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ORIGINAL RESEARCH

Compliance to International Guidelines and Rational Use of Antibiotics in Urinary Tract Infections in a Country without National Guidance: A Cross-Sectional Study

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Abstract

Background: Urinary Tract Infections (UTI) are among the most common bacterial infections, and appropriate antimicrobial therapy with agents that minimize resistance is crucial. Despite international concern, adherence to guidelines is still suboptimal. This study aims to determine the effect of the absence of national guidelines and the rate of conformity to international guidelines among physicians in antibiotic prescriptions for the treatment of UTIs in adults; and detect the factors that are associated with a higher rate of non-compliance.

Methods: Patient-related characteristics and the prescribed antibiotics were gathered from patients' medical files, and a questionnaire was directed to physicians to elicit the factors involved in decision-making. Four criteria were evaluated: Molecule conformity, Daily Dose conformity, Duration conformity, and Global conformity.

Results: 37 Lebanese physicians and 185 prescriptions were included. The most prevalent class of antibiotics was fluoroquinolones (30.3%). Global conformity to guidelines was 31.4%, while conformity on drug choice, daily dose, and duration of treatment were 83.2%, 74.7%, and 41.6% respectively. There were no differences in conformity rates according to the physician's specialty (p = 0.135). Physicians who studied in an American system university had an increased risk of non-conformity, (A or = 2.107, p = 0.018). Patients with higher education levels, or presenting with fever or chills, were more likely to get a non-compliant prescription (a OR = 2.140, p = 0.032 and a OR = 4.947, p = 0.033 respectively).

Conclusion: In a country with no local guidelines, non-conformity to international guidelines is high. Larger national studies are needed with immediate interventions to enhance physicians' prescribing practices.

Keywords

Compliance, Conformity, Antibiotic, Urinary tract infections, Prescriptions, Guidelines

Abbreviations

AAFP: American Academy of Family Physicians; ATB: Antibiotic; EAU: European Association of Urology; GEE: Generalized Estimating Equation; IDSA: Infectious Diseases Society of America; LOP: Lebanese Order of Physicians; SD: Standard Deviation; SPILF: Société de Pathologie Infectieuse de Langue Française (French Language Infectious Diseases Society); UTI: Urinary Tract Infection; WHO: World Health Organization

Background

Urinary Tract Infections (UTI) are among the most common bacterial infections in humans [1-5]. Women are significantly more affected than men: One in three women will have at least one episode of UTI by the age of 24, and roughly 50% of women will experience a UTI in their lifetime [3].

UTIs are classified according to the site of infection (pyelonephritis, cystitis, urethritis, prostatitis) and

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the presence of risk factors for complications [3,6]. While asymptomatic UTIs are left untreated in most cases according to guidelines, the high incidence of symptomatic UTIs that require antibiotics emphasizes the need to ensure appropriate therapy with agents that maximize success and minimize the risk of resistance [4,6].

According to the World Health Organization (WHO), rational drug use requires that patients receive drugs appropriate to their clinical condition, in doses that suit their needs, for an adequate period of time and at the lowest cost for themselves and their community [7].

Additionally, the increasing use of antibiotics (ATB) has an impact on bacterial resistance trends and the WHO has warned that antimicrobial resistance is today one of the biggest threats to global health [8]. Despite this international concern, adherence to guidelines is still suboptimal, with concordance averaging around 30% in many countries [9-15]. Factors related to non-adherence are physician's specialty, age or patient load, some patient's characteristic (fever, desire for antibiotics, longer duration of symptoms, insurance type) and healthcare system-related factors (time pressure and policies/guidelines implemented) [16-23].

In Lebanon, ATB resistance levels are high: in particular, *Escherichia coli* and *Klebsiella* spp, causing common community-acquired infections, are significantly resistant to many antibiotics, mainly to internationally recommended drugs for empiric treatment of these infections like UTIs and intra-abdominal infections [24,25]. Unfortunately, until 2017, Lebanon had no national directives on UTI treatments [26] and physicians had to rely on international recommendations to guide their choices. Although small studies have been conducted in Lebanon to assess the compliance of ATB prescriptions with some international recommendations, they had multiple limits because, as the data were being collected in pharmacies and not in a doctor's clinics, physician-related factors and detailed patient characteristics were not assessed [23,27]. This study will be the first to evaluate the conformity of antibiotic prescriptions to guidelines specifically in UTIs at the physician level, and the first to our knowledge to describe the practice of physicians who rely on international guidelines in a country with no local guidelines.

The objectives of our study are thus to determine the prevalence of conformity to international guidelines among Lebanese physicians in ATB prescriptions for the treatment of non-hospitalized acute UTIs in adults and identify the factors that are associated with a higher rate of non-compliance to guidelines.

Materials and Methods

Study design

This is a cross-sectional survey of physicians practicing in Lebanon between March and August 2016. Physicians most likely to treat UTIs were selected: General practitioners, specialists in urology, infectious diseases, gynecology, internal medicine, and family medicine.

Sampling

We chose to select 5 prescriptions per physician to keep a small cluster size and minimize selection bias. Consequently, with an acceptable margin of error of 7%, a design effect of 1 and an expected frequency of conformity of 35%, a sample size of 185 prescriptions from 37 physicians were required with a confidence level of 95%.

Physicians' selection: Sampling by convenience from the exhaustive list of specialists provided by the Lebanese Order of Physicians (LOP) was done until we reached the calculated minimum sample size of 37 physicians.

Prescriptions' selection: Each physician was visited once by the researchers and asked to provide his last 10 antibiotics prescriptions for the treatment of a UTI, The medical records were then reviewed for eligibility criteria, and 5 patients were randomly selected from all eligible records. Eligibility criteria were defined as follows:

- Patients 18-years-old or above;

- Diagnosis of simple or complicated cystitis, simple or complicated pyelonephritis, or prostatitis based on physician's appreciation and notes in the medical record;

- Outpatient treatment with an oral or intramuscular antibiotic;

- Patient not known to have a psychiatric illness, concurrent infections, sexually transmitted diseases, or candidiasis

Data collection and tools

Data were collected using a questionnaire which included two sections. The first section was drawn from medical records and comprised the socio-demographic characteristics of patients, their diagnosis, comorbidities, risk factors for resistant UTIs (recent hospitalization, surgery, use of ATB) and symptoms; the doctor's diagnostic methods, and the prescribed antibiotics. The second section was as self-administered questionnaire for doctors, and included their socio demographic characteristics, specialty, practice characteristics (location, number of patients), and factors likely to be involved in decision-making such as their subscription to medical journals or their tendency to prescribe ATB when they are unsure of the diagnosis, as well as some additional factors. The American crowding index was calculated: Crowding occurs if there is more than one person per room; severe crowding occurs if there are

more than 1.5 persons per room (excluding bathrooms, balconies, porches, foyers, hall-ways and half-rooms) [28].

Conformity criteria

In the absence of Lebanese guidelines before 2017, physicians relied on international recommendations to guide their prescriptions, primarily those of the Infectious Diseases Society of America (IDSA) [29], the French Language Infectious Diseases Society (SPILF) [30] and the European Association of Urology (EAU) [6]. Thus, the guidelines adopted by each physician can be different. This is mainly driven by the medical school or hospital they specialized in. For that reason, we compiled the recommendations of the IDSA, the SPILF, and the EAU, and any first-line or second-line antibiotic that was recommended in at least one of those guidelines was considered correct (Appendix 1).

Each prescription was evaluated for compliance of molecule choice, daily dose, and duration of treatment to any of the guidelines. Global conformity was then computed: Treatment was considered generally compliant if all three conformities described above were in accordance with any of the recommendations.

Statistical analysis

Descriptive data for physicians' and patients' characteristics, as well as conformity results, were presented using their mean and Standard Deviation (SD) for quantitative continuous variables and the frequency and percentage for categorical variables. To identify the factors associated with prescriptions' non-conformity to guidelines, we first performed bi variate analysis using a separate Generalized Estimating Equations (GEE) model for each factor and by taking conformity as reference. GEE was chosen to account for correlation of data coming from the same physician. The independent variables that were associated with non-conformity with a p-value < 0.2 were then included in nested GEE models according to variable groups (physicians' socio-demographic variables, patients' socio-demographic variables, patients' symptoms and medical status, diagnosis and diagnostic modalities). Finally, all the variables associated with non-conformity with a p-value < 0.05 in the different GEE models were included in one final model. Results were presented with their adjusted odds ratio (a OR) and their p-value. Analyses were performed using Statistical Package for Social Sciences (SPSS) software version 22.0. A p-value < 0.05 in the final model was considered statistically significant.

Ethical considerations

Anonymity and confidentiality were respected throughout the study by codification of identification data. An oral consent was given by participating physicians. There are no conflicts of interest to report. The study was approved by the Institutional Review Board (2020RC-044-LIUSOP).

Results

Characteristics of physicians and patients

This study included a total of 37 physicians and 185 patients. Physicians' and patients' characteristics are summarized in Table 1 and Table 2. Notably, the distribution of factors involved in the physician decision-making was almost similar for all the included physicians.

In general, almost all physicians relied on the clinical evaluation to establish the diagnosis. While urine analysis and culture were prescribed in 49% and 27% of simple cystitis cases respectively, they were almost universally prescribed for the remaining types of UTIs.

Characteristics and Types of UTIs

The most frequent diagnosis in our sample was simple cystitis (71.4% of cases), followed by prostatitis (18.9%) (Table 3). While simple cystitis is, normally, only found in women (because a UTI is, by definition, always complicated in men), we note that 20 patients with simple cystitis (15.2%) in our sample were men.

Cultures were positive in 47.6% of cases. The most frequent germ detected was Escherichia Coli (51.2%). The most frequently prescribed antibiotic was Amoxicillin clavulanate, while the most prevalent class was fluoroquinolones (Figure 1 and Appendix 2).

Prevalence of conformity to guidelines

Prevalence of global conformity to guidelines was 31.4%. In most cases of simple cystitis, the choice of drug was compliant with guidelines (93.9%), while the duration of treatment was correct in 45.2% of cases, with a tendency towards longer treatments. For instance, in simple cystitis, Ciprofloxacin and Nitrofuratoin were prescribed for a longer duration than recommended in 79% and 85.7% of cases respectively. Two molecules were notably prescribed for shorter than recommended durations: Cefixime in simple cystitis (6 days instead of 7 days in 96% of cases), and Ertapenem in prostatitis (7 days instead of 10 to 14 days in 42% of cases). In prostatitis, global conformity was 8.6%, with a drug choice conformity of 57.1% and a duration conformity of 15%. Other conformity results are shown in Figure 2.

Factors associated with non-conformity

Results of the bivariate analysis are shown in Appendix 3 and Appendix 4. Physician specialty was significantly associated with non-conformity in the bivariate analysis (p = 0.002): Compared to primary care physicians, the odds of non-conformity were approximately three times higher in urology or nephrology specialists, while they were significantly lower in gynecologists. However, this association disappeared after adjustment for confounding variables in the multivariate analysis (p = 0.135). Non-conformity to guidelines was statistically associated with having studied in an American system

Table 1: Characteristics of physicians (n = 37).

	Physicians' characteristics		Count	(%)	Mean (SD)
Sociodemographic characteristics	Years of experience				25 (11)
	Age				54 (11)
	Gender	Male	34	(91.9)	
		Female	3	(8.1)	
	University of last diploma	American system university	10	(27.0)	
		French system university	27	(73.0)	
	Specialty	Primary care physicians	11	(29.7)	
		Internal medicine or infectious diseases	8	(21.6)	
		Gynecology	7	(18.9)	
		Urology or nephrology	11	(29.7)	
	Studied abroad	No	15	(8.1)	
		France	115	(62.2)	
		USA	55	(29.7)	
Practice characteristics	Clinic setting	Non-hospital setting	9	(24.3)	
		In-hospital setting, university hospital	18	(48.6)	
		In-hospital setting, non-university hospital	10	(27.0)	
	Clinic region	Mount Lebanon	17	(45.9)	
		Beirut	8	(21.6)	
		North Lebanon	12	(32.4)	
	Consultation fees	[30000-50000] LBP	14	(37.8)	
		[50000-100000] LBP	16	(43.2)	
		[100000-150000] LBP	7	(18.9)	
	Daily number of patients	< 20	23	(62.2)	
		> 20	14	(37.8)	
Factors likely to be involved in decision-making	Subscription to medical journals	Yes	37	(100.0)	
	Attendance of ≥ 1 medical conference/year	Yes	37	(100.0)	
	Main source of information on UTI treatments	Medical representatives	32	(86.5)	
		Journals or conferences	5	(13.5)	
	ATB prescription if unsure of diagnosis	Never	37	(100.0)	
	ATB prescription at a patient's request	Never	35	(94.6)	
		Sometimes	2	(5.4)	
	ATB prescription over the phone	Never	37	(100.0)	
	Taking a patient's socio-economic status into account when prescribing	Yes	23	(62.2)	
		No	14	(37.8)	
	Taking a patient's medical insurance type into account when prescribing	Yes	36	(97.3)	
		No	1	(2.7)	
	Prescription of generics	Yes	37	(100.0)	

university (a OR = 2.107, p = 0.018). All other factors related to physicians had no effect on non-conformity. Similarly, non-conformity was associated to 2 patient-related factors: Patients with a higher education level, as well as patients presenting with fever or chills, were more likely to get a prescription that was not compliant with the guidelines (a OR = 2.140, p = 0.032 and a OR = 4.947, p = 0.033 respectively) compared to others. Multivariate analysis results are presented in Table 4,

while detailed results of the nested model multivariate analysis are presented in Appendix 5.

Discussion

This study is, to our knowledge, the first in Lebanon to evaluate the conformity of antibiotic prescriptions to international guidelines, in the absence of local guidelines, specifically in UTIs and at the physician level. Around 70% of all antibiotic prescriptions for UTIs

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Table 2: Characteristics of patients (n = 185).

	Patients' characteristics		Count	(%)	Mean (SD)
Sociodemographic characteristics	Age				48 (18)
	Gender	Male	58	(31.4)	
		Female	127	(68.6)	
	Place of residence	Mount Lebanon	96	(51.9)	
		Beirut	33	(17.8)	
		South	1	(.5)	
		North	55	(29.7)	
	Educational Level	School	46	(24.9)	
		University	139	(75.1)	
	Monthly income	< 5 million LBP	30	(16.2)	
		5-10 million LBP	102	(55.1)	
		> 10 million LBP	53	(28.6)	
	Marital status	Single	80	(43.2)	
		Married	105	(56.8)	
	American Crowding Index	Normal	174	(94.1)	
		Crowded	9	(4.9)	
		Severely crowded	2	(1.1)	
Medical status	Pregnant	No	126	(99.2)	
		Yes	1	(.8)	
	Smoking status	Nonsmoker	137	(74.1)	
		Smoker	48	(25.9)	
	Presence of at least one risk factor of resistance	No	161	(87.0)	
		Yes	24	(13.0)	
Symptoms	Pain in the genitourinary area or with urination	No	3	(1.6)	
		Yes	182	(98.4)	
	Urinary urgency	No	110	(59.5)	
		Yes	75	(40.5)	
	Pollakiuria	No	116	(62.7)	
		Yes	69	(37.3)	
	Foul smell in urine	No	162	(87.6)	
		Yes	23	(12.4)	
	Hematuria	No	167	(90.3)	
		Yes	18	(9.7)	
	Fever or chills	No	143	(77.3)	
		Yes	42	(22.7)	
	Nausea or vomiting	No	167	(90.3)	
		Yes	18	(9.7)	
	Lumbar pain	No	170	(91.9)	
		Yes	15	(8.1)	
	Pain in the last week	No	63	(34.1)	
		Yes	122	(65.9)	
Supporting modalities	Clinical diagnosis	No	1	(.5)	
		Yes	184	(99.5)	
	Urine analysis	No	69	(37.3)	
		Yes	116	(62.7)	
	Ultrasound	No	143	(77.3)	
		Yes	42	(22.7)	
	Uroscan	No	156	(84.3)	
		Yes	29	(15.7)	
	Urine culture	No	100	(54.1)	
		Yes	85	(45.9)	

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Table 3: Prevalence of each UTI diagnosis in the sample (n = 185).

		Count (%)
Established diagnosis	Simple cystitis	132 (71.4)
	Complicated cystitis	6 (3.2)
	Simple pyelonephritis	6 (3.2)
	Complicated pyelonephritis	6 (3.2)
	Prostatitis	35 (18.9)

Table 4: Multivariate analysis results for global non-conformity (n =185).

			Global conformity to guidelines [*]Ref category is conformity				OR	p-value ([a]p of model)
			Non-conformity		Conformity			
			Count	(%)	Count	(%)		
physicians' characteristics	University educational system	American system university	39	(78.0)	11	(22.0)	2.107	0.018
		French system university	88	(65.2)	47	(34.8)	Ref	
	Specialty	Primary care physicians	37	(67.3)	18	(32.7)	Ref	0.135[a]
		Internal medicine or infectious diseases	27	(67.5)	13	(32.5)	0.944	0.892
		Gynecology	15	(42.9)	20	(57.1)	0.655	0.362
		Urology or nephrology	48	(87.3)	7	(12.7)	2.880	0.025
	Do you take a patient's medical insurance type into account when prescribing?	No	2	(40)	3	(60)	Ref	
		Yes	125	(69.4)	55	(30.6)	1.806	0.061
Patients' characteristics	Patient gender	Male	49	(84.5)	9	(15.5)	1.315	0.529
		Female	78	(61.4)	49	(38.6)	Ref	
	Education Level	School	26	(56.5)	20	(43.5)	Ref	
		University	101	(72.7)	38	(27.3)	2.140	0.032
	Fever or chills	No	88	(61.5)	55	(38.5)	Ref	
		Yes	39	(92.9)	3	(7.1)	4.947	0.033
	Urine analysis	No	34	(49.3)	35	(50.7)	Ref	
		Yes	93	(80.2)	23	(19.8)	1.609	0.281

were not compliant with guidelines. Non-conformity was related to the university educational system of the physician, to the educational level of the patient and to the patient presenting with fever or chills. Our results raise several important points and major problems related to the absence of well-defined local guidelines for antibiotic prescriptions and the reliance on international guidelines.
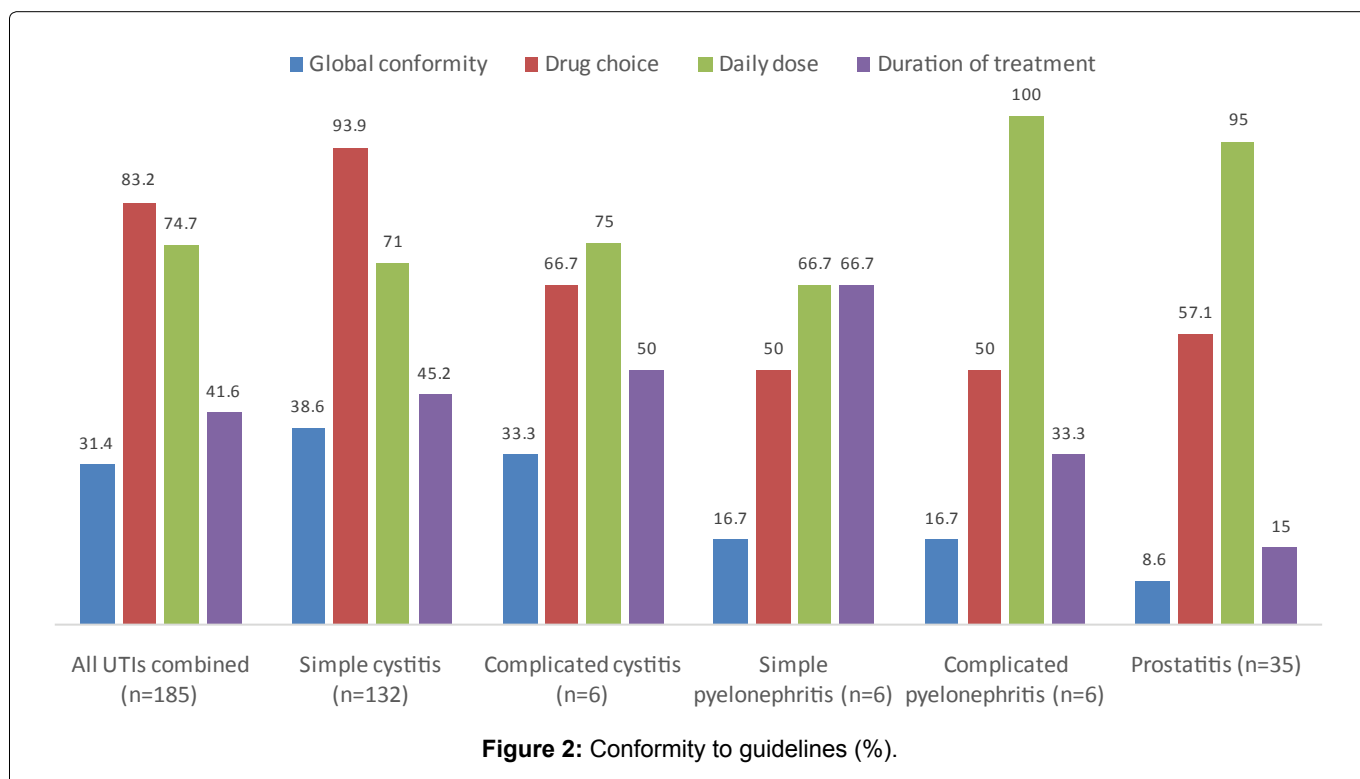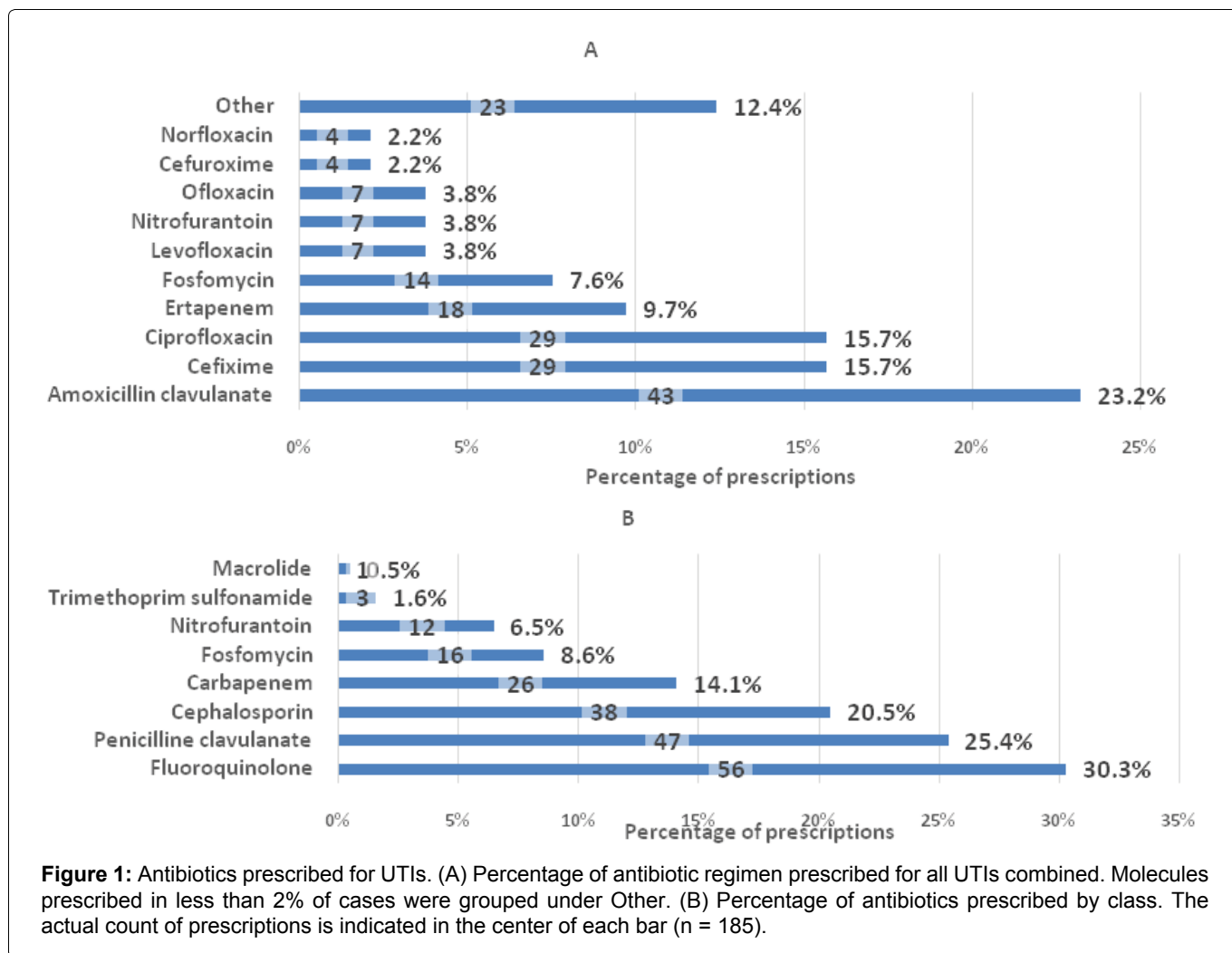
Global conformity to guidelines

Only 30% of overall prescriptions in our sample were compliant with international guidelines. This rate is similar to the ones found by Saleh, et al. in 2014 and Kabbara, et al. in 2018 when they assessed antibiotic prescriptions in pharmacies [23,27]. It is also concordant with reports from other countries, such as Spain, the USA, and France [11-15]. In Taiwan however, studies that evaluated conformity to the local guidelines in 2007 and 2011 found high percentages of 70% and 80% [31,32].

We note that physicians prescribed confirmatory urine analysis in almost all cases of UTIs except in simple cystitis, where the prevalence of urine analysis was around 50%. This is in accordance with international guidelines, which state that simple cystitis can be diagnosed and treated empirically [6,30]. Specifically, the American Academy of Family Physicians (AAFP) report that women who self-diagnose a UTI may even be treated safely with telephone management [33].

Drug choice conformity

Fluoroquinolone use is still prevalent in Lebanon, despite recommendations to avoid them as a first-line treatment when possible [29]. These results are similar to those found in France, Germany and the USA [34,35]. This may be a remnant of the time when quinolones were first discovered and included in guidelines as first-line antibiotics [36,37]. Additionally, as these molecules are recommended today as the first-line treatment in pyelonephritis, some physicians may be prescribing

Figure 1: Antibiotics prescribed for UTIs. (A) Percentage of antibiotic regimen prescribed for all UTIs combined. Molecules prescribed in less than 2% of cases were grouped under Other. (B) Percentage of antibiotics prescribed by class. The actual count of prescriptions is indicated in the center of each bar (n = 185).

Figure 2: Conformity to guidelines (%).

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them in virtually all cases of cystitis to feel more secure by covering an eventual unsuspected pyelonephritis.

We found that molecule conformity was elevated (83%), which is higher than previous reports from Lebanese pharmacies (35% to 61%) [23,27]. While this number may seem encouraging, it may be artificially elevated because our compilation of multiple international guidelines included more treatment options than each guideline separately and because second-line agents were also considered appropriate for the lack of a detailed medical history. Indeed, molecule conformity rates are less than 50% in France, Lebanon and the USA in studies that only consider first-line agents [11,23,36].

In general, our results suggest that physicians in Lebanon tend to choose antibiotics with broader indications and coverage. This could be due to most medical training being made in in-hospital settings, or to extrapolation from other infection types with similar pathogens for which more data are available in Lebanon. Indeed, since our data collection was completed, local guidelines by the Lebanese Society of Infectious Diseases and Clinical Microbiology were published and they confirmed the appropriateness of broad-spectrum antibiotics in UTIs other than simple cystitis in Lebanon, because of the local epidemiology of third-generation-cephalosporin-resistant organisms [24,26].

Daily dose and duration conformity

When the drug choice was appropriate, dose conformity was generally high, ranging from 71% to 100% according to the diagnosis. This is similar to the 2018 Lebanese study [23] and could be explained by the fact that most drugs, like Fosfomycin, nitrofurantoin, or ertapenem have one standard dosing regimen thus errors are inexistent in that case. Dose conformity was lowest in simple cystitis, mainly driven by prescriptions of Ciprofloxacin and Levofloxacin. While they are recommended as second-line antibiotics at low doses (250 mg twice a day), they were prescribed in 100% of cases at a standard daily dose of 500 mg twice a day.

Duration conformity, which is the lowest of all 3 conformities, follows the same trend. In most cases, treatment durations were too long. Ciprofloxacin and Levofloxacin, which should be prescribed for 3 days only in simple cystitis, were given for up to 7 to 15 days in many cases; nitrofurantoin was given for 7 days instead of 5 in two-thirds of cases. One notable exception is cefixime, which, in almost all cases (21 of 25 prescriptions), was given for a total of 6 days instead of 7 days. Upon looking into the brands available in Lebanon, it appeared to us that the most common brand is sold in boxes of 6 pills. Because in Lebanon, drugs are sold to the patient in full boxes and not as an exact number of pills like other countries, it seems that physicians take this point into account and prefer giving

the drug for one day less, instead of letting the patient buy an additional box to use one additional pill only.

In prostatitis, it is recommended to initiate treatment for at least 2 weeks, then the patient should be reassessed for the need of prolonging the course for up to 6 weeks [6,30]. Therefore, initial empiric prescription should be for 2 weeks only. In our sample, more than 50% of prescriptions were for 3 weeks or more. Interestingly, of the 12 prescriptions of ertapenem, 5 (41.7%) were given for a noticeably short duration of 7 days. While we had to count them as non-compliant with guidelines, it is possible that, due to the high price of this molecule in Lebanon (around 50 USD per dose) [38], physicians asked the patients to buy a limited number of ampoules while awaiting the urine culture results because there was a chance they would be able to change it or de-escalate treatment later.

These results concur with international literature and previous Lebanese findings; treatment duration of UTIs is inappropriate in many parts of the world [14,17,23,27,36,39,40]. In particular, a big cohort of 654,432 women in the USA showed that > 75% of prescriptions were written for non-recommended treatment durations [11]. Explanations may be the same as described above: partial knowledge of the guidelines, multiplicity of guidelines, extrapolation from other infections where standard treatment is around 7 to 10 days, sense of security of the physicians when they prescribe longer treatment courses, or regulation problems that lead to dispensing full boxes of drugs instead of the exact number needed.

Factors associated with global non-conformity

Our results found that presence of fever and chills was one of the most determinant associated factors for non-conformity, with an odds ratio of approximately 5. This is higher than what was found in other studies focusing on respiratory tract infections, where the OR were around 3 [19,21,22]. Physicians seem to be more prone to give inappropriate prescriptions when patients present with more severe features; although these symptoms are usually diagnostic criteria of pyelonephritis or prostatitis which raises the possibility of inappropriateness being linked to the diagnosis and not to fever itself.

Physicians from an American system university were at risk of non-conformity with an OR of 2.1. As this multiplicity of educational systems in Lebanon is somehow rare in other countries, it is difficult to establish comparisons with other studies. However, we think that this association can be the result of the difference in guidelines between Europe and the USA, as in some cases, American guidelines and reviews adopt a different classification of UTIs where any infection extending beyond the bladder is considered complicated (i.e. there is no uncomplicated

pyelonephritis) [29,41]. Additionally, American system universities included in our study have 2 or 3 university hospitals for training, while physicians from French system universities, especially the Lebanese University, are scattered across a multitude of small to middle-sized hospitals. Therefore, it is possible that the big American hospitals report their susceptibility patterns more frequently and have more standardized internal prescribing guidelines, so that physicians already know which antibiotics would be more recommended in their settings while the other physicians must stick to the international recommendations due to not having any standardized guide common to the many hospitals that they train in.

In our adjusted model, physician's specialty, gender, and other intrinsic factors were not associated with conformity. Our results are almost identical to those described in the systematic review by Rodrigues, et al., and corroborate the conclusion of Veninga, et al. who commented that non-conformity in antibiotic prescriptions are mostly due to factors unrelated to the physicians themselves [16,42]. Interestingly, patients with higher educational degrees in our sample were more at risk of receiving inappropriate prescriptions than others. We think that they may tend to search for information about their symptoms and treatments, and to insist on getting more potent antibiotics, although physicians stated that they do not let themselves be influenced by a patient's request.

Limitations and strengths

This is an observational study that included a small number of participants and a high refusal rate of physicians; it may not be powered enough to identify the factors associated with poor adherence to guidelines. The sampling that had to be completed by convenience introduced a selection bias although post-hoc comparison showed that the distribution of physicians from French- and American-system universities is similar to the Lebanese physicians' population [43,44]. A confounding bias may be present, due to some factors affecting conformity not taken into consideration. Finally, our compilation of multiple international guidelines may have led to artificially increasing our conformity rates, while the lack of information on the patients' infectious history may have decreased these rates by labeling an informed prescription (which should have thus been excluded) as non-compliant with empiric guidelines.

The strengths of our study lie in the fact that, to our knowledge, this is the first Lebanese study to evaluate the rationality of antibiotic prescriptions for UTIs in doctors' outpatient clinics and not from prescriptions collected in pharmacies. Doctors from all specialties who treat UTIs were included, unlike many studies that evaluated compliance only among general practitioners or emergency room doctors. For our conformity criteria, and despite the drawbacks described earlier, we considered the most prominent recommendations that are followed in Lebanon and created a global conformity-appraisal algorithm that takes them all into account, instead of relying on only one specific guideline; this allowed us not to over-estimate the prevalence of non-conformity.

Conclusion

Non-conformity of Lebanese-physicians to international guidelines is high, and a majority of UTIs is still treated with fluoroquinolones. Now that Lebanese guidelines are available, national studies are needed to compare the results and assess the impact of their publication. Because suboptimal antibiotic prescribing can result in decreased efficacy, prolonged patient morbidity, and increased healthcare costs, there is a crucial need for immediate interventions in countries with no local guidelines to enhance physicians' prescribing practices.

Declarations

Acknowledgements

Not applicable.

Conflicts of interest statement

The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethics approval and consent to participate

The study was approved by the Institutional Review Board (2020RC-044-LIUSOP). All methods were conducted in accordance with the ethical standards of the declaration of Helsinki. Each physician was informed of the course of the study and gave an oral consent for their inclusion and use of the data.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available in the Mendeley repository, with the DOI: 10.17632/98p49gmm5v.1.

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Authors' contributions

All authors participated equally to this study. JK was the main investigator, he did the statistical analysis and wrote the main manuscript text. NS, NL and MH supervised the study progress and coordinated the data collection. MH, NS and PM participated in writing the study protocol. All authors reviewed the manuscript.

References

1. Tandogdu Z, Wagenlehner FME (2016) Global epidemiology of urinary tract infections. Curr Opin Infect Dis 29: 73-79.

2. Gobernado M, Valdés L, Alós JI, García-Rey C, Dal-Ré R, et al. (2007) Antimicrobial susceptibility of clinical Escherichia coli isolates from uncomplicated cystitis in women over a 1-year period in Spain. Rev Esp Quimiote 20: 68-76.

3. Foxman B (2003) Epidemiology of urinary tract infections: Incidence, morbidity, and economic costs. Dis Mon DM 49: 53-70.

4. Foxman B (2014) Urinary tract infection syndromes: Occurrence, recurrence, bacteriology, risk factors, and disease burden. Infect Dis Clin North Am 28: 1-13.

5. Schappert SM (1999) Ambulatory care visits to physician offices, hospital outpatient departments, and emergency departments: United States, 1997. Vital Health Stat 13.

6. Grabe M, Bartoletti R, Bjerklund Johansen TE, Cai T (2015) EAU Guidelines: Urological Infections.

7. World Health Organization (2002) Promoting rational use of medicines: Core components. Promoción del uso racional de medicamentos: Componentes centrales.

8. World Health Organization (2018) Antibiotic resistance.

9. World Health Organization (2014) Antimicrobial resistance: Global report on surveillance. Geneva, Switzerland: World Health Organization 232.

10. Kim M, Lloyd A, Condren M, Miller MJ (2015) Beyond antibiotic selection: Concordance with the IDSA guidelines for uncomplicated urinary tract infections. Infection 43: 89-94.

11. Durkin MJ, Keller M, Butler AM, Kwon JH, Dubberke ER, et al. (2018) An Assessment of inappropriate antibiotic use and guideline adherence for uncomplicated urinary tract infections. Open Forum Infect Dis 5: ofy198.

12. Grover ML, Bracamonte JD, Kanodia AK, Bryan MJ, Donahue SP, et al. (2007) Assessing adherence to evidence-based guidelines for the diagnosis and management of uncomplicated urinary tract infection. Mayo Clin Proc 82: 181-185.

13. Llor C, Rabanaque G, López A, Cots JM (2011) The adherence of GPs to guidelines for the diagnosis and treatment of lower urinary tract infections in women is poor. Fam Pract 28: 294-299.

14. McEwen LN, Farjo R, Foxman B (2003) Antibiotic prescribing for cystitis: How well does it match published guidelines? Ann Epidemiol 13: 479-483.

15. Taur Y, Smith MA (2007) Adherence to the infectious diseases society of america guidelines in the treatment of uncomplicated urinary tract infection. Clin Infect Dis 44: 769-774.

16. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT (2013) Understanding physician antibiotic prescribing behaviour: A systematic review of qualitative studies. Int J Antimicrob Agents 41: 203-212.

17. Al Salman J, Alawi SS, Alyusuf EY (2017) Antibiotic appropriateness for urinary tract infection in the emergency room. Bahrain Med Bull 39: 38-42.

18. Cadieux G, Tamblyn R, Dauphinee D, Libman M (2007) Predictors of inappropriate antibiotic prescribing among primary care physicians. CMAJ Can Med Assoc J 177: 877-883.

19. McKay R, Mah A, Law MR, McGrail K, Patrick DM (2016) Systematic review of factors associated with antibiotic prescribing for respiratory tract infections. Antimicrob Agents Chemother 60: 4106-4118.

20. Schmidt ML, Spencer MD, Davidson LE (2018) Patient, provider, and practice characteristics associated with inappropriate antimicrobial prescribing in ambulatory practices. Infect Control Hosp Epidemiol 39: 307-315.

21. Akkerman AE, Kuyvenhoven MM, van der Wouden JC, Verheij TJM (2005) Determinants of antibiotic overprescribing in respiratory tract infections in general practice. J Antimicrob Chemother 56: 930-936.

22. Dekker ARJ, Verheij TJM, van der Velden AW (2015) Inappropriate antibiotic prescription for respiratory tract indications: Most prominent in adult patients. Fam Pract 32: 401-407.

23. Kabbara WK, Meski MM, Ramadan WH, Maaliki DS, Salameh P (2018) Adherence to international guidelines for the treatment of uncomplicated urinary tract infections in lebanon. Can J Infect Dis Med Microbiol 2018: 7404095.

24. Moghnieh RA, Musharrafieh UM, Husni RN, Abboud E, Haidar M, et al. (2014) E. coli, K. pneumoniae and K. oxytoca community-acquired infections susceptibility to cephalosporins and other antimicrobials in Lebanon. J Med Liban 62: 107-112.

25. Chamoun K, Farah M, Araj G, Daoud Z, Moghnieh R, et al. (2016) Surveillance of antimicrobial resistance in Lebanese hospitals: Retrospective nationwide compiled data. Int J Infect Dis 46: 64-70.

26. Husni R, Atoui R, Choucair J (2017) The Lebanese society of infectious diseases and clinical microbiology : guidelines for the treatment of urinary tract infections. Leban Med J 65: 208-219.

27. Saleh N, Awada S, Awwad R, Jibai S, Arfoul C, et al. (2015) Evaluation of antibiotic prescription in the Lebanese community: A pilot study. Infect Ecol Epidemiol 5: 27094.

28. National Center for Biotechnology, Pike USNL of M 8600 R, MD B, Usa 20894 (2018) Measures of crowding. World Health Organization 2018.

29. Gupta K, Hooton TM, Naber KG, Wullt B, Colgan R, et al. (2011) International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the infectious diseases society of america and the european society for microbiology and infectious diseases. Clin Infect Dis 52: e103-e120.

30. Caron F, Galperine T, Etienne M, Merens A, Flateau C (2015) Diagnostic et antibiothérapie des infections urinaires bactériennes communautaires de l'adulte. SPILF 2015.

31. Chen CC, Wu LC, Li CY, Liu CK, Woung LC, et al. (2011) Non-adherence to antibiotic prescription guidelines in treating urinary tract infection of children: A population-based study in Taiwan. J Eval Clin Pract 17: 1030-1035.

32. Jan I-S, Cheng S-H, Hsu H-C, Hsueh P-R (2007) Physicians' adherence to guidelines for empirical treatment of urinary tract infection in Taiwan. J Microbiol Immunol Infect Wei Mian Yu Gan Ran Za Zhi 40: 532-536.

Khoury et al. J Fam Med Dis Prev 2024, 11:160

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33. Colgan R, Williams M (2011) Diagnosis and treatment of acute uncomplicated cystitis. Am Fam Physician 84: 771-776.

34. Zweigner J, Meyer E, Gastmeier P, Schwab F (2018) Rate of antibiotic prescriptions in German outpatient care - are the guidelines followed or are they still exceeded? GMS Hyg Infect Control 13: Doc04.

35. Robinson TF, Barsoumian AE, Aden JK, Giancola SE (2020) Evaluation of the trends and appropriateness of fluoroquinolone use in the outpatient treatment of acute uncomplicated cystitis at five family practice clinics. J Clin Pharm Ther 45: 513-519.

36. Denes E, Prouzergue J, Ducroix-Roubertou S, Aupetit C, Weinbreck P (2012) Antibiotic prescription by general practitioners for urinary tract infections in outpatients. Eur J Clin Microbiol Infect Dis 31: 3079-3083.

37. Warren JW, Abrutyn E, Hebel JR, Johnson JR, Schaeffer AJ, et al. (1999) Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. Clin Infect Dis 29: 745-759.

38. Lebanese Ministry of Public Health (2019) Minister's Decision No. 1558/1 Aug 2, 2019.

39. Björkman I, Berg J, Viberg N, Stålsby Lundborg C (2013) Awareness of antibiotic resistance and antibiotic prescribing in UTI treatment: A qualitative study among primary care physicians in Sweden. Scand J Prim Health Care 31: 50-55.

40. Kahan NR, Chinitz DP, Kahan E (2004) Physician adherence to recommendations for duration of empiric antibiotic treatment for uncomplicated urinary tract infection in women: A national drug utilization analysis. Pharmacoepidemiol Drug Saf 13: 239-242.

41. Hooton TM, Gupta K (2019) Acute complicated urinary tract infection (including pyelonephritis) in adults - UpToDate.

42. Veninga CC, Lundborg CS, Lagerløv P, Hummers-Pradier E, Denig P, et al. (2000) Treatment of uncomplicated urinary tract infections: Exploring differences in adherence to guidelines between three European countries. Drug Education Project Group. Ann Pharmacother 34: 19-26.

43. Kassak K, Ghomrawi H, Osseiran A, Kobeissi H (2006) The providers of health services in Lebanon: A survey of physicians. Hum Resour Health 4: 4.

44. Akl EA, El Asmar K, Khater Menassa B, Maroun N, Adib S (2012) Characteristics of physicians practising in Lebanon: a survey. East Mediterr Health J 18: 712-717.

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