

DOI: 10.4274/mjima.galenos.2024.24291.1

Mediterr J Infect Microb Antimicrob 2025;14:24291.1

Erişim: <http://dx.doi.org/10.4274/mjima.galenos.2024.24291.1>

# Trend of Use of Quinolone Antibiotics in Community-Acquired Pneumonia

## Toplum Kökenli Pnömonide Kinolon Antibiyotik Kullanım Eğilimi

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### Abstract

**Introduction:** Quinolone group antibiotics are frequently used in the treatment of community-acquired pneumonia (CAP). There have also been rising safety concerns related to quinolone usage. In this study, we investigated physicians' tendencies to prescribe quinolones when managing outpatient pneumonia treatment and the factors influencing this decision.

**Materials and Methods:** Physicians were asked to participate in a survey consisting of 20 questions. They were queried about the antibiotic groups they most frequently prescribe for outpatient treatment in cases of CAP, the specific type of quinolone they most commonly used, their opinions on the effects and side effects of quinolones through Likert-type survey, and the clinical scenarios that lead them to prescribe quinolones. In addition, a comparison was made between pulmonologists and other specialists on these factors.

**Results:** A total of 16.29% of physicians primarily prescribed quinolones. The most preferred quinolone was moxifloxacin (50%). In cases of treatment failure, physicians were more likely to opt for hospitalization and a broad-spectrum antibiotic treatment approach (78.09%). Pulmonologists were more likely to prescribe quinolones in cases of unresponsiveness to previous beta-lactam therapy and complicated pneumonia than nonpulmonologists ( $p=0.013$ ,  $p=0.044$ , respectively). Pulmonologists placed more importance on the tendinitis side effect compared to nonpulmonologists ( $p=0.019$ ). Among the clinical factors, the previous use of beta-lactam antibiotics and the presence of chronic disease in the patient's medical history were significantly associated with physicians who preferred quinolones as their first choice compared with those who did not ( $p=0.008$  and  $p=0.006$ , respectively).

**Conclusion:** The fact that quinolones can be used alone and contribute to the speed of recovery is appealing to clinicians. However, the relevant guidelines conflict with each other regarding their first-line of use in CAP. In addition, knowledge about the side effects of quinolones is increasing. The prescription rates of quinolones should therefore be closely monitored and in cases of an increase in the prescription rates, legal regulations should be more strictly adhered to if guideline recommendations are inadequate.

**Keywords:** Fluoroquinolones, pneumonia, surveys, questionnaires

### Öz

**Giriş:** Kinolon grubu antibiyotikler, toplum kökenli pnömoni tedavisinde sıkça kullanılmaktadır. Bununla birlikte, kinolonlara ilişkin güvenlik endişeleri de giderek artmaktadır. Bu çalışma, hekimlerin ayaktan tedavi edilen pnömoni yönetiminde kinolon reçeteleme eğilimlerini ve bu kararı etkileyen faktörleri araştırmayı amaçlamıştır.

**Gereç ve Yöntem:** Hekimler, 20 sorudan oluşturulan ankete davet edildi. Ankette, toplum kökenli pnömoni için ayakta tedavi reçetelemesinde en sık kullandıkları antibiyotik grupları, en çok tercih ettikleri kinolon çeşidi, kinolonların etkileri ve yan etkileri konusundaki görüşleri (Likert tipi sorular ile) ve kinolon reçetelemelerine yol açan klinik senaryolar sorgulandı. Ayrıca, göğüs hastalıkları uzmanları ile diğer uzmanlar karşılaştırıldı.

**Cite this article as:** Akgün KB, Ceylan E, Karadağ M, Ayık Türk M. Trend of use of quinolone antibiotics in community-acquired pneumonia. Mediterr J Infect Microb Antimicrob. 2025;14:24291.1



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Received/Geliş Tarihi: 03.09.2024 Accepted/Kabul Tarihi: 18.11.2024

Presented in: This article was presented at the 46<sup>th</sup> annual congress of the Turkish Respiratory Society.

Epub: 19.11.2024

Published: 03.12.2025



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**Bulgular:** Hekimlerin %16,29'u öncelikli olarak kinolon reçetelemekteydi. En çok tercih edilen kinolon moksifloksasin (%50) oldu. Tedavi başarısızlığı durumlarında, hekimlerin hastaları hastaneye yatırmaya ve geniş spektrumlu antibiyotik tedavisine yönelmeye daha yatkın oldukları belirlendi (%78,09). Göğüs hastalıkları uzmanları, önceki beta-laktam tedavisine yanıt alınamayan durumlarda ve komplike pnömoni vakalarında kinolon reçetelemede diğer uzmanlara göre daha fazla eğilim göstermekteydi (sırasıyla  $p=0,013$ ,  $p=0,044$ ). Göğüs hastalıkları uzmanları, tendinit yan etkisine diğer uzmanlara göre daha fazla önem vermekteydi ( $p=0,019$ ). Klinik faktörler arasında, daha önce beta-laktam antibiyotik kullanımı ve hastanın tıbbi geçmişinde kronik hastalık bulunması, kinolonu ilk tercih olarak kullanan hekimlerle kullanmayanlar arasında anlamlı bir farklılık göstermekteydi (sırasıyla  $p=0,008$  ve  $p=0,006$ ).

**Sonuç:** Kinolonların tek başına kullanılabilmesi ve iyileşme hızına katkı sağlaması klinisyenler için cazip bir özelliktir. Ancak, kinolonların toplum kökenli pnömönide birinci basamak kullanımı konusunda kılavuzlar birbiriyle çelişmektedir. Ayrıca, kinolonların yan etkilerine ilişkin bilgiler gittikçe artmaktadır. Kinolonların reçeteleme oranları yakından izlenmeli ve reçeteleme oranlarında artış tespit edilirse, kılavuz önerilerinin yetersiz kaldığı durumlarda yasal düzenlemelerin daha etkili olduğu unutulmamalıdır.

**Anahtar Kelimeler:** Florokinolonlar, pnömoni, anketler, soru formları

## Introduction

Microbial etiology varies in community-acquired pneumonia (CAP). In particular, diseases caused by resistant pathogen microorganisms cause failure in empirical treatments, and, as a result, physicians' interest in newly developed antibiotics is increasing. Quinolone prescription rates have been on an increasing trend in recent decades<sup>[1]</sup>. In the American Thoracic Society (ATS)/Infectious Diseases Society of America (IDSA) 2019 CAP guideline, it was suggested that quinolones can be used in primary care in outpatients with comorbid diseases<sup>[2]</sup>. Considering the increasing antibiotic resistance and drug side effects, efforts are being made to limit their use in the first-line of pneumonia treatment<sup>[3]</sup>. In the 2021 CAP guideline, which was created through a consensus of pulmonologists, infectious diseases, internists, and family physicians in Türkiye, it was recommended as an alternative treatment in cases where beta-lactam combinations could not be used or have been used recently<sup>[4]</sup>. In this study, we evaluated physicians' tendencies to prescribe quinolones in the outpatient treatment of CAP.

## Materials and Methods

Approval for this study was obtained from the Hatay Mustafa Kemal University Non-Interventional Ethics Committee (decision number: 20, dated: 04.03.2024). The research was conducted as a cross-sectional descriptive survey, including all physicians involved in the diagnosis and treatment of respiratory tract infections, with a focus on pulmonologists and other specialists managing the outpatient treatment of CAP. This study aimed to assess their perspectives and compare these groups to evaluate differences in their prescribing patterns. As this was an exploratory study intended to gather insights into prescribing tendencies, no sample size calculation was performed. To ensure a larger sample size, the study targeted physicians across Türkiye rather than focusing on a specific hospital. To increase the number of participants, physicians in our hospital involved in CAP were asked to share the survey link in the specialty

association WhatsApp groups. Data collection was conducted over 3 months, from March to June 2024.

A 20-question survey form was prepared to question the physicians' tendencies toward outpatient CAP treatment and was delivered online to the targeted physician group via social media applications. Antibiotic options were created as multiple choices based on the ATS/IDSA guidelines for CAP<sup>[2]</sup>. The first four questions of the survey were on expertise, job description, current work institution, and the number of patients with pneumonia diagnosed annually. In the following questions, antibiotic selection and quinolone preference in the outpatient treatment of pneumonia developing in the community, as well as which quinolone was preferred, were inquired. In addition, the survey included 12 Likert scale questions comparing physicians' views on the advantages and disadvantages of quinolones with those of non-quinolone antibiotics. The commonly reported side effects in the literature were used to develop the question items<sup>[5-7]</sup>. As the last question, alternative treatment tendencies in cases of treatment failure were prepared as a separate question for the participants (See Annex 1 for the survey form).

## Statistical Analysis

Categorical variables are presented as numbers and percentages. Comparisons between categorical variables were examined using Pearson's chi-square test or Fisher's exact test. As a result of the evaluation where a significant difference was detected in comparisons of more than two groups, a post-hoc analysis with the Bonferroni method examined the variable that affected the difference. The hypotheses were accepted as bidirectional.

For statistical clarity, respondents who answered "not important" and "less important" were combined into one group, those who answered "doesn't matter" were placed in a second group, and those who answered "important" and "very important" were categorized into a third group for the Likert scale questions.

After data collection, a post-hoc power analysis was conducted using the G\*Power software to assess the adequacy of the sample size. In this study, an independent two-sample t-test

(means: difference between two independent means) was used to compare the prescription practices of pulmonologists and other specialists. A one-tailed test was applied, as the hypothesis expected a difference in a specific direction. The analysis parameters were set as follows: alpha level of 0.05, desired power (1- $\beta$ ) of 0.80, and an effect size of 0.5.

The post-hoc analysis yielded a power of 0.95 with the existing sample size, indicating a 95% probability of detecting a significant difference in the specified effect size. All statistical analyses were performed using SPSS version 25.0 (or other software used).

## Results

A total of 178 physicians agreed to participate in the study. The specialty, duty description, organizations, and annual number of patients were recorded as demographic data (Table 1).

First, the tendencies of the physicians participating in the study regarding antibiotic preferences in the outpatient treatment of CAP were evaluated. Participants prioritized quinolones (n=102, 57.30%), amoxicillin + macrolides (90, 50.56%), and macrolides (51, 28.65%) in the first-line of treatment prescription, respectively. Those who prioritized only quinolones as first-line antibiotics in the outpatient treatment of CAP were in the minority (16.29%). In the mentioned patients, half of the physicians who preferred quinolones in the first-line treatment reported using moxifloxacin molecule, while levofloxacin was reported to be the second-line treatment with a rate of 32.5%. Figure 1 cites the most common reasons given by physicians for preferring quinolones that are using prior steroid treatment (n=163, 91.57%), complicated pneumonia (n=135, 75.84%), and parenchymal lung disease (n=116, 65.17%) (Figure 1).

Antibiotic trends of specialty, place of duty, and annual patient number data were examined. No statistically significant relationship was found between these demographic data and antibiotic priority, quinolone priority, or clinical approach to treatment failure (p>0.05).

The majority of clinicians rated the speed of recovery as important/very important in antibiotic selection (n=120, 67.4%). However,

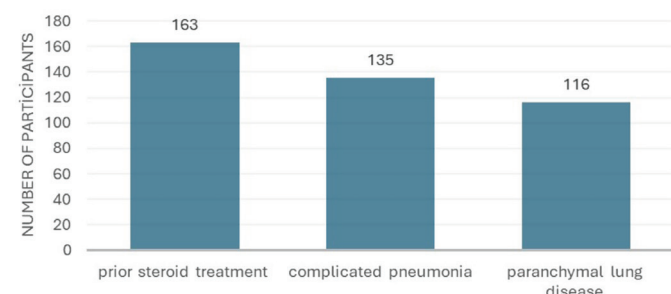


Figure 1. Most common reasons for preferring quinolones

the same level of importance given to drug-drug interactions was noted in a minority of them (n=40, 22.5%). The fact that the drugs were new-generation agents was important/very important for the majority of clinicians (n=121, 68.0%). When evaluating whether the drugs could be used as monotherapy, the importance was similarly dominant (n=155, 87.1%). The broad-spectrum nature of the drugs was also considered important/very important by most clinicians (n=167, 93.8%). A minority of them considered allergy and arrhythmia to be important/very important (n=60, 33.7% and n=20, 11.2%, respectively). Nearly half of the clinicians attributed importance to the tendinitis side effect (n=88, 49.4%). Although there was no clear majority, gastrointestinal side effects and the ease of access to the drug were mostly rated as important (n=70, 39.3% and n=84, 47.2%, respectively). The effects on the central nervous system were considered important by the majority of the clinicians (n=116, 65.2%). About half of the clinicians remained neutral regarding the ease of monitoring (n=90, 50.6%).

The relationship between clinicians' perspectives on antibiotic efficacy and side effects and the antibiotic groups they chose as their first option was examined. A significant difference was

Table 1. Demographic data

Specialty	n	%
Pulmonology	88	49.4
Emergency room	17	9.6
Internal medicine	11	6.2
Family medicine	45	25.3
Infectious diseases	8	4.5
Other specialties	9	5.1
(Non-pulmonology)	(90)	(50.6)
Duty description	n	%
General practitioner	11	6.2
Research assistant doctor	60	33.7
Specialist physician	80	44.9
Academician	27	15.2
Organization	n	%
1 <sup>st</sup> -level health services	27	15.2
2 <sup>nd</sup> -level health services	43	24.2
Tertiary health services	62	34.8
University health services	46	25.8
Annual number of pneumonia cases	n	%
<100	55	30.9
100-250	56	31.5
250-500	36	20.2
500-1000	20	11.2
>1000	11	6.2
Total	178	100.0

noted only among those who prioritized monotherapy in their initial treatment approaches ( $p=0.01$ ). Clinicians who exclusively selected quinolones as their first choice displayed a significantly greater tendency to prioritize monotherapy compared with those who chose only nonquinolone antibiotics ( $p=0.045$ ). Those without a clear preference placed more importance on monotherapy than clinicians who chose only nonquinolone antibiotics ( $p<0.001$ ). However, there was no difference between those who exclusively chose quinolones and those without a clear preference ( $p=0.548$ ). Since individuals without a clear preference also prescribed quinolones as their first choice, the results suggest that the monotherapy advantage of quinolones may influence prescribing habits. No clinical relationship was found between the first choice of antibiotic selection and the importance given to recovery speed, drug-drug interactions, generation differences, spectrum of activity, ease of monitoring, accessibility, anti-tuberculosis activity, allergy risk, arrhythmia side effects, tendinitis risk, gastrointestinal side effects, or central nervous system effects ( $p>0.05$ ).

Clinicians' perspectives on the efficacy and side effects of drugs were largely similar. No significant differences were noted between pulmonologists and other specialties in terms of the importance attributed to drug efficacy, drug-drug interactions, generation differences, spectrum of activity, ease of monitoring, drug accessibility, or anti-tuberculosis activity nor were there any disagreements regarding allergy, arrhythmia, gastrointestinal, and central nervous system side effects ( $p>0.05$ ). The only difference observed between the specialties was in the importance given to tendinitis, with pulmonologists attributing a higher level of importance ( $p=0.019$ ), although the risk of tendinitis was still not considered insignificant by most nonpulmonologists (Table 2). The difference in views regarding

tendinitis likely did not independently influence drug selection as there was a general agreement among clinicians on other efficacy and side effect factors.

The groups were analyzed based on their antibiotic preferences, and their views on drug efficacy and side effects were examined. In a group with a preference for quinolones, the importance given to the recovery speed was significantly higher compared with others ( $p=0.041$ ). This finding suggests that physicians may be prescribing quinolones more frequently due to their belief that they lead to faster recovery compared with other antibiotics.

In addition, both the groups with a preference for quinolones and those without any clear preference placed more importance on the advantage of monotherapy compared to those who prioritized nonquinolone antibiotics ( $p=0.002$ ). The ability to use quinolones as monotherapy may explain why clinicians who prioritize monotherapy tend to prescribe quinolones or at least why they do not hold a strict stance against them.

When analyzing groups based on their approach to treatment failure, those who opted for hospitalization or broad-spectrum antibiotics placed more importance on the anti-tuberculosis effect of the drugs, while only eight physicians chose outpatient alternative quinolone therapy ( $p=0.032$ ). This report indicates that tuberculosis is often considered in cases of resistant pneumonia, and, as an alternative, treatment is continued with broad-spectrum antibiotics that do not have any anti-tuberculosis effect, rather than those with quinolones that do (Table 3).

Participants' opinions regarding the consideration of clinical findings such as underlying parenchymal disease, previous

**Table 2. Comparisons of antibiotic preferences according to the specialty**

		Pulmonologists (n=88)	Non-pulmonologists (n=90)	p
		n (%)	n (%)	
First choice antibiotic group	Only quinolone	17 (19.3)	12 (13.3)	0.263
	Only nonquinolone	32 (36.4)	43 (47.8)	
	No priority	39 (44.3)	35 (38.9)	
Prior beta-lactam treatment	No	26 (29.5)	43 (47.8)	0.013
	Yes	62 (70.5)	47 (52.2)	
Complicated pneumonia	No	61 (69.3)	74 (82.2)	0.044
	Yes	27 (30.7)	16 (17.8)	
Tendinitis	Not at all important/ Not important	19 (21.59) <sup>a,b</sup>	24 (26.66) <sup>a,b</sup>	0.019
	Somewhat important	16 (18.18) <sup>a</sup>	31 (34.44) <sup>a</sup>	
	Important/ Very important	53 (60.22) <sup>b</sup>	35 (38.88) <sup>b</sup>	

Means followed by distinct <sup>(a,b)</sup> small letters in the same column are significantly different ( $p<0.05$ ), \*p value obtained from the chi-square test

**Table 3. Comparison of drug effect-side effect opinions according to antibiotic priority**

First choice antibiotic group		Only quinolone	Only non-quinolone	No priority	p
Clinical recovery speed	Hardly increases at all/ Generally does not increase	1 (3.4) <sup>a,b</sup>	4 (5.3) <sup>a</sup>	2 (2.7) <sup>b</sup>	<b>0.041</b>
	Similar	4 (13.8) <sup>a,b</sup>	30 (40) <sup>a</sup>	17 (23) <sup>b</sup>	
	Mostly faster/Generally faster	24 (82.8) <sup>a,b</sup>	41 (54.7) <sup>a</sup>	55 (74.3) <sup>b</sup>	
The monotherapy advantage	Not at all important/ Not important	0 (0) <sup>a,b</sup>	8 (10.7) <sup>a</sup>	0 (0) <sup>a</sup>	<b>0.002</b>
	Somewhat important	2 (6.9) <sup>a</sup>	10 (13.3) <sup>a</sup>	3 (4.1) <sup>a</sup>	
	Important/Very important	27 (93.1) <sup>a,b</sup>	57 (76) <sup>b</sup>	71 (95.9) <sup>a</sup>	
Approach to treatment failure		Follow-up with non-quinolone treatment	Follow-up with alternative quinolone treatment	Hospitalization and broad-spectrum treatment	p
Anti-tuberculosis activity	Not at all important/ Not important	1 (3.2) <sup>a</sup>	2 (25) <sup>a</sup>	9 (6.5) <sup>a</sup>	<b>0.032</b>
	Somewhat important	11 (35.5) <sup>a</sup>	0 (0) <sup>a</sup>	24 (17.3) <sup>a</sup>	
	Important/Very important	19 (61.3) <sup>a</sup>	6 (75) <sup>b</sup>	106 (76.3) <sup>b</sup>	

The p value was obtained from the chi-square test. Means followed by distinct (<sup>a,b</sup>) small letters in the same column are significantly different (p<0.05)

unresponsiveness to a beta-lactam group, previous steroid use, underlying chronic diseases, use of broad-spectrum beta-lactam antibiotics in the last 3 months, and complicated pneumonia in the decision to choose a quinolone as the first antibiotic are given in Table 4. Among the clinical factors, the rates of previous use of beta-lactam antibiotics and the presence of a chronic disease in their past medical history were found to be different between those who reported quinolone as their first choice and those who reported non-quinolone as their first choice or those who did not report a first choice (p=0.008 and p=0.006, respectively). Physicians who did not prioritize specific antibiotics group and reported other than quinolone antibiotics as their first choice antibiotic had a significantly higher rate of prescriptions due to non-response to beta-lactam (54, 73%; 43, 57.3%, respectively).

## Discussion

Quinolones are frequently used in pneumonia, and their usage rates are continuing to increase. The first synthetic quinolone was discovered by George Leshner in the 1960s, and nalidixic acid was the prototype to be used as a drug. After this date, a wide variety of quinolones have been produced, with the 4<sup>th</sup>-generation being the latest. Currently, there are 2<sup>nd</sup>-generation ciprofloxacin, 3<sup>rd</sup>-generation levofloxacin, and 4<sup>th</sup>-generation moxifloxacin in our country. The latest generation quinolones are used in the treatment of various infections, including pneumonia, by inhibiting bacterial DNA gyrase and topoisomerase IV isoenzyme<sup>[8]</sup>.

Quinolones have a broad-spectrum of use, covering not only respiratory infections but also urinary and digestive

system infections<sup>[9]</sup>. With the introduction of new-generation quinolones, the tendency to prescribe them had increased significantly, and, at one point, they became the most commonly prescribed antibiotic group in the U.S., with expectations at the time that this trend would continue<sup>[1,10]</sup>. According to the ATS/IDSA 2019 CAP guideline, respiratory quinolones (levofloxacin, moxifloxacin, gemifloxacin) can be used alone as a first-line treatment option in patients with comorbidities<sup>[2]</sup>. Although quinolones have strong activity against many infectious agents, they can cause serious side effects, and many quinolones are withdrawn after being introduced to the market. Gemifloxacin, recommended in the guideline, has been withdrawn from the market in our country because of its serious erythematous rash side effect. The Food and Drug Administration (FDA) has issued serious warnings regarding ciprofloxacin, levofloxacin, and moxifloxacin, which are commonly used in the treatment of pneumonia in our country<sup>[11]</sup>. The U.S. The FDA and the European Medicines Agency have restricted the use of quinolones due to their side effects, indicating the risks associated with their use as first-line therapy. Following this restriction, a decrease in the prescription rate of quinolones was observed, suggesting that health policies may be more effective than guidelines in influencing prescribing habits<sup>[12]</sup>. In our study, no obvious differences were detected in the clinical conditions affecting the first antibiotic choice, probably because there are no restrictions in Türkiye. The tendency to prescribe quinolones to those who do not have an antibiotic group priority in case of previous beta-lactam use may be due to the scarcity of alternative antibiotic groups. Those who only prioritized quinolones seemed to avoid quinolones in cases of previous



**Table 4. Comparisons of the importance of clinical problems in antibiotic selection between groups formed according to first-line antibiotic preference**

Only quinolone		First choice antibiotic group			
		Only non-quinolone	No priority		
		(n=29, 16.29%)	(n=75, 42,13%)	(n=74, 41.57%)	p
Parenchymal lung disease (n, %)	Yes	12 (41.4)	22 (29.3)	28 (37.8)	0.398
	No	17 (58.6)	53 (70.7)	46 (62.2)	
Prior beta-lactam treatment (n, %)	Yes	<sup>a</sup> 12 (41.4)	<sup>a</sup> 43 (57.3)	<sup>b</sup> 54 (73)	<b>0.008</b>
	No	<sup>b</sup> 17 (58.6)	<sup>a</sup> 32 (42.7)	<sup>a</sup> 20 (27)	
Prior steroid treatment (n, %)	Yes	1 (3.4)	7 (9.3)	7 (9.5)	0.573
	No	28 (96.6)	68 (90.7)	67 (90.5)	
Chronic diseases (n, %)	Yes	<sup>a</sup> 12 (41.4)	<sup>b</sup> 23(30.7)	<sup>a</sup> 42 (56.8)	<b>0.006</b>
	No	<sup>a</sup> 17 (58.6)	<sup>b</sup> 52(69.3)	<sup>b</sup> 32 (43.2)	
Broad-spectrum beta-lactamase treatment in the last 3 months (n, %)	Yes	15 (51.7)	45 (60)	43 (58.1)	0.744
	No	14 (48.3)	30 (40)	31 (41.9)	
Complicated pneumonia (n, %)	Yes	4 (13.8)	20 (26.7)	19 (25.7)	0.359
	No	25 (86.2)	55 (73.3)	55 (74.3)	

p value, chi-square test. Different superscript letters (<sup>a,b</sup>) in the column indicate statistically significant differences (p<0.05) according to the post-hoc test (Bonferroni method)

beta-lactam use or comorbidity, albeit the fact that this group consisted of fewer people compared to the other groups may have affected the results.

A study conducted in Denmark surveyed 108 general practitioners (GPs) about their antibiotic choices in CAP. This study investigated how GPs treat adults with CAP and explored the associations between GP characteristics and treatment duration. In this study, quinolones were not included among the options and were probably considered among the "other options" by the participants. In the study, antibiotic changes were made in 83.3% of cases when the first-line treatment failed. The remaining group preferred "other options" such as reevaluation of the patient and additional tests<sup>[13]</sup>. In our study, the tendency for hospitalization and the use of broad-spectrum antibiotics in first-line treatment failure was 78.09%. We believe that this difference is due to the predominance of specialist physicians in the study and the tendency of physicians to change in line with the physical facilities in cases of treatment failure.

An old survey of 288 internal medicine clinicians in West Germany in 1989 found that quinolones were used very rarely (2.5%) in cases of mild pneumonia. The statement "quinolones produce inadequate response against pneumococci and are not indicated in pneumonia" in the discussion segment of a past study is probably related to the information at that time<sup>[14]</sup>. In our study, 16.29% of physicians used quinolones as their first choice, and this rate increased to 34.5% among physicians who cared about the wide spectrum of action. When clinicians were asked about the healing rate of antibiotics, the majority of them thought that quinolones had a "faster" healing rate (p=0.041). However, studies comparing quinolones with other antibiotics

in terms of clinical recovery rate are limited, and there was no significant difference in the meta-analysis of studies conducted with tetracyclines<sup>[15]</sup>.

Once-daily dosing can be particularly important for the geriatric population who often take multiple medications. While moxifloxacin and levofloxacin offer the convenience of once-daily administration, most beta-lactam antibiotics require multiple doses per day and are often used in combination with macrolides for treating CAP. This difference may explain why those who initially preferred nonquinolone antibiotics considered monotherapy to be less critical (p=0.002).

In a study conducted in Türkiye, the antibiotics prescribed to the patients referred to the tuberculosis outpatient clinic were examined; it was revealed that 16 (15%) patients had previously been administered quinolone, 5 by pulmonology, and 11 by other specialties. According to our survey results, the importance given to the anti-tuberculosis activity of quinolones by chest disease physicians is consistent with these past data. Meanwhile, the anti-tuberculosis activity of quinolones and macrolides explains the decision of physicians who are alert about this issue in the treatment approaches with broad-spectrum antibiotics with hospitalization in cases of treatment failure due to the lack of oral options. However, behavior changes were encountered with hemoptysis, which is one of the specific findings of tuberculosis. A total of 29 patients had hemoptysis and only one was prescribed moxifloxacin (p=0.04)<sup>[16]</sup>. We believe that the determining factor here is the experience of tuberculosis among clinicians, considering the difference between pulmonology and other branches. Gemifloxacin was also found to be prescribed in this study. Because of its low anti-tuberculosis effectiveness

and reduction in the delay in tuberculosis treatment, it may affect physician behavior in pulmonology, especially in areas with high tuberculosis prevalence<sup>[17]</sup>. However, it could not be examined in our study because it was removed from the market and there were no quinolones with similar properties. Moreover, a comparison of pulmonologists with other specialties revealed similar perceptions regarding the effects and side effects of antibiotics, except for "tendinitis". Pulmonologists were observed to place greater emphasis on the side effects of tendinitis when compared with other specialties. However, given the similarities in other tendencies, we believe that specialization alone does not significantly influence antibiotic prescribing tendencies.

### Study Limitations

The primary limitation of this study is the relatively small and heterogeneous sample size, which may not fully represent broader trends. Moreover, the study's exploratory nature and the lack of a calculated sample size limit the generalizability of its findings.

### Conclusion

With advancements in quinolone antibiotics, quinolones are expanding their range of applications. As a result, information about the side effects of quinolones is increasingly becoming more available and their use is getting restricted, and some are even getting withdrawn from the market. Considering that the side effects of quinolones outweigh their benefits, it should be kept in mind that they are not recommended for use in first-line treatment, except for cases of contraindications to other antibiotics. Although it is known that antibiotic guidelines influence physicians' opinions, it should be noted that restrictions imposed by local health authorities are more effective. For this purpose, while the annual number of antibiotics, the number of antibiotics per outpatient clinic, and the annual distribution of antibiotic groups are regularly recorded in some countries, it is clear that these data should be tracked more rigorously in our country.

### Ethics

**Ethics Committee Approval:** Approval for this study was obtained from the Hatay Mustafa Kemal University Non-Interventional Ethics Committee (decision number: 20, dated: 04.03.2024).

**Informed Consent:** Informed consent was obtained.

### Footnotes

### Authorship Contributions

Concept: K.B.A., Design: M.A.T., Data Collection or Processing: K.B.A., M.K., Analysis or Interpretation: E.C., M.K., Literature Search: M.A.T., Writing: K.B.A.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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

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