norazida AR, Cheong LT and Sheamini S. Antibiotic prescribing in public and private practice: a cross-sectional study in primary care clinics in Malaysia. *BMC Infect Dis* 2016; 16: 208.
58. Siddiqi S, Hamid S, Rafique G, Chaudhry SA, Ali N and Shahab S. Prescription practices of public and private health care providers in Attock District of Pakistan. *Int J Health Plann Manage* 2002; 17: 23–40.
59. Indira K, Devi R, Pillay R, Jeyseelan L, Chandy S, Kumar R, et al. *Antibiotic prescribing pattern (APP) and related factors in primary and secondary health care facilities of government and private settings*. The

INCLEN India Infectious Disease Initiative (IIDI) – USAID/INCLEN Final Report 2004. Annex 19. Chennai: Inclen Trust.
60. Ofori-Asenso R and Agyeman AA. A review of injection and antibiotic use at primary health care (public and private) centers in Africa. *J Pharm Bioallied Sci* 2015; 7: 175–180.
61. Dato MI and Imaz MS. Tuberculosis control and the private sector in a low incidence setting in Argentina. *Rev Salud Publica (Bogota)* 2009; 11: 370–382.
62. Udwadia ZF, Pinto LM and Uplekar MW. Tuberculosis management by private practitioners in Mumbai, India: has anything changed in two decades? *PLoS One* 2010; 5: e12023.
63. Vandan N, Ali M, Prasad R and Kuroiwa C. Assessment of doctors' knowledge regarding tuberculosis management in Lucknow, India: a public–private sector comparison. *Public Health* 2009; 123: 484–489.
64. Steinman MA, Gonzales R, Linder JA and Landefeld CS. Changing use of antibiotics in community-based outpatient practice, 1991–1999. *Ann Intern Med* 2003; 138: 525–533.
65. van den Broek d'Obrenan J. Antibiotic use in Dutch primary care: relation between diagnosis, consultation and treatment. *J Antimicrob Chemother* 2014; 69: 1701–1707.
66. Adolfo F, Fátima R, Maria TH, Sara S, António TR and Luiza B. Educational interventions to improve prescription and dispensing of antibiotics: a systematic review. *BMC Public Health* 2014; 14: 1276.
67. Murphy M, Bradley CP and Byone S. Antibiotic prescribing in primary care, adherence to guidelines and unnecessary prescribing – an Irish perspective. *BMC Fam Pract* 2012; 13: 43.
68. Panasiuk L, Lukas W, Paprzycki P, Verheij T, Godycki-Cwirko M and Chlabicz S. Antibiotics in the treatment of upper respiratory tract infections in Poland. Is there any improvement? *J Clin Pharm Ther* 2010; 35: 665–669.
69. Spyridis N and Sharland M. The European Union Antibiotic Awareness Day: the paediatric perspective. *Arch Dis Child* 2008; 93: 909–910.
70. de Bie S, Kaguelidou F, Verhamme KM, de Ridder M, Picelli G, Straus SM, et al. Using prescription patterns in primary care to derive new quality indicators for childhood community antibiotic prescribing. *Pediatr Infect Dis J* 2016; 35: 1317–1323.
71. Schurink CA, Hoitsma M, Rozenberg-Arska M, Joore JC, Hoepelman IM and Bonten MJ. Do cultures contribute to optimization of antibiotic therapy in the intensive care unit? *Int J Antimicrob Agents* 2004; 23: 325–331.
72. Vincent JL, Bihari DJ, Suter PM, Bruining HA, White J, Nicolas-Chanoin MH, et al. The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. EPIC International Advisory Committee. *JAMA* 1995; 274: 639–644.
73. Bergmans DC, Bonten MJ, Gaillard CA, van Tiel FH, vander Geest S, de Leeuw PW, et al. Indications for antibiotic use in ICU patients: a one-year prospective surveillance. *J Antimicrob Chemother* 1997; 39: 527–535.
74. Erbay A, Bodur H, Akinci E and Colpan A. Evaluation of antibiotic use in intensive care units of a tertiary care hospital in Turkey. *J Hosp Infect* 2005; 59: 53–61.
75. Hartmann B, Junger A, Brammen D, Röhrig R, Klasen J, Quinzio L, et al. Review of antibiotic drug use in a surgical ICU: management with a patient data management system for additional outcome analysis in patients staying more than 24 hours. *Clin Ther* 2004; 26: 915–924; discussion: 904.
76. Williams A, Mathai AS and Phillips AS. Antibiotic prescription patterns at admission into a tertiary level intensive care unit in Northern India. *J Pharm Bioallied Sci* 2011; 3: 531–536.
77. Abebe F, Fikadu D, Hadgu A, Zeru H and Akaleweld M. Drug use evaluation of ceftrixone: the case of Ayder referral hospital, Mekelle, Ethiopia. *IJPSR* 2012; 3: 2191–2195.
78. Meduri GU, Mauldin GL, Wunderink RG, Leeper KV, Jones CB, Tolley E, et al. Causes of fever and pulmonary densities in patients with clinical manifestations of ventilator-associated pneumonia. *Chest* 1994; 106: 221–35.