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# Prescription of antibiotics in the medical care of newly arrived refugees and migrants

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## Abstract

**Purpose:** Unnecessary and inappropriate use of antibiotics is a widespread problem in primary care. However, current data on the care of refugees and migrants in initial reception centers is pending. This article provides data on prescription frequencies of various antibiotics and associated diagnoses.

**Methods:** In this retrospective observational study, patient data of 3255 patients with 6376 medical contacts in two initial reception centers in Germany were analyzed. Patient data, collected by chart review, included sociodemographic characteristics, diagnoses, and prescriptions. Antibiotic prescription behavior and corresponding physician-coded diagnoses were analyzed.

**Results:** Nineteen percent of all patients in our study received systemic antibiotics during the observation period, with children below the age of 10 years receiving antibiotics most frequently (24%). The most commonly prescribed antibiotics were penicillins (65%), macrolides (12%), and cephalosporins (7%). The most frequent diagnoses associated with antibiotic prescription were acute tonsillitis (26%), bronchitis (21%), infections of the upper respiratory tract (14%), and urinary tract infections (10%). In case of acute bronchitis 74% of the antibiotic prescriptions were probably not indicated. In addition, we found a significant number of inappropriate prescriptions such as amoxicillin for tonsillitis (67%), and ciprofloxacin and cotrimoxazol for urinary tract infections (49%).

**Conclusion:** Regarding inappropriate prescription of antibiotics in refugee healthcare, this study shows a rate ranging from 8% for upper respiratory tract infections to 75% for acute bronchitis. Unnecessary use of antibiotics is a global problem contributing to gratuitous costs, side effects, and antimicrobial resistance. This research contributes to the development of stringent antibiotic stewardship regiments in the particularly vulnerable population of migrants and refugees.

KEYWORDS
antibiotic prescription, antimicrobial resistance, inappropriate prescription, pharmacoepidemiology, primary healthcare, refugee healthcare, viral infection

Evelyn Kleinert and Nele Hillermann are joint first authors, and Frank Müller and Anne Simmenroth are joint senior authors.

## 1 | INTRODUCTION

The annual Global Trends Report of the United Nations High Commissioner for Refugees (UNHCR) shows that at the end of 2018, 70.8 million people worldwide were forcibly displaced.[1] Since the beginning of 2015, more than 1.6 million people applied for asylum in Germany.[2] This high number of refugees and their integration, particularly into the German healthcare system, poses a great challenge. In a 2016 questionnaire study, 86% of medical practitioners declared that they treated patients who had arrived in Germany as asylum seekers since 2015.[3] Common reasons of refugee patients for seeking treatment are respiratory and neuropsychological diseases, gastrointestinal disorders, diseases of the musculoskeletal system, and skin complaints. Studies showed that the reasons for medical encounters in refugee patients differ little from those of local patients.[4,5]

In Germany, physicians prescribed 368 million defined daily doses (DDD) of systemic antibiotics in 2016,[6] which is equivalent to 14.14 DDD per 1000 inhabitants per day.[7] Systemic antibiotics are more often prescribed to children, especially at preschool age, than to all other age groups.[7-9] Generally, women receive more antibiotics than men.[8,9] A key reason for this finding can be seen in the fact that some infectious diseases, for example, urinary tract infections (UTI), are more common in women due to the anatomy of the female urinary tract. Additionally, women seek medical care more often than men and are therefore more likely to receive antibiotic prescriptions.[10,11]

Antibiotics are frequently prescribed to patients with respiratory diseases, even though antibiotics are not indicated because most respiratory infections are of viral origin. Moreover, antibiotics do not reduce disease duration.[12-14] Doctors reported that their reasons for prescribing not indicated antibiotics were most commonly due to patient demands and also that the demand arose in urgent care settings.[15] Frequently prescribed antibiotics are penicillins and aminopenicillins, cephalosporins, tetracyclines, and quinolones.[6,7] Inadequate use of antibiotics causes antimicrobial resistance, which significantly limits treatment options in the treatment of severe infections. Antibiotic resistance is considered one of the largest threats to global health. One of the most important strategies worldwide is responsible and prudent use of systemic antibiotics, realized by thorough guidelines and so-called antibiotic stewardship.[16,17] Antibiotic stewardship programs subsume different measures for targeted and adequate antibiotic therapy and for avoiding unnecessary prescriptions. These can include training of physicians, patient education and empowerment, and joint patient visiting rounds with microbiologists and pharmacists, as well as tracking and reporting the use and prescription of antibiotics. Typically, interprofessional antibiotic stewardship units are established in hospitals for this purpose.[18,19]

Several studies have demonstrated that people with low educational status are particularly unaware of the mode of functioning of antibiotics and at risk of antibiotic resistance.[20-23] This might be an important aspect in refugee healthcare considering that 30% of asylum seekers in Germany have only attended primary school or have never attended school at all.[24] Additionally, language and cultural barriers complicate doctor-patient relationship and general healthcare provision.[25-28] Still, there is a gap in research on antibiotic prescribing in healthcare facilities for refugees and asylum seekers.

**Key Points**

- We observed a high rate of inappropriate prescription of antibiotics in a large current cohort of refugees newly arriving in Germany.
- Especially in the context of common viral infection such as acute bronchitis, the observed high rate of prescription of antibiotics appears to be unnecessary.
- To avoid unnecessary costs, side effects, and the emergence of antimicrobial resistance, healthcare providers caring for refugees must be aware of this problem and be trained in antibiotic stewardship.
- In our setting of healthcare provision in initial reception centers, cultural and language barriers as well as changing medical staff with limited time resources may have contributed to the high rate of prescription of antibiotics.

This study collects data on the prescription of antibiotics in primary healthcare centers in two German initial reception facilities for refugees and asylum seekers. We provide an overview of antibiotic prescription behavior in primary refugee healthcare in Germany in the context of diagnoses and demographic characteristics.

## 2 | METHODS

### 2.1 | Study population

In this retrospective observational study, all patient charts from two on-site primary healthcare wards of the initial reception facilities Celle and Friedland in Germany were analyzed. In total, we included data from 3255 patients with 6376 medical contacts in the study. The first cohort we analyzed consists of 1017 refugee patients (with a total of 2282 encounters) who sought medical care between September and December 2015 at the medical ward of the refugee reception facility in Celle (in Northern Germany). This facility was a temporary shelter that was built to cope with the large number of refugees during the 2015 refugee crisis and was closed with the decrease in numbers in mid-2016. Parts of this cohort have been described previously.[29,30] The second cohort consists of 2238 refugee patients who had 4094 encounters in total and arrived at the reception facility in Friedland (in Central Germany) between August 2017 and August 2018. Other aspects of this cohort and their typical healthcare needs have been published previously.[5] The reception facilities provided primary medical care by on-site medical wards to all residents of the facilities according to the German asylum seeker benefits law (Asylbewerberleistungsgesetz), which restricts medical services in comparison to those covered by the statutory health insurance. In brief, patients receive primary care to meet basic healthcare needs

and can be referred to a specialist or hospital for treatment if necessary. Each on-site ward was staffed by emergency medical personnel 24 h per day, supplemented by consultation hours by various doctors on each weekday.

## 2.2 | Data collection and analysis

Patient data were extracted from electronic (Celle) or paper-based (Friedland) health records, including age, sex, refugee status (asylum seeker or resettlement refugee), and country of origin. Whenever available, diagnosis coding according to the International Statistical Classification of Diseases and Related Health Problems (ICD-10) was also recorded for each consultation. Prescribed drugs were coded using the Anatomical Therapeutic Chemical Classification System (ATC). Coding was performed by a late-stage medical student and supervised by experienced physicians. Random audits were performed to ensure data quality. Because patients often consulted their doctors with several health concerns (e.g., tonsillitis, migraine, and depression), the antibiotic-relevant diagnosis (tonsillitis) was identified manually (see File S1).

Prescriptions were coded using different ATC coding levels including anatomical main group (first level), therapeutic/pharmacological subgroup (third level), and chemical substance (fifth level). In this study, we only evaluate the prescription of systemic antibiotics, therefore antibiotics for topical use were not taken into account. The statistical software package IBM SPSS statistics 25 (IBM, Armonk, NY) was used for all analyses. Descriptive statistical methods were used to describe the patient cohort and their diagnoses and prescriptions. Differences in age and sex were tested for significance by using the Mann–Whitney *U* test (for metric non-normally distributed variables) and the Pearson $Chi^2$ test (for categorical variables).

Our findings are discussed in consideration of the national guidelines of the German Society of General Practice and Family Medicine (Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin, DEGAM) and further literature with focus on the most frequent infectious diseases leading to prescription of antibiotics in our cohort: tonsillitis, acute bronchitis, upper respiratory tract infections (URTI), urinary tract infections (UTI), and otitis media (Table 1).

Acute bronchitis is typically characterized by cough, sore throat, and fever. Because it is usually caused by a viral infection, antibiotic treatment is not recommended.[31] Nevertheless, antibiotic treatment may be indicated when patients have certain risk constellations.

Tonsillitis is a frequent infection in patients between five and 15 years and is in this age group often caused by group-A streptococci (GAS).[32] Patients report sore throat, headache, and fever, accompanied by gastro-intestinal symptoms in children. The Centor- and McIsaac Score are used to estimate the probability of an infection with GAS based on the occurrence of fever, absence of cough, cervical lymph node swelling, enlarged or occupied tonsils, and age under 15 years. High scores (≥3) are used as an indicator for antibiotic treatment. Substance of choice is penicillin V or erythromycin in case of allergy.

Viruses cause the vast majority of acute URTI, often without fever, but with headache, cough, and sore throat, often accompanied by lassitude. In most cases, these infections heal without later complications.[31,33]

Community-acquired uncomplicated UTI are most commonly caused by *E. coli*. First-line antibiotic therapies are currently fosfomycin, nitrofurantoin, nitroxolin, pivmecillinam, or trimethoprim.

With regard to otitis, it is recommended to abstain from immediate prescription of antibiotics for patients with otitis without risk factors and toddlers over the age of 6 months. In case of aggravation or lack of amelioration within 48 h, the patient should be reevaluated. When an antibiotic therapy is required, amoxicillin or a second-generation cephalosporin are recommended.[35]

# 3 | RESULTS

Of all patients in both reception facilities, 45% were female, with significantly more female patients in Friedland than in Celle ($p \leq 0.001$).

**TABLE 1** Most frequent diagnoses with antibiotic prescription and recommended treatment according to the DEGAM guidelines

| Diagnosis | Antibiotic prescription 1st line | Antibiotic prescription 2nd line |
|---|---|---|
| Tonsillitis | • Penicillin V if Centor- or McIsaac Score ≥3 or delayed prescription (Exacerbation of symptoms/no improvement after 3–5 days)<br>• Score values up to 2: no antibiosis, symptomatic therapy only | Erythromycin if Centor- or McIsaac Score ≥3 and Penicillin allergy |
| Acute bronchitis | No antibiotics recommended | No antibiotics recommended |
| URTI | No antibiotics recommended | No antibiotics recommended |
| UTI | Fosfomycin, nitrofurantoin, nitroxolin, pivmecilliam, trimethoprim | in case of recurrence or new infection <14 days - > change of first-line antibiotic |
| Otitis media | • No antibiotics recommended for patients over the age of 6 months and without fever<br>• Or back up/delayed prescription of amoxicillin | • Second-generation cephalosporins<br>• Makrolid in case of allergies to penicillins/cephalosporins (e.g., erythromycin) |

Abbreviations: DEGAM, German Society of General Practice and Family Medicine (Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin); URTI, upper respiratory tract infections; UTI, urinary tract infections.

On average, patients in Celle were younger (mean: 21.89 years) than those in Friedland (mean: 25.79 years, $p \leq 0.001$), although there were more children below the age of 10 years in Friedland (Table 2). All patients in Celle were asylum seekers, whereas 43% of patients in Friedland were resettlement refugees. Most common countries of origin of patients in both camps were Syria, Iraq, and Afghanistan. On average, patients consulted the doctor 1.9 times during their stay. Of all patients, 50% presented with diagnoses within the ICD-10 category R00-R99 comprising symptoms, signs, abnormal clinical and laboratory findings, and ill-defined conditions for which no diagnosis classifiable elsewhere is recorded. In this category, symptoms such as cough, sore throat, fever and headache, and abdominal pain are usually coded, which are very common in general practice. Other common reasons for consultation in our cohorts were diseases of the respiratory system (35%) and diseases of the musculoskeletal system and connective tissue (15%). Most frequently prescribed drugs were

**TABLE 2** Sociodemographic and medical characteristics of the patients in the two reception facilities

| ***Sociodemographic characteristics*** | | **Friedland ($n = 2238$)** | **Celle ($n = 1017$)** | **Total ($N = 3255$)** |
|---|---|---|---|---|
| Age (years) | | Mean = 25.79 (0–90, SD = 18.65) | Mean = 21.89 (0–75, SD = 14.38) | Mean = 24.56 (0–90, SD = 17.49) |
| | | ***n* (%)** | ***n* (%)** | ***n* (%)** |
| Age groups (years) | 0–9 | 610 (27.3) | 259 (25.5) | 869 (26.7) |
| | 10–19 | 280 (12.5) | 172 (17.2) | 452 (13.9) |
| | 20–29 | 395 (17.7) | 304 (29.8) | 699 (21.5) |
| | 30–39 | 450 (20.1) | 150 (14.8) | 600 (18.4) |
| | 40–49 | 233 (10.4) | 86 (8.5) | 319 (9.8) |
| | 50–59 | 144 (6.5) | 34 (3.3) | 178 (5.5) |
| | 60–69 | 92 (4.1) | 6 (0.6) | 98 (3.0) |
| | 70+ | 29 (1.3) | 1 (0.1) | 30 (0.9) |
| | Missing | 5 (0.2) | 5 (0.5) | 10 (0.3) |
| Sex (female) | Total female patients | 1103 (49.9) | 371 (35.5) | 1474 (45.3) |
| | ≤19 years[a] | 405 (45.5) | 183 (42.5) | 588 (44.5) |
| | ≥20 years[a] | 696 (53.0) | 186 (32.0) | 882 (45.9) |
| Residence permit status | Asylum seekers | 1275 (57.4) | 1017 (100.0) | 2292 (70.9) |
| | Resettlement refugees | 948 (42.6) | 0 (0) | 948 (29.1) |
| Countries of origin | Syria | 906 (40.8) | 453 (44.5) | 1358 (41.8) |
| | Iraq | 224 (10.1) | 191(18.8) | 415 (12.7) |
| | Afghanistan | 130 (5.9) | 151 (14.9) | 281 (8.6) |
| | other | 978 (43.2) | 222 (21.8) | 1201 (36.9) |
| ***Medical characteristics*** | | | | |
| | | ***n*** | ***n*** | ***n*** |
| Total consultations | | 4094 | 2282 | 6376 |
| Consultations per patient | | 1.8 | 2.2 | 1.9 |
| | | ***n* (%)** | ***n* (%)** | ***n* (%)** |
| Diagnoses[b,c] (ICD-10) | R00-R99 | 949 (42.4) | 669 (65.8) | 1618 (49.7) |
| | J00-J99 | 680 (30.4) | 445 (43.7) | 1125 (34.6) |
| | M00-M99 | 323 (14.4) | 153 (15.0) | 508 (14.6) |
| Prescribed drugs[c] (ATC, level 1) | Respiratory system (R) | 712 (31.8) | 522 (51.3) | 1234 (37.9) |
| | Nervous system (N) | 530 (23.7) | 258 (25.4) | 788 (24.2) |
| | Anti-infectives for systemic use (J) | 491 (21.9) | 187 (18.4) | 678 (19.7) |

Abbreviation: SD, standard deviation.

[a]Percentage of all female patients. Due to missing values for age, four persons are missing here.

[b]Diagnoses are described based on ICD-10 coding: R00-R99: symptoms, signs, abnormal clinical and laboratory findings, and ill-defined conditions for which no diagnosis classifiable elsewhere is available; J00-J99: diseases of the respiratory system; M00-M99: diseases of the musculoskeletal system and connective tissue.

[c]Multiple answers are possible.

those of the ATC groups R = respiratory system (38%), N = nervous system (24%), and J = antiinfectives for systemic use (20%).

## 3.1 | Prescription of antibiotics

In total, 11% of all consultations resulted in antibiotic prescription. 19% (N = 624) of all patients were prescribed at least one antibiotic medication for systemic use. Five hundred and fifty-one patients of these (89%) received only one antibiotic prescription, and 54 patients (9%) received two antibiotic prescriptions. More frequent prescriptions were rare (see Table 3). Patients with at least one antibiotic prescription were significantly younger than those without (mean: 22.8 years, SD: 18.23 vs. 24.8 years, SD: 17.22, $p = 0.003$). Antibiotic prescriptions were most prevalent in children under the age of 10 years ($N = 209$, 24%) and patients over the age of 70 years ($N = 7$, 24%), (Figure 1). However, the group of people over 70 is very small ($n = 22$). As shown in Table 3, the most commonly prescribed antibiotics were penicillins, macrolides, and cephalosporins. Tonsillitis, acute bronchitis, URTI, UTI, and otitis were the most common diagnoses leading to antibiotic prescriptions. Regarding the total number of antibiotic prescriptions, no differences regarding sex were observed, but cephalosporins were prescribed significantly less to female (31%) than to male patients (69%, $p = 0.048$). Considering only adult patients, women were treated more often (51% out of 45% female patients) with antibiotics than men (49% out of 55% male patients, $p = 0.041$).

Among antibiotic-related diagnoses, female patients were significantly less likely to receive a diagnosis of URTI (30%, $p \leq 0.001$) and

**TABLE 3** Characteristics of antibiotic prescriptions

| | | Female sex[a] | |
|---|---|---|---|
| | ***n* (%)** | ***n* (%)** | ***p*-Value** |
| Patients with antibiotic prescriptions | | | |
| Total patients with antibiotics | 621 (19.1)[b] | 291 (46.8) | 0.345 |
| ≤19 years | 282 (45.5)[c] | 118 (41.8) | 0.316 |
| ≥20 years | 338 (54.5)[c] | 172 (50.9) | **0.041** |
| Number of antibiotic prescriptions per patient ($n = 621$) | | | |
| 1 prescription | 551 (88.7) | Not calculated due to too small subgroups | |
| 2 prescriptions | 54 (8.7) | | |
| 3 prescriptions | 12 (1.9) | | |
| 4 prescriptions | 2 (0.3) | | |
| 5 prescriptions | 1 (0.2) | | |
| 6 prescriptions | 1 (0.2) | | |
| Consultations with antibiotic prescriptions | | | |
| Total consultations with antibiotic prescriptions | 691 (10.8)[b] | 317 (45.9) | 0.799 |
| Most common substance groups (ATC, level 3/4; $n = 691$) | | | |
| Penicillins | 449 (65.0)[d] | 199 (44.4) | 0.659 |
| Macrolides | 82 (11.9)[d] | 41 (50.0) | 0.402 |
| Cephalosporins | 48 (7.0)[d] | 15 (31.3) | **0.048** |
| Other | 112 (16.2) | 62 (53.4) | 0.073 |
| Most frequent diagnoses leading to antibiotic prescription ($n = 691$) | | | |
| Tonsillitis | 179 (25.9)[d] | 86 (48.0) | 0.449 |
| Acute bronchitis | 143 (20.7)[d] | 69 (48.3) | 0.533 |
| URTI | 95 (13.6)[d] | 29 (30.3) | **0.001** |
| UTI | 70 (10.1)[d] | 52 (74.3) | **0.001** |
| Otitis media | 60 (8.7)[d] | 28 (46.7) | 0.898 |
| Other | 109 (15.8)[d] | 45 (37.2) | **0.035** |
| No diagnosis | 35 (5.1)[d] | 18 (51.4) | 0.499 |

*Note*: The whole column *p*-value represents the corresponding significance values. For a quicker overview, we have marked the values <0.05 in bold.
Abbreviations: URTI, upper respiratory tract infections; UTI, urinary tract infections.

[a]Percentages must be interpreted in the context of the proportion of 45.2% women in the total patient cohort. *p*-Values show $Chi^2$-tests regarding the distribution between women and men.

[b]Percentage of total sample.

[c]Percentage of patients with antibiotics. Due to missing in age one person is missing here.

[d]Percentage of consultations with antibiotic prescriptions.

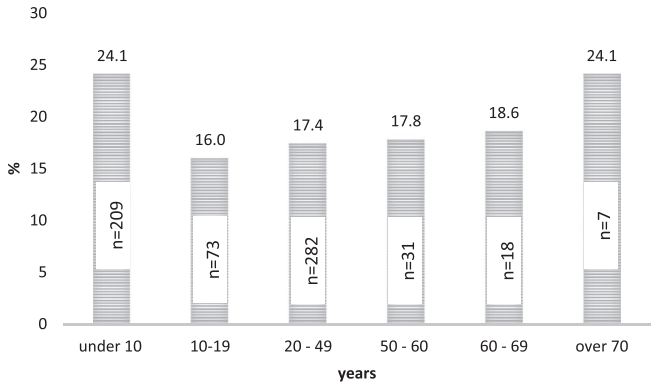


**FIGURE 1** Age of patients with at least one antibiotic prescription

significantly more likely to receive a diagnosis of UTI (74%, $p \leq 0.001$; Table 3).

## 3.2 | Diagnosis-specific antibiotic prescription

As shown in Table 4, 89% of patients diagnosed with tonsillitis received antibiotic treatment. They were treated with amoxicillin in 67% of cases followed by phenoxymethylpenicillin (12%). Phenoxymethylpenicillin complies with DEGAM guidelines if Centor- or McIsaac Score are >3 or if symptoms exacerbate or do not improve after 3–5 days. Relevant McIsaac Score parameters were age less than 15 years in 44%, fever in 11%, and cervical lymph node swelling in 3% of cases of tonsillitis with antibiotic prescription.

Acute bronchitis was treated with antibiotics in 74% of cases, contrary to the DEGAM guidelines in Table 1. Most frequently prescribed antibiotics in this context were amoxicillin (45%) and doxycyclin (13%).

In the third largest group of antibiotic-relevant diagnoses, URTI ($n = 95$), 8% of all patients received antibiotic treatment, of whom half were treated with amoxicillin (4%). The very low prescribing rate for URTI is consistent with the guidelines.

Patients with UTI were treated with antibiotics in 73% of cases, mostly with sulfamethoxazole/trimethoprim and ciprofloxacin, although neither is recommended by the DEGAM guideline.

Forty-two percent of patients with otitis media were treated with antibiotics and mostly with amoxicillin (37%), which is in accordance with the guidelines in case of age under 6 months or high fever and if a re-presentation after 24 h is not possible. Fever was documented in 15% of antibiotic-treated patients with otitis media.

# 4 | DISCUSSION

To our knowledge, this is the first study that collected systematic data on antibiotic prescriptions in a representative group of asylum seekers in Germany during the current exodus. Given that a large proportion of migrants in our cohort were younger than 30 years, the majority of refugees were male, and home countries frequently were Syria, Iraq, and Afghanistan, the demographic characteristics match the group of all asylum seekers in Germany in the immigration statistics since 2015.[2,36]

In most cases, doctors coded patients' symptoms such as cough, sore throat, fever, and headache using the ICD-10 category R00-99. The underlying respiratory ailments are in accordance with primary healthcare demands in the respective German population, where respiratory diseases are a highly prevalent complaint leading to medical attendance.[37]

Overall, 19% patients in our cohorts received systemic antibiotics during the observation period. Patients with antibiotic prescription were significantly younger than those without. Nearly a quarter of the patients below the age of 10 years received antibiotic treatment, and about 45% of all antibiotics were prescribed to patients up to age of 19 years. This result complies with previous research on age distribution of antibiotic prescriptions.[7-9] In general, women in Germany are reported to receive more antibiotics than men.[9,38] This is seen as a result of an overall higher prevalence of UTI in women than in men, and of sex-specific differences in utilization of health care services.[39,40] The latter could be confirmed for the Celle cohort, as well for children and adolescents[29] as for adults.[30] For the Friedland cohort, sex-dependent differences in medical attendance could not be investigated as there were no sociodemographic characteristics available for all Friedland residents.

In our whole patient cohort, we found no sex dependency in overall antibiotic prescribing: The proportion of female individuals was 47% in the group of patients with antibiotic prescription and corresponded to that of female individuals (45%) in the whole cohort. As mentioned above, about 45% of antibiotics ($n = 282$ out of 621) in our study were prescribed to patients up to the age of 19 years, and sex dependencies are presumably less likely in diagnoses most frequently treated with antibiotics in this age group. On the other hand, only 10% ($n = 70$ out of 691) of all antibiotic prescriptions were due to UTI, a diagnosis that women are significantly more often diagnosed with and treated for. These two subgroups' respective proportions of all antibiotic prescriptions might reduce sex-dependent influences in the whole patient cohort. However, considering only adult patients (age ≥20 years), our data do confirm the formerly described higher frequency of antibiotic prescription to women.

In our setting, most antibiotics were prescribed for respiratory diseases, which is in line with previous findings in German[6,21,41] and international primary care.[9,42] Frequent diagnoses in case of antibiotic prescription were tonsillitis, acute bronchitis, URTI, UTI, and otitis. Following the DEGAM guidelines, there is no need for antibiotic prescription in patients with acute bronchitis or URTI because these infections are mostly caused by viruses.[12-14,31,33] In our study, 237 not indicated antibiotic prescriptions for acute bronchitis and URTI were identified (34% of all antibiotic prescriptions). One reason for the presumably not indicated prescription of antibiotics may be the doctors' fear of a higher number of complications.[43]

In our setting, 89% of the patients with tonsillitis received an antibiotic. Only a minority of these patients met criteria for bacterial

**TABLE 4** Diagnoses most frequently treated with antibiotics and respective prescriptions

| Diagnoses (n) | Antibiotic prescription *n* (%) | Most frequently prescribed antibiotics | | Consistent with recommendations |
|---|---|---|---|---|
| | | Name | *n* (%) | |
| Tonsillitis (201) | 179 (89.1) | Amoxicillin | 134 (66.7) | No |
| | | Phenoxymethylpenicillin | 25 (12.4) | Possibly yes, first choice |
| | | Others | 20 (10.0) | - |
| Acute bronchitis (191) | 142 (74.4) | Amoxicillin | 85 (44.5) | No |
| | | Doxycyclin | 25 (13.1) | No |
| | | Roxithromycin | 15 (7.9) | No |
| | | Others | 17 (8.9) | - |
| URTI (1271) | 95 (7.5) | Amoxicillin | 51 (4.0) | No |
| | | Clarithromycin | 16 (1.3) | No |
| | | Cefuroxime | 11 (0.9) | No |
| | | Others | 17 (1.3) | - |
| UTI (96) | 70 (72.9%) | Sulfamethoxazole + Trimethoprim | 25 (26.0) | No |
| | | Ciprofloxacin | 22 (22.9) | No |
| | | Others | 23 (24.0) | - |
| Otitis media (143) | 60 (42.0) | Amoxicillin | 53 (37.1) | Yes, second choice, or delayed prescription |
| | | Others | 7 (4.9) | - |

Abbreviations: URTI, upper respiratory tract infections; UTI, urinary tract infections.

infections such as cervical lymph node swelling or fever, which indicate GAS infection and should lead to antibiotic treatment according to current guidelines.[33] However, it is difficult to capture the parameters of the Centor- or McIsaac Score from our data, because "no cough" was not documented and probably other symptoms were often not coded separately. Even if we assume that antibiotic treatment was indicated, amoxicillin was prescribed in 67% of cases, which is neither first nor second line antibiotic.[33]

Almost half of the patients with UTI received ciprofloxacin or cotrimoxazol (sulfamethoxazole and trimethoprim). These drug therapies are not recommended in the guidelines anymore,[34] but are generally often prescribed in primary care settings, possibly because they were still among the second-line antibiotics in 2009.[44] In none of the recorded UTI cases, fever was documented. Fever could be a sign for a pyelonephritis, in which case ciprofloxacin would be the preferred treatment option.[34] Changes in the resistance situation or updates to the benefit–risk profiles mean that antibiotic guidelines are constantly updated. Neugebauer et al show that 23% of physicians have no access to a database of national guidelines[45] and instead use their usual medications.

In our observation, patients with otitis media received amoxicillin in 88% of antibiotic prescriptions. Following DEGAM guidelines, amoxicillin is the agent of choice for treating otitis media when antibiotic therapy is indicated, but the guideline emphasizes the principle of reluctant prescription when no risk factors are present.[35,46] However, beyond refugee healthcare, the concept of reluctant or delayed prescription of antibiotics is often not followed by general practitioners. Petruscke et al. suggest that main reasons for abstaining from delayed prescription were impending weekend or a hard-to-estimate disease course (44%), as well as the patient's demand for an antibiotic prescription (30%), unfamiliar patients (15%), or language barriers and mental limitations of patients (13%).[47]

In refugee healthcare, studies revealed that physicians rate language barriers as the strongest obstacle for treating a patient in an optimal fashion,[48-51] followed by cultural differences, psychic trauma, and lacking cooperation of the patients.[48] Language barriers are also associated with higher healthcare costs[52] and lower treatment quality[25-28] and pose the largest impediment for refugees when they seek medical advice.[50,53,54] In our cohort, the frequent and presumably not indicated prescription of amoxicillin may arise because antibiotics are freely available in some countries and may be a "go-to medicine" for many migrants seeking medical help. It is conceivable that patients might ask for it directly and doctors might give in because of the perceived pressure and the lack of communication possibilities. In general, in our setting of healthcare provision in initial reception centers, cultural and language barriers as well as changing medical staff with limited time resources who are caring for a permanently fluctuating group of refugees may have contributed to the high rate of antibiotic prescriptions.

Our study has several limitations. First, the retrospective design prohibited systematic screening for antibiotic-relevant symptoms in all patients. Diagnoses were mainly based on clinical judgment of the experienced general practitioners. It is possible that the doctors' documentation was incomplete and some antibiotic-related symptoms were not recorded. In addition, a bias among doctors cannot be excluded. However, the representativity and size of the patient sample is a strength of the study.

## 5 | SUMMARY

Taken together, these data show a rate between 8% and 75% of inappropriate prescriptions of antibiotics in a large current cohort of refugees newly arriving in Germany. This corresponds to inappropriate prescriptions in general population in several high-middle income countries.[55-58] Especially in the context of common viral infections such as acute bronchitis, the observed high rate in the prescription of antibiotics appears to be associated with the risks of unnecessary costs, side effects, and the emergence of antimicrobial resistance. In cases of tonsillitis or UTI, where antibiotics are generally appropriate, substances were frequently prescribed that were not or no longer in accordance with the guidelines. Unfortunately, we cannot assess the extent to which infectious diseases with resistant microbial strains occur among refugees and migrants based on our data. This aspect calls for further investigation.

In our setting of healthcare provision in initial reception centers, cultural and language barriers as well as changing medical staff with limited time resources may have contributed to the high rate of inappropriate prescription of antibiotics. Healthcare providers caring for refugees should be aware of this problem and be particularly trained in antibiotic stewardship. We hope to contribute to developing regimens for stringent antibiotic stewardship in the particularly vulnerable population of migrants and refugees in the current situation.

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### CONFLICT OF INTEREST

The authors declare they have no conflict of interest.

### ETHICS STATEMENT

The Research Ethics Board of the Göttingen University Medical Center approved the study (Ethics Approval No. 18/5/16) as part of the DICTUM-Friedland study.[59] The study site in Celle was separately approved by the Research Ethics Board of Hannover Medical School (Ethics Approval No. 3217-2016).

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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