

# Antibiotic preferences and treatment durations in community-acquired infections

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## ABSTRACT

**OBJECTIVE:** Since Infectious diseases and Clinical Microbiology specialists (IDS) are guiding both the community and other health professionals, it is important to use antibiotics in accordance with the guidelines. In this study, it was aimed to evaluate the approaches of IDS to the use of antibiotics and treatment times in community-acquired infections.

**METHODS:** Our study was conducted as a digital survey study applied to IDS between January 2019 and December 2020. Community-acquired pneumonia, cystitis, acute tonsillopharyngitis, acute otitis media, acute sinusitis, cellulitis, as well as the antibiotics they prefer and their duration of treatment, were asked by questionnaire method. A descriptive statistical analysis was performed on all the information obtained.

**RESULTS:** A total of 203 IDS participated in the study. About 34.7% of the participants worked as specialists for 0–5 years, 33.6% between 6 and 15 years, and 31.7% for more than 15 years. Most of the participants had problems adhering to the guidelines recommendations in their choice of antibiotics and in determining the duration of treatment. Non-compliance rates were higher among specialists who served for more than 5 years.

**CONCLUSION:** By providing radical changes in both specialty training and post-specialty trainings, creating online learning environments, and encouraging trainings, problems can be solved to a significant extent and new information can be accessed more quickly.

*Keywords:* Antibiotics; community-acquired infections; infectious diseases.

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In recent years, there has been a tendency to shorten treatment times for both community- and hospital-acquired infections. By shortening the duration of treatment, both costs and hospitalization and antibiotic use periods are reduced. More importantly, it contributes to the reduction of antibiotic resistance [1, 2]. However, despite all efforts today, adequate optimization in the use of antibiotics has not been achieved, and the wrong and unnecessary antibiotic prescription rates, especially in upper respiratory tract infec-

tions, have still not been reduced to the desired levels [3–5]. Rational Drug Applications trainings prepared by the Ministry of Health, especially for primary care physicians, have been accelerated. As a result of these trainings, although it is seen that antibiotic prescription rates have decreased according to the ministry data, antibiotic use has not been reduced to the desired levels, and it is seen that antibiotic use is still high compared to the average of most developed countries [3, 5]. At this point, the approach of Infectious

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Diseases and Clinical Microbiology Specialists (IDS) to antibiotic use and treatment times is of particular importance in order to guide and set an example for all physicians, especially physicians working in primary care. Therefore, in our study, antibiotic choices and preferred treatment times for IDS in community-acquired infections were evaluated.

## MATERIALS AND METHODS

Our study was conducted as a digital survey study applied to IDS between January 2019 and December 2020. IDS's contact information was obtained through the relevant specialist associations, and the survey questions were answered online. The questionnaire questions included the most common antimicrobial agents that can be used in community-acquired infections (community-acquired pneumonia, cystitis, acute tonsillopharngitis, acute otitis media, acute sinusitis, and cellulitis) and treatment periods that are frequently encountered in the institution and daily practice of the participants. The study has been approved by the Karadeniz Technical University Scientific Research Ethics Committee on May 26, 2022, protocol number 24237859-361 (no. 04).

### Statistical Analysis

A descriptive statistical analysis was performed with IBM SPSS 26 (New Orchard Road Armonk, New York 10504-12722 United States) for all the information obtained in the study. The chi-square test was used in the analysis of categorical variables. The data obtained by measurement were expressed as standard deviations of the average. The data obtained by counting were expressed as numbers (%).  $P < 0.05$  was considered statistically significant.

## RESULTS

203 IDS participated in the study. 61.9% of the participants were female, and the mean age of our participants was  $41.6 \pm 10.1$  years. 68.3% of the participants worked in tertiary hospitals; 34.7% were between 0 and 5 years old; 33.6% were between 6 and 15 years old; and 31.7% were working as specialists for more than 15 years. The antibiotic preferences and duration of treatment of the participants are given in Table 1.

### Highlight key points

- Non-compliance rates were higher in specialists who served for more than 5 years.
- Antibiotic preferences and treatment durations in community-acquired infections were less in line with the guidelines.
- It would be more appropriate to bring online learning environments to the forefront.

### Community-Acquired Pneumonia

In the treatment of community-acquired pneumonia, 39.1% of the participants preferred macrolides, 39.6% of Fluoroquinolone group antibiotics, 35.6% of Aminopenicillin +  $\beta$ -Lactamase Inhibitor, and 26.7% of 2<sup>nd</sup> or 3<sup>rd</sup> generation preferred Cephalosporins. While 61.4% recommended 5–7 days of treatment as a duration of treatment, 34.1% preferred 10–14 days of treatment. There was no statistically significant relationship between the duration of the physicians' study and antibiotic preferences and duration of treatment ( $p = 0.256$ ).

### Cystitis

The most commonly preferred antibiotics in the treatment of cystitis were Phosphomycin (47.5%), 3<sup>rd</sup> generation cephalosporins (38.6%), and Fluoroquinolone group antibiotics (28.7%). 35.7% of our participants preferred 3–5 days of treatment, while the remaining 64.3% preferred treatments longer than 7 days. Physicians who worked for more than 5 years were 55% more likely to use Fluoroquinolone ( $p = 0.012$ ; Odds Ratio [OR] = 0.45 [0.22–0.90]).

### Acute Tonsillopharngitis

It was seen that 48% of our participants prescribed antibiotics to more than 20% of patients. The most commonly preferred antibiotics were Aminopenicillins (51.5%), Benzathine Penicillin-G (34.2%), Oral Penicillin-V (22.3%), Macrolides (8.9%), and Generation 2–3 Cephalosporins (8.8%), respectively. Although the rate of those who gave Benzathine penicillin-G was 34.2%, the rate of those who gave single-dose treatment was 23.8%. The rate of those who recommended macrolide was 8.9%, while the rate of those who gave 5-day treatment was 14.4%. Physicians who worked for more than 5 years were 49% more likely to prescribe antibiotics to their patients ( $p = 0.019$ ; OR = 0.51 [0.027–0.96]). In addition, experts in the first 5 years of their specialization prefer 1.92 times more Benzathine Penicillin ( $p = 0.017$ ; OR = 1.92 [1.05–3.49]) and 2.15 times more preferred single-dose treatment ( $p = 0.011$ ; OR = 2.15 [1.12–4.13]).

**TABLE 1.** Antibiotic preferences and treatment durations of the participants

|                               | Antibiotics preferred   | Treatment durations<br>(days: %)                                      |  |
|-------------------------------|---|---|--|
| Pneumonia (%)                 | FQ: 39.6<br>Macrolides: 39.1<br>Aminopenicillin+ $\beta$ -lactamase inhibitor: 35.6<br>3 <sup>rd</sup> generation SS: 16.8<br>2 <sup>nd</sup> generation SS: 9.9  | 3: 0.5<br>5: 9.9<br>7: 51.5<br>10: 29.2<br>14: 8.9                    |  |
| Cystitis (%)                  | Fosfomycin: 47.5<br>3 <sup>rd</sup> generation SS: 38.6<br>FQ: 28.7<br>Nitrofurantoin: 27.2<br>2 <sup>nd</sup> generation SS: 17.3<br>Co-trimoxazole: 14.9<br>Aminopenicillin+ $\beta$ -lactamase inhibitor: 7.4<br>Aminoglycosides: 1.5                          | 3: 12.4<br>5: 23.3<br>7: 46.5<br>10: 15.3<br>14: 6.9                  | For how many patients with acute tonsillopharyngitis do you prescribe antibiotics?             |
| Acute tonsillopharyngitis (%) | Aminopenicillin: 51.5<br>Benzathine penicillin: 34.2<br>Oral Pen-V: 22.3<br>Macrolides: 8.9<br>Procaine penicillin: 8.4<br>2 <sup>nd</sup> generation SS: 5.9<br>3 <sup>rd</sup> generation SS: 2.9<br>FQ: 0  | Single dose: 23.8<br>3: 3.5<br>5: 14.4<br>7: 25.2<br>10: 33.2         | %5: %23.3<br>%10: %21.3<br>%15: %7.4<br>%20: %12.9<br>%25: % 12.4<br>%30: %13.9<br>>%40: %13.4 |
| Acute otitis media (%)        | Aminopenicillin: 64.4<br>2 <sup>nd</sup> generation SS: 28.7<br>3 <sup>rd</sup> generation SS: 15.3<br>FQ: 13.4<br>Macrolides: 7.9<br>Benzathine penicillin: 2.5<br>Oral Pen-V: 1.5   | Single dose: 0<br>3: 1.5<br>5: 9.4<br>7: 33.7<br>10: 39.1<br>14: 16.3 |  |
| Acute sinusitis (%)           | Aminopenicillin: 64.9<br>FQ: 26.2<br>2 <sup>nd</sup> generation SS: 22.3<br>Macrolides: 14.9<br>3 <sup>rd</sup> generation SS: 7.9<br>Oral Pen-V: 3<br>Benzathine penicillin: 0.5   | Single dose: 0<br>3: 1.5<br>5: 6.9<br>7: 30.7<br>10: 33.2             |  |
| Cellulitis (%)                | Aminopenicillin+ $\beta$ -lactamase inhibitor: 83.2<br>FQ: 21.3<br>1 <sup>st</sup> generation SS: 20.3<br>Clindamycin : 18.8<br>Fusidic Acid: 17.3<br>2 <sup>nd</sup> generation SS: 7.4<br>Co-trimoxazole: 4.5<br>3 <sup>rd</sup> generation SS: 4<br>Other: 0.9 | 14: 27.7<br>3: 0<br>5: 4.5<br>7: 30.7<br>10: 41.6<br>14: 23.3         |  |

FQ: Fluoroquinolone; SS: Cephalosporin.

### Acute Otitis Media

While 65% of the participants preferred Aminopenicillins, 44% preferred cephalosporins, and 14% preferred Fluoroquinolone group antibiotics, when the treatment periods were examined, it was determined that 43% of them gave 5–7 days of treatment, and the remaining 57% gave 10–14 days of treatment. Physicians who worked for more than 5 years were 67% more likely to use fluoroquinolones ( $p=0.016$ ;  $OR=0.33$  [0.12–0.91]).

### Acute Sinusitis

In the treatment of acute sinusitis, 65% of the participants preferred Aminopenicillins, 26.2% preferred the Fluoroquinolone group, and 30.2% preferred the 2–3<sup>rd</sup> generation Cephalosporins. 37.6% of the participants recommended 5–7 days of treatment, while 60.9% preferred 10–14 day treatments. Physicians who worked for more than 5 years were 55% more likely to use fluoroquinolones ( $p=0.015$ ;  $OR=0.45$  [0.22–0.92]).

### Cellulitis

The most commonly preferred antibiotics in the treatment of cellulitis were Aminopenicillin +  $\beta$ -Lactamase Inhibitor 83.2%, Fluoroquinolone group antibiotics (21.3%), 1–2<sup>nd</sup> Generation Cephalosporins (27.7%), Clindamycin (18.8%), and Fusidic Acid (17.3%). 3% of the participants preferred 5–7 day treatment periods, while 64.9% preferred 10–14 day treatments. There was no statistically significant relationship between the duration of the physicians' study and antibiotic preferences and duration of treatment ( $p=0.482$ ).

## DISCUSSION

In recent years, the duration of treatment has been shortened. This stands out both in terms of the absence of a significant difference between long-term treatments and short-term treatments in terms of mortality and recurrence and in terms of reducing side effects [1, 6]. In addition, significant changes are observed in the preferences of some antibiotics, such as the fluoroquinolone group [7–9]. A study conducted in Germany states that inappropriate antibiotic use decreases with increasing compliance with guidelines and protocols [6]. When evaluated from this point of view, it is important to follow the current literature closely. From the point of view of IDS, This issue becomes even more important because both society and other health professionals fol-

low their example and provide guidance. In our study, antibiotic regimens and treatment periods preferred by IDS in community-based infectious diseases that are frequently encountered in daily practice were examined.

### Community-Based Pneumonia

In general, it is seen that most of the participants do not comply with the current literature in terms of both antibiotic selection and treatment duration. In the Infectious Diseases Society of America (IDSA) pneumonia guidelines, limiting the duration of treatment to 5–7 days and not using Fluoroquinolones primarily in outpatient patients, the use of combinations of Macrolides or Doxycycline together with Cephalosporin stands out [7]. However, a significant number of our participants used Fluoroquinolones in the treatment and preferred longer-term treatments as the duration of treatment.

### Cystitis

The use of nitrofurantoin, and co-trimoxazole is recommended as the first option in the treatment of cystitis, and it is recommended that Fluoroquinolones be used in the absence of another alternative agent that can be given [8]. In the treatment of cystitis, which we frequently encounter in daily practice, it has been observed that the participants prefer Phosphomycin most often, and 1/3 of them use fluoroquinolones. Nitrofurantoin was preferred by only 1/4 of the participants. In the recommended treatment periods, it was seen that nearly half of them preferred 7 days and 1/4 preferred 10 days or longer. In particular, the antibiotic preferences and recommended treatment periods of long-term specialists were not in accordance with the guidelines.

### Acute Tonsillopharyngitis

In cases of acute tonsillopharyngitis, which is one of the most common diseases in the community, it was seen that there were significant problems with antibiotic selection and treatment times. A significant part of acute tonsillopharyngitis occurs due to viral agents. The leading indication for antibiotic administration in this group of patients is Group A  $\beta$  Hemolytic Streptococcus, which causes serious morbidities, and the incidence is quite low [10]. But close to half of the participants tended to prescribe antibiotics to most of this group of patients. It was seen that Benzatin Penicillin-G, which was the first choice in treatment, was 34.2%, and then Aminopenicillins were used. Among the alternative

options, the use of Clindamycin, Clarithromycin, and Azithromycin, as well as the first group of cephalosporins, Cephalexin and cephalexil, can be preferred [10]. The duration of treatment varies according to the antibiotic chosen. A single dose is recommended for benzathine Penicillin-G, 5 days for Azithromycin, and 10 days for other antibiotics [10]. Although there were no 3- or 7-day regimens in the treatment of acute tonsillopharyngitis, 28.7% of the participants were given 3- or 7-day treatments. Although the use of aminopenicillins was 51.2%, the rate of those who gave 10-day treatment was 33.2%. Another important point was that although the rate of physicians who gave benzathine penicillin-G was 34.2%, the rate of those who recommended single-dose treatment unfortunately remained at 23.8%. This suggests that some physicians gave additional antibiotics along with benzathine penicillin-G. It was seen that 2<sup>nd</sup> or 3<sup>rd</sup> generation Cephalosporins, the use of which is not recommended, were used at a rate of 8.8%, so there were significant problems in antibiotic selection, treatment duration, and antibiotic prescribing rates in acute tonsillopharyngitis. In particular, it was observed that physicians who had been working for more than 5 years were worse in compliance with current literature and guidelines.

### Acute Otitis Media

It is often caused by viruses, and bacterial acute otitis media is more common in children than in adults. The duration of treatment is recommended as 5–7 days [11]. Amoxicillin-Clavulonic Acid can be preferred as the first option, followed by Cefdinir, Cefpodoxime, Cefuroxime Axetyl, Ceftriaxone, Doxycycline, and Macrolides as alternatives [11–14]. Fluoroquinolones are recommended only in patients who have not responded to initial treatment and in the absence of another alternative [12–14]. Although a significant number of the participants preferred Aminopenicillins, 14% preferred Fluoroquinolones. In particular, physicians who worked longer than 5 years were using 67% more fluoroquinolones. When evaluated in terms of treatment time, it was seen that more than half of the participants preferred long-term treatments.

### Acute Sinusitis

Amoxicillin or Amoxicillin-Clavuronic Acid is recommended as the first option in treatment. Doxycycline, Cefixime, and Cefpodoxime are recommended in pa-

tients with a history of allergic or anaphylactic reactions to penicillins or in cases of a high probability of resistance in *Streptococcus* spp. The use of Fluoroquinolones is recommended in cases of unresponsiveness to initial treatment and in the absence of another alternative option. The use of macrolides in empirical treatment is not recommended. In general, 5–7 days of treatment are recommended [15, 16]. Although it was seen that 65% of our participants preferred aminopenicillins, more than 1/4 preferred Fluoroquinolones, 2<sup>nd</sup> Generation Cephalosporins, and Macrolides, which are not recommended in the initial treatment. It was seen that physicians who had been working for more than 5 years were using fluoroquinolones at a rate of 55% more. When the treatment periods preferred by our participants were examined, it was seen that 60% of them preferred long-term treatments.

### Cellulitis

In general, 5-day treatments are recommended. In mild to moderate infections, oral or Parenteral Penicillins, Cefazolin, Ceftriaxone, Clindamycin, Doxycycline, Trimethoprim-Sulfametaxazole are among the antibiotics initially recommended [9, 17]. In publications, the use of fluoroquinolones is recommended as a combination regimen in patients who require serious hospitalization. While 1/5 (20%) of our participants preferred Fluoroquinolone group antibiotics in outpatient treatments, 65% applied long-term treatment regimens.

Most of the participants did not comply with the guidelines recommendations in their antibiotic choices or in determining the duration of treatment. The fact that the incompatibility rates in specialists who have served for more than 5 years are higher than in newly specialized physicians suggests the necessity of post-graduation training. Especially today, rapid changes in information are occurring with the emergence of changes in newly defined pathogens, diseases, and treatment regimens. A physician needs to read pages every day to stay up to date, which is very difficult. For this reason, it would be more appropriate to bring online learning environments to the forefront. There are institutions in the world that accredit online learning environments and implement scoring systems such as CME and CPD [18]. In addition to the many advantages of online learning environments, there are also disadvantages, such as self-motivation and difficulty planning

and managing time well. Although the presentations of the meetings held by different specialized associations in our country are published online, there are no accreditation institutions like in Europe or the United States. This brings with it the security problem, which is one of the most important deficiencies in online training. For this purpose, it should be ensured that accreditation centers are established in our country, and that the residency training associations are planned at regular intervals under the supervision of these centers, that participation in the trainings is maximized and that the scoring systems are implemented effectively. Thus, it will be easier and more effective to refresh up-to-date information. It is thought that the trainings can be short presentations supported by a small number of questions in the form of quizzes or directly online through live broadcasts. In these trainings, it will be more effective for the participants to see their own deficiencies and update their knowledge. Another important point is that young experts are also seen to go beyond the current literature and guideline recommendations. This suggests that there are problems in residency training for community-acquired infections. Although these subjects are included in the specialty education curricula, especially in the practical sense, due to the fact that complicated patients often come to medical faculties, deficiencies may arise, and this situation causes problems after specialization. For this purpose, the physicians in residency training are sent on a rotation to public hospitals in the last years of their assistantship and discussed with the consultants the approach to the community-acquired infections they encounter in these places, revealing the mistakes made, reviewing the literature and guidelines, and having reports prepared by developing similar policies to eliminate the practical and theoretical knowledge deficiencies of the physicians in residency training on these issues. and where necessary, local policymakers will be contacted and necessary measures will be taken. In this way, the practices will direct the approaches of other physicians in a more scientifically accurate way and will also provide a better-quality patient care service. As a result, it is seen that there are important problems in the approach of IDS, who should be a guide and example to other physicians and especially to society in dealing with community-acquired infections. For the reasons we have explained, the problems can be solved to a significant extent by providing radical changes in Training should be encouraged both during and after residency training.

## Conclusion

In general, there is a low rate of appropriate antibiotic use among all participants. The longer the period after residency training, the lower the rate of appropriate antibiotic use. During residency training in university hospitals, severe and healthcare-associated infections are predominantly encountered. After residency training, information begins to be forgotten due to insufficient updating of information. For these reasons, policies should be developed to update both residency training curricula and post-residency training information.

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