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Antibiotic-Prescribed Infections in Patients Receiving Home Care Services

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ABSTRACT: In our study, it was aimed to examine "antibiotic (AB) prescribed infections" (ABPI) in patients receiving home care service (HCS) in the last year. Patients receiving HCS from a tertiary hospital were evaluated (n=176). In addition to descriptive information such as demographics, devices used and chronic diseases, ABs prescribed to patients in the last year and infections that were the reason for their prescription were screened retrospectively. It was determined that 138 patients had been prescribed AB at least once. In total, 691 ABs were used in 550 prescriptions. It was observed that the most common ABPI was urinary tract infection (44.9%), and the most commonly prescribed AB was amoxicillin-clavulanic acid (n=123). Using assistive devices for breathing and lung disease increased the risk of lower respiratory tract infection, for which ABs were prescribed at least once. These predictive factors were feeding with a nasogastric catheter or percutaneous endoscopic gastrostomy for upper respiratory tract infections and using a urinary catheter for urinary tract infections. Our study revealed the most common ABPI in patients receiving HCS and the factors predicting them. These findings will shed light on the planning and management of HCS.
Keywords: Antibiotics; home care services; infections.

INTRODUCTION

Home care services (HCS) are formal and regular care programs provided by various health care professionals at the patient's home, including medical and social services aimed at promoting and restoring health while reducing the effects of disability and illness[1,2]. In Turkey, these services were legally defined for the first time in 2005 and are planned to be provided mainly within the body of state hospitals as of 2015[3]. Within the scope of HCS, those who need post-operative care and the elderly and disabled people who need care due to chronic severe diseases or orthopedic problems are served by the healthcare team until their illness or health needs are over[4].

The vast majority of patients receiving HCS are elderly or people with chronic diseases[5]. In addition to the slower and weaker response of the immune system to the antigens it encounters with aging, chronic dysfunctions such as diabetes mellitus, atherosclerosis, degenerative joint diseases, dementia, etc., urinary or stool incontinence, pressure ulcers developing in bedridden patients, use of enteral or urinary catheters, prostheses placed in areas such as the heart or joints and medical devices used by patients at home cause microorganisms to enter the body more efficiently and make them more susceptible to infection[6,7]. As a result of the development of disease, the frequency of drug use also increases.

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Different findings have been revealed in various studies investigating previous infections in HCS patients. A systematic review observed that the most common infection in home care patients was a line-related infection in those receiving parental nutrition therapy, followed by UTI[7]. A large-scale study conducted in the United States (USA) in 2010 showed that respiratory tract infections were most common in the HCS population, followed by wound infections and UTI[8]. More information is needed about infection in HCS patients, especially regarding their use of antibiotics. This study aimed to determine the antibiotics (ABs) used by patients receiving HCS from a tertiary hospital in the last year and for which infection they were prescribed.

MATERIALS AND METHODS

This cross-sectional study was conducted in the HCS unit of a tertiary hospital in October-December 2022. All patients registered in the unit and receiving HCS for at least one year were included in the study. Approval for the study was obtained from the Health Sciences University Trabzon Faculty of Medicine Scientific Research Ethics Committee with the date of 29.06.2022 under the number 10496660-3.

The current patient list was obtained from the HCS secretariat at the beginning of each month during the study. A total of 361 patients were scanned alphabetically, and electronic patient information records and documents of 178 patients who met the inclusion criteria were retrospectively reviewed individually. Inclusion criteria; have received HCS for at least one year and have access to electronic patient information records. Demographic characteristics such as age, gender, and place of residence and defining features such as being bedridden, use of urinary catheters, feeding with a nasogastric catheter (NG) or percutaneous endoscopic gastrostomy (PEG), presence of tracheostomy and chronic diseases were recorded. The state of being bedridden was evaluated with the Katz Index of Independence in Activities of Daily Living. The pressure ulcer status was assessed with the Braden Scale for Predicting Pressure Ulcer Risk. Afterwards, the prescribed ABs and the diagnoses in the same prescription were determined by examining the electronic patient records.

Statistical calculations were made using the SPSS version 23.0 (IBM, Chicago, USA) package program. Descriptive statistics were performed, and the suitability of the numerical variables to the normal distribution was evaluated with the Kolmogorov Smirnov Z test. Numerical data were analyzed with the Mann-Whitney U test; categorical data were analyzed with the Chi-square test. Multiple regression analysis was performed to determine the independent risk factors for each type of infection that caused at least one AB prescription. Variables observed to have $p<0.05$ in single comparisons were included in the model. Numerical data were expressed as median [interquartile range] and categorical data as numbers (percentage). The statistical significance level was accepted as $p<0.05$.

RESULTS AND DISCUSSION

The median age of the patients was 81 [16], and 107 (60.8) were female. It was determined that 138 (78.4) of the patients had at least one "antibiotic-prescribed infection" (ABPI). 691 ABs were prescribed, with 550 prescriptions (median: 2 [4]) for the whole group. No diagnosis of infection was found in 121 of them. The descriptive characteristics of the patients and ABPI numbers according to these are shown in Table 1 and Table 2.

Table 1. Descriptive Characteristics of The Patients and the Number of "Antibiotic-Prescribed Infections" According to These.

	n (%)	**Number of ABPI**	**p values***
Gender			0.788
Female	107 (60.8)	2 [3]	
Male	69 (39.2)	2 [4]	
Living place			0.618
Urban	73 (41.5)	2 [4]	
Rural	103 (58.5)	2 [3]	
Be bedridden			0.220
Yes	52 (29.5)	3 [4]	
No	124 (70.5)	2 [5]	
Air bed use			**0.006**
Yes	47 (26.7)	**4 [4]**	
No	129 (73.3)	**2 [4]**	
Diaper use			**0.006**
Yes	147 (83.5)	**3 [4]**	
No	29 (16.5)	**1 [3]**	
Colostomy			**0.028**
Yes	4 (2.3)	**6.5 [4]**	
No	172 (97.7)	**2 [3]**	
Urinary catheter			**<0.001**
Yes	52 (29.5)	**4 [4]**	
No	124 (70.5)	**2 [4]**	
Obesity			0.597
Yes	37 (34.3)	3 [5]	
No	71 (65.7)	3 [4]	
Feeding with NG or PEG			**<0.001**
Yes	50 (28.4)	**4 [5]**	
No	126 (71.6)	**2 [3]**	
Tracheostomy			**0.002**
Yes	21 (11.9)	**4 [5]**	
No	155 (88.1)	**2 [3]**	
Use of assistive devices for breathing			**0.008**
Yes	33 (18.8)	**4 [4]**	
No	143 (81.3)	**2 [3]**	
Pressure ulcer			0.693
Yes	54 (30.7)	3 [3]	
No	122 (69.3)	2 [4]	

Numerical data were expressed as median [interquartile range]
ABPI: antibiotic prescribed infections, NG: nasogastric catheter, PEG: percutaneous endoscopic gastrostomy
*: Mann-Whitney U test

Table 2. Chronic Diseases of the Patients and the Number of "Antibiotic-Prescribed Infections" According to These.

	n (%)	**Number of ABPI**	**p value***
Neurological disease			0.460
Yes	150 (85.2)	2.5 [4]	
No	26 (14.8)	2 [4]	
Cardiovascular disease			0.299
Yes	86 (48.9)	2 [3]	
No	90 (51.1)	3 [4]	
Hypertension			0.518
Yes	130 (73.9)	3 [3]	
No	46 (26.1)	2 [5]	
Diabetes mellitus			0.243
Yes	58 (33.0)	3 [4]	
No	118 (67.0)	2 [3]	
Hypothyroidism			**0.018**
Yes	19 (10.8)	**4 [3]**	
No	157 (89.2)	**2 [3]**	
Orthopedic disease			0.800
Yes	40 (22.7)	2.5 [4]	
No	136 (77.3)	2 [4]	
Lung disease			**0.011**
Yes	44 (25.0)	**4 [4]**	
No	132 (75.0)	**2 [3]**	
Psychiatric illness			0.543
Yes	47 (26.7)	2 [3]	
No	129 (73.3)	2 [4]	
Malignancy			0.078
Yes	13 (7.4)	4 [5]	
No	163 (92.6)	2 [3]	
Kidney disease			0.708
Yes	13 (7.4)	3 [5]	
No	163 (92.6)	2 [3]	

Numerical data were expressed as median [interquartile range]
ABPI: antibiotic-prescribed infections
*: Mann-Whitney U test

While the most common ABPIs were urinary tract infections (UTI), upper respiratory tract infections (URTI) and lower respiratory tract infections (LRTI), respectively, the most prescribed antibiotic preparations were amoxicillin-clavulanic acid, fosfomycin and ciprofloxacin. The number of patients prescribed AB, the type and the total number of infections are shown in Table 3, and AB is prescribed to patients, and the number of prescriptions is shown in Figure 1.

Table 3. The Number of Patients Prescribed an Antibiotic, the Type, and the Number of Infections.

	n (%) *	Total number of ABPI
All infections	138 (78.4)	550
Urinary tract infections	79 (44.9)	203
Lower respiratory tract infections	44 (25.0)	80
Upper respiratory tract infections	48 (27.3)	75
Skin and subcutaneous tissue infections	40 (22.7)	71
Dental infections	10 (5.7)	15
Gastrointestinal infections	7 (4.0)	8
Osteomyelitis	1 (0.6)	1
Cholecystitis	1 (0.6)	1
No diagnosis of infection	69 (39.2)	121

In 23 antibiotic use 2 infections and 1 antibiotic use 3 infections were found together.
ABPI: Antibiotic-prescribed infection
*: Number of patients prescribed at least one antibiotic for the specified infection.

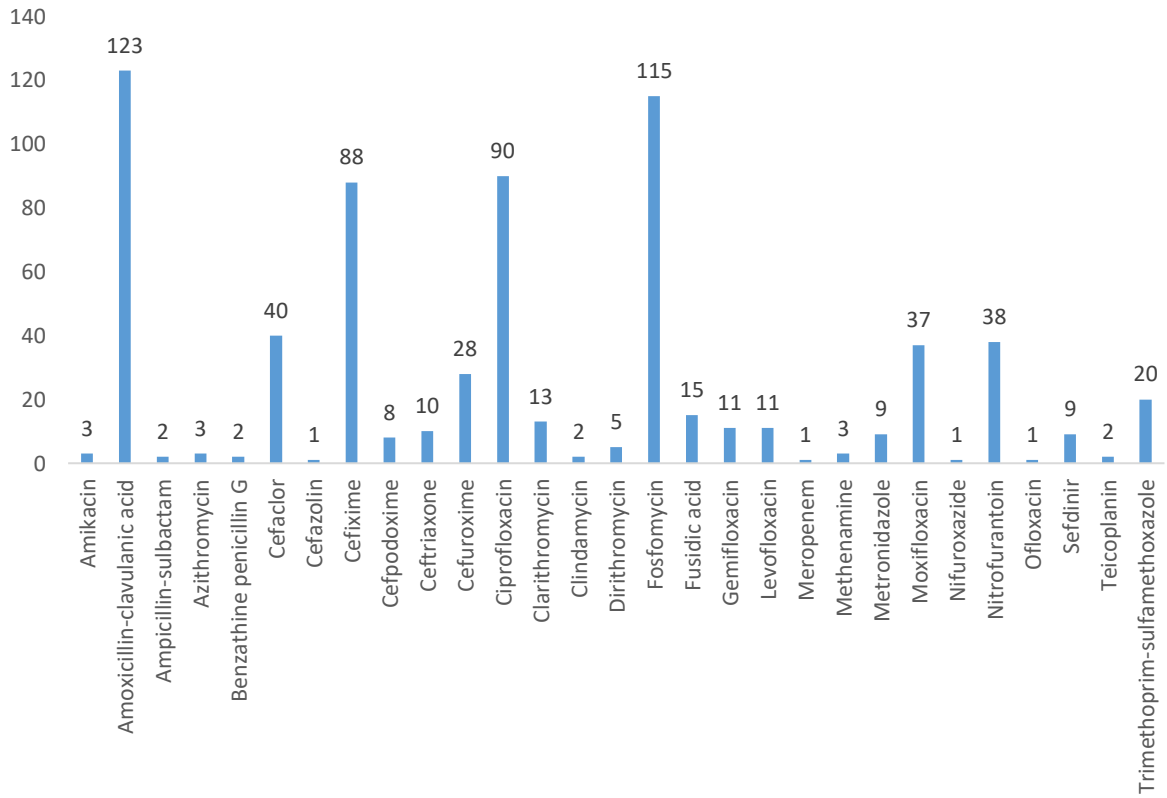

Figure 1. Antibiotics Prescribed to Patients and the Number of Prescriptions

While the most used single AB was amoxicillin-clavulanic acid (103 times), the most frequently combined AB pair was cefixime and fosfomycin (22 times). When the AB used according to the infections was examined, it was observed that fosfomycin in UTI, moxifloxacin in LRTI, amoxicillin-clavulanic acid in URTI, skin and subcutaneous tissue infections and dental infections, and metronidazole in gastrointestinal infections

were the most common prescriptions. The most prescribed ABs according to infections are shown in Table 4.

Table 4. Most Prescribed Antibiotics According to Infections

	Total number of prescriptions
Urinary tract infections	
Fosfomycin	81
Ciprofloxacin	48
Cefixime	39
Lower respiratory tract infections	
Moxifloxacin	22
Amoxicillin-clavulanic acid	14
Gemifloxacin	7
Upper respiratory tract infections	
Amoxicillin-clavulanic acid	42
Cefixime	10
Cefuroxime	7
Skin and subcutaneous tissue infections	22
Amoxicillin-clavulanic acid	14
Ciprofloxacin	10
Cefaclor	
Dental infections	
Amoxicillin-clavulanic acid	13
Cefixime	2
Metronidazole	1
Gastrointestinal infections	
Metronidazole	6
Ciprofloxacin	2
Nifuroxazide	1
No diagnosis of infection	
Fosfomycin	27
Cefixime	27
Ciprofloxacin	21

The independent risk factors for at least one AB prescription for LRTI, URTI, and UTI are shown in Table 5.

In our study, it was found out that patients who received HCS had a median of 2 ABPI in the last year. The median is higher in those who use air bed, use diapers, have a colostomy, have urinary catheters, are fed with NG or PEG, have a tracheostomy, use assistive devices for breathing, have hypothyroidism and have lung disease (Table 1, Table 2).

In two different studies conducted in Turkey in patients receiving HCS, the most common infections were lung infections, followed by decubitus and UTI[9,10]. In another study involving patients hospitalized in the palliative care unit, UTI was the most common in patients, followed by wound infection and LRTI[11]. Our study observed that the most common conditions in home care patients were UTI, followed by URTI and LRTI. The Centers for Disease Control and Prevention (CDC) estimates that 93,300

catheter-related UTI occurred in USA hospitals in 2011. UTI still account for 12.9% of healthcare-associated infections and 23% of infections in intensive care units (ICU), and most UTI are associated with indwelling urinary catheters; approximately 70% (and 95% of UTI occurring in ICU) develop in patients with urinary catheters[12]. In our study, under the literature, it was determined that using a urinary catheter predisposed the development of UTI (Table 5). In a study by Ergin et al., it was reported that 21.7% of the patients had a urethral catheter, and 53% of the patients with a urethral catheter had UTI[13]. A study by Yörük et al. stated that 5.6% of the elderly who received HCS had a urogenital catheter (14). According to these results, it is clear that the urinary catheter use rate of the patients included in our study is higher than in other studies (29.5%). As a result, urinary catheter use poses a risk for UTI. According to the CDC, 65% to 70% of catheter-related UTI are estimated to be preventable[12]. In this respect, it is essential to minimize the use of catheters and to reduce infection rates by taking the necessary precautions.

Table 5. Independent Risk Factors for Lower Respiratory Tract Infections, Upper Respiratory Tract Infections, and Urinary Tract Infections for Whom Antibiotics Have Been Prescribed at Least Once.

	Odds ratio	p value
Lower respiratory tract infections*		
Use of assistive devices for breathing	2.7 [1.1-6.3]	0.026
Having lung disease	4.0 [1.8-8.7]	<0.001
Upper respiratory tract infections**		
Feeding with nasogastric catheter (NG) or percutaneous endoscopic gastrostomy (PEG)	2.9 [1.2-7.0]	0.016
Urinary tract infections***		
Use of a urinary catheter	6.6 [3.0-14.5]	<0.001

Variables observed to have p<0.05 in single comparisons were included in the multiple regression model. These;
*: "Use of assistive devices for breathing" and "lung disease"
**: "Age", "feeding with NG or PEG", "presence of tracheostomy", "presence of heart disease" and "hypertension"
***: "bed dependency," "air bed use", "diaper use", "urinary catheter use", and "feeding with NG or PEG"

Our study determined that 28.4% of the patients were fed with NG or PEG, which poses a risk in terms of URTI (Table 1, Table 5). In the study of Balcıoğlu, 31.4% of the patients in the palliative care unit were fed via PEG and no relationship was found between the feeding way and the presence of infection[11]. Cohen et al. showed that home-used nebulizers contain microorganisms[15]. A study conducted in Spain observed that S. aureus grew most frequently in mechanical ventilators used at home, and the degree of ventilator cleaning and disinfection affected contamination[16]. In our study, following the literature, it was determined that using assistive devices for respiration creates a predisposition in terms of LRTI (Table 5). The possible reason is that the patients do not comply adequately with the cleaning measures. Schweon et al. showed that a comprehensive hand hygiene education program conducted in a nursing home reduced the prevalence of LRTI from 0.97 to 0.53 per 1,000 person-days[17,18]. It is possible to reduce the risk of infection by training to be given to patients receiving HCS and their relatives.

Problems such as using too many drugs per patient, using these drugs incorrectly, prescribing inappropriate drugs to special patient groups, using unnecessary drugs, and using insufficient doses and inappropriate antimicrobials for non-bacterial infections are called irrational drug use[19,20]. ABs are the leading drug groups that are consumed irrationally[21]. A study conducted in Turkey declared that 24.97% of prescriptions written by family physicians included at least one AB, and the most commonly prescribed ABs were the combination of amoxicillin and beta-lactamase inhibitor, clarithromycin and cefuroxime[19]. The study of Deniz et al. showed that moxifloxacin is the most commonly used AB in home care patients[9]. Our research observed that the most frequently prescribed AB was amoxicillin-clavulanic acid, followed by fosfomycin and ciprofloxacin (Figure 1). WHO reports that unnecessary prescription of antibiotics, preferring broad-spectrum ones, and not using them in sufficient time or appropriately lead to the development of resistance, resulting in ineffectiveness in treatment and additional health expenditures[22]. In this respect, it is essential for public health to act carefully and consciously in the use of ABs.

Our study's first and most important limitation is that the data were obtained retrospectively from patient records. It is doubtful whether ABs are used for the specified infection in prescription. As a matter of fact, a large number of AB prescriptions without a diagnosis of infection were found. Another area for improvement is the inability to establish a cause-effect relationship due to the cross-sectional nature of the study. Finally, the fact that the HCS unit where the study was conducted addresses a certain area prevents our findings from being attributed to the whole country or the world. These limitations can be avoided with multicenter studies to be planned in a prospective structure.

CONCLUSION

As a result of our study, it was determined that the most common ABPIs among patients receiving HCS from a tertiary hospital were UTI. The most commonly used ABs were amoxicillin-clavulanic acid, and some descriptive characteristics of the patient affected the total ABPI number. Patients receiving HCS are more prone to infections than other people due to many reasons, such as chronic diseases, medical devices they use, urinary catheters, and inactivity. This situation should be recognized, and appropriate measures should be taken, such as preventing malnutrition, improving living conditions and paying attention to hygiene. Enteral or urinary catheters should only be used if there is an indication, as they will facilitate the entry of microorganisms into the body. This study tried to determine AB use, their infections, and the characteristics related to these in the patients receiving HCS. The dissemination of this and similar studies will contribute to the planning and management of HCS.

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest regarding this article.

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