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A Survey on Medication Adherence and Its Associated Factors in Antibiotic-Takers Following Their Discharge from Hospital

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Abstract

Background: High adherence to antibiotic therapy is essential for complete cure, reduction of treatment costs, and prevention of drug resistance.
Objectives: The aim of this study was to evaluate adherence to antibiotic treatment and its associated factors in patients after hospital discharge.
Methods: This was a cross-sectional study. This study was conducted on 313 patients discharged from the hospital on antibiotics from October 6 to December 21, 2020. Demographic information of the participants was obtained at the time of discharge from the hospital, and the Morisky medication adherence scale was completed one week after discharge. Data were analyzed using descriptive statistics and the chi-square test at a significance level of < 0.05.
Results: The mean age of patients was 44.17 ± 19.51 years, and 95% of them were discharged with only one oral antibiotic. The mean score of drug adherence in this research was 6.45 ± 1.41. Those under 40 years of age had poorer adherence to antibiotic treatment than patients aged over 40 years ($P = 0.04$). The patients who should have consumed antibiotics thrice a day forgot taking their medications more than others ($P = 0.02$). The patients who received antibiotics twice a day were less likely to discontinue their medication without informing their physicians ($P = 0.03$).
Conclusions: Adherence to antibiotic treatment after hospital discharge is poor among patients. All patients, especially those under 40 years of age and those who should receive medications more often, must be given serious considerations for treatment adherence.

Keywords: Antibiotic, Medication Adherence, Patients, Patient Discharge

1. Background

Outpatient antibiotic prescriptions in 2015 were estimated at 838 per 1,000. Antibiotics are among the most beneficial and widely used treatments that save millions of lives every year (1). Antibiotics are necessary for treating most bacterial infections, and avoiding taking them in some cases can be life-threatening (2). Antibiotics help cure and recover from diseases, but their incorrect administration and indiscriminate use cause many side effects such as drug resistance and treatment failure. Treating infections with antibiotics is becoming more and more difficult, and the number of failures is increasing. A reason for that is the emergence of antibiotic-resistant pathogens. In addition to treatment failure, antibiotic resistance has some other complications, including prolonged hospital stay and urges to resort to older antibiotics, causing more side effects and high costs and consequently reducing the quality of life (3). It is estimated that at least 33% of all drug-related hospital admissions in developing countries are due to poor medication adherence (4). In the US, approximately 20 - 30% of prescribed medications are not filled, resulting in an estimated 125,000 deaths annually, a 10% increase in the hospitalization rate, and 100 - 290$ billion annual costs (5). Antibiotic resistance is such a serious matter that several international statements have been issued to motivate governments to combat this phenomenon (6, 7); however, there are serious concerns about how to deal with this phenomenon (8-10). Studies have reported low levels of antibiotic adherence. Chen et al. reported 40% (11), and another study reported 49% (12) adherence to antibiotics.

The most important reason for antibiotic resistance is the misuse and overuse of antibiotics both in human medicine and in agriculture (13). Antibiotic resistance is a serious global threat, especially in developing countries, due to their inappropriate use and lack of proper adherence to antibiotic therapy (14). Drug adherence is important not merely for preventing antibiotic resistance but also for treating and avoiding secondary infections. Grosso et al. showed that the early discontinuation of antibiotics because the person feels better was the most important reason for non-adherence to antibiotics (15). Valline et al. showed that the public had little information about proper adherence to antibiotics, as well as the risk of antibiotic resistance (16). A study by Wathne et al. showed that adherence to antibiotic use guidelines improved treatment outcomes, prevented readmission, and reduced treatment costs (17).

A main concern in this regard is the extent to which patients follow antibiotic regimens after being discharged from the hospital. Also, it is important to investigate the factors affecting these patients' adherence to antibiotic regimens. As a result, this study aimed to examine the factors affecting adherence to antibiotic regimens in the patients discharged from the hospital.

2. Methods

This cross-sectional study was conducted on the patients discharged on antibiotics from three teaching hospitals affiliated with Babol University of Medical Sciences from October 6 to December 21, 2020. Among 348 patients who were discharged on antibiotics, 313 patients completed questionnaires and entered the study.

Demographic information of the patients, including age, sex, type of disease, hospitalization ward, place of residence, marital status, occupation, level of education, economic status, antibiotics, polypharmacy, instructions about using antibiotics given by nurses and physicians, and the insurance coverage of prescribed antibiotics, were collected after obtaining informed consent from the participants.

The eight-item Morisky medication adherence scale (MMAS-8) was used to measure the patients' antibiotic adherence. The information required for completing this scale was obtained by making phone calls a week after discharge.

The scale consists of eight items, including seven yes/no questions and one item on a five-point Likert scale (18). For the first seven items, each "yes" answer was given a score of zero, and each "no" answer was given a score of one. For the last item (i.e., the Likert scale), which asked about the frequency of the patient's forgetting to take the prescribed medication, the scores were as follows: (1) never = 1, (2) once in a while = 3, (3) sometimes = 2, (4) usually = 0.25, and all the times = 0. The total score, which ranged between zero and eight, was calculated by summing up all MMAS-8 items. A score of less than six reflects low adherence, a score of six or seven reflects medium adherence, and a score of eight reflects high adherence. Although MMAS-8 is more useful for chronic conditions, it has also been used by several studies investigating antibiotic adherence (19, 20). The validity and reliability of the instrument were evaluated and confirmed in other studies (21-23).

The patients who answered all of the questions were included in the study. Data analysis was performed using SPSS software version 25, and a P-value of less than 0.05 was considered statistically significant. The chi-square test was used to examine the relationship of each categorical variable with the level of drug adherence and Morisky questionnaire items. The study was approved by the research vice chancellor of Babol University of Medical Sciences under the ethical code of IR.MUBABOL.REC.1399.151.

3. Results

In this study, 313 patients discharged on antibiotics from 14 wards of Rouhani and Shahid Beheshti hospitals in Babol were investigated. The mean age of the patients was 44.17 $\pm$ 19.51 years, and 45.1% of them were 40 to 65 years old. The mean medication adherence score was 6.45 $\pm$ 1.41. Among the study participants, 66.8% had complete adherence to prescribed antibiotics, while 7.3% had poor adherence.

About 95% of the patients were discharged with only one oral antibiotic. Most of the patients discharged on antibiotics were from urology (n = 40), orthopedics (n = 38), and infectious diseases wards (n = 34). The most commonly prescribed antibiotics were cephalexin (500 mg three times a day, n = 129) and cefixime (once a day for one week, n = 36) (Table 1).

The < 18-year-old age group had the weakest adherence to antibiotic treatment compared to other age groups (P = 0.001, Table 2).

The < 18- and 25 - 40-year-old age groups forgot to take their antibiotics significantly more often than other age groups (P = 0.04). Discontinuing antibiotics for a reason other than forgetting to take them was significantly more common among < 18 years old patients compared to other age groups (P = 0.001). Moreover, stopping antibiotics one day before the end of the period was notably more prevalent in the < 18-year-old age group than in other age groups (P = 0.001).

Table 1. Frequency of the Antibiotics Prescribed in Different Hospital Wards

Variables	Urology	Orthopedics	Infectious	Pediatric	General	GI	ENT	Neurology	Respiratory	Gynecology	Hematology	Skin	Heart & critical	Total
Cephalexin	10	38	10	7	16	5	3	8	2	4	5	7	14	129
Metronidazole	3	0	3	4	2	12	0	1	0	4	2	0	1	32
Cefixime	8	0	5	1	2	1	2	5	4	2	2	2	2	36
Ciprofloxacin	12	0	1	0	1	1	2	2	1	3	0	0	2	25
Co-amoxiclav	0	0	1	4	0	0	3	0	2	0	1	0	0	11
Clindamycin	0	0	3	3	1	1	1	2	0	0	0	0	0	11
Amoxicillin	0	0	1	3	0	3	2	0	0	0	0	0	0	9
Azithromycin	0	0	1	3	0	0	1	1	3	0	1	0	0	10
Levofloxacin	0	0	1	0	1	0	1	0	7	1	0	0	0	11
Doxycycline	0	0	2	0	1	0	1	0	0	1	1	4	0	10
Clarithromycin	0	0	0	0	0	3	0	1	0	0	0	0	0	4
Cotrimoxazole	2	0	2	0	1	1	0	2	0	0	0	0	0	8
Other	5	0	3	1	1	0	18	1	0	0	0	0	0	29
Total	40	38	33	26	26	27	34	23	19	15	12	13	19	325

Table 2. Distribution of Drug Adherence Level Based on Demographic Variables

Variables	Drug Adherence			P-Value
	Poor	Moderate	High	
Age				0.000
< 18	9	11	12	
18 - 40	11	29	54	
40 - 65	3	32	110	
> 65	0	9	33	
Polypharmacy				0.78
Yes	3	24	74	
No	20	57	135	
Sex				0.99
Male	10	35	91	
Female	13	46	118	
Consumption instruction				0.34*
Once a day	0	0	9	
Twice a day	14	49	99	
3 times a day	7	24	67	
4 times a day	2	8	34	
Education				0.10
High school	9	36	112	
Diploma	8	15	48	
Academic	6	30	49	
Job				0.13
Employee	6	15	30	
Self-employed	7	32	98	
Housewife	4	26	69	
Unemployed	6	8	12	
Marital status				0.000
Single	15	22	31	
Married	8	56	162	
Residence				0.63
Urban	12	40	116	
Rural	11	41	93	

Stopping antibiotics when feeling the disease was under control was more frequently observed in the < 18- and 25 - 40-year-old age groups compared to other age groups (P = 0.001).

Antibiotic discontinuation when feeling bad about taking them was significantly less prevalent in the > 65-year-old age group than in other age groups (P = 0.02).

Forgetting to take antibiotics or remembering it late was considerably more common in the < 18-year-old age group (P = 0.001, Table 3).

The patients who took antibiotics three times a day forgot their medications more often than others (P = 0.02), and the ones who took antibiotics twice a day were less likely to discontinue their medications without informing their physicians (P = 0.03).

In addition, the patients who took antibiotics once a day forgot their medications or remembered it late significantly less frequently than other patients (P = 0.04, Table 3).

4. Discussion

According to the results of the present study, cephalexin, a first-generation cephalosporin, was the most common antibiotic prescribed at the time of hospital discharge (39% of all antibiotics). Cefixime, a third generation cephalosporin, had been prescribed as an antimicrobial treatment for more than 11% of the patients at the time of hospital discharge. In a study by Hashimoto et al., cephalosporins were mentioned as the most common antibiotics in outpatient settings in Japan (24). In the United States, penicillin and macrolides were the most commonly used antibiotics for outpatients (25). It is noteworthy that the present study only examined the antibiotics prescribed at the time of hospital discharge but not in the outpatient setting. However, the frequency of prescribing cephalexin (500 mg) was remarkable, which could be due to the relatively high number of the patients who entered the study from surgical wards.

In this study, 33.2% of the patients had poor adherence to antibiotic therapy. This rate of non-adherence is alarming according to the recommendations of the World Health Organization and increases the risk of antibiotic resistance. In the study of Suffoletto et al., the rate of non-adherence to antibiotic treatment after discharge was 49%, and a follow-up intervention using a Mobile Phone Text Message Program did not affect patients' adherence to the treatment (12). In the study of Munoz et al., although an educational intervention had a significant effect on antibiotic adherence, this rate was still reported to be about 67% after hospital discharge (26).

In the present study, among the assessed demographic variables, only age and duration of medication use were significantly associated with adherence to antibiotic regimens. In a study by Shuangmeitong et al. in 2018, there were significant relationships between adherence to antibiotic treatment and the variables of age, sex, place of residence, level of education, and income (27). Here, we noticed that < 18- and 18-40-year-old individuals had significantly lower adherence to antibiotic treatments. It is necessary for physicians and nurses to pay more serious attention to this issue and put more emphasis on antibiotic adherence when they are dealing with these patients. In Ahmed's study, most participants were between 10 and 29 years of age, and more than 73% of them reported that they sometimes forgot to take their antibiotics because of simply feeling well or being too busy (28). In another study, the rate of non-adherence to antibiotic regimens in children was 36% (29).

Comparing the < 18- and 18-40-year-old age groups with other age groups, we found that the most important reasons for non-adherence were forgetting the medication, stopping it for reasons other than forgetfulness, and feeling better and having a bad feeling after taking the medication. It seems that the most important reasons for poor medication adherence in these age groups are heavy workloads and lack of awareness about the risks of medication misuse (28). Further studies are required to investigate other possible reasons for non-adherence in these age groups.

Liano et al. (2018) showed that the patients who took medications once a day had a higher adherence than those taking medications twice a day (14). In the study of Testa et al. (2017), it was stated that patients with once per day medication regimens were more adherent to the treatment than those taking medications several times a day (30). In accordance, we demonstrated that the patients who took antibiotics three times a day (tds) were more likely to forget and feel bad after taking them compared to those who took the medication once or twice a day. The frequent use of medications is why patients forget to take them since it may interfere with their sleep or other activities. Although doctors sometimes have no other choice than prescribing medications three or more times a day, choosing antibiotics that need to be taken fewer times per day can improve medication adherence.

4.1. Limitations

Since all the included patients were recruited at the same time period, it was not possible to select equal proportions of participants from each different ward.

Table 3. The Factors Affecting Drug Adherence

Variables	Sex			Age (y)					Consumption Instruction			
	Female	Male	P-Value	< 18	18 - 40	40 - 65	> 65	P-Value	TDS	BD	Dily	P-Value
Q1			0.90					0.041*				0.02*
Yes	35	45		13	30	30	7		49	27	4	
No	101	134		19	69	112	35		123	71	41	
Q2			0.21					0.00*				0.47
Yes	16	30		17	17	9	3		25	12	9	
No	120	149		15	82	133	39		147	86	36	
Q3			0.90					0.17*				0.03*
Yes	25	32		3	25	27	2		41	7	9	
No	111	147		29	74	115	40		131	91	36	
Q4			0.41					0.80				0.59
Yes	26	41		10	27	23	7		38	22	7	
No	110	138		22	72	119	35		134	76	38	
Q5			0.37					0.00*				0.23
Yes	16	21		13	21	9	0		21	18	4	
No	120	150		19	76	133	42		150	80	40	
Q6			0.18*					0.00*				0.77
Yes	17	41		10	34	11	3		34	16	8	
No	119	138		22	65	131	39		138	82	37	
Q7			0.57					0.02*				0.053
Yes	16	17		7	11	15	0		17	15	1	
No	120	162		25	88	127	42		155	83	44	
Q8			0.35					0.00*				0.043*
Sometimes/usually [a]	52	72		22	49	42	11		72	42	10	
Once in a while	70	98		10	42	89	27		92	46	30	
Never	14	9		0	8	11	4		8	10	5	
Adherence			0.96					0.00*				0.19
Yes	45	59		20	43	32	9		63	31	10	
No	91	118		12	54	110	33		108	67	34	

[a] Modified.

4.2. Conclusion

The level of non-adherence to antibiotic treatment was considerably high in our study. All patients should be trained by physicians and nurses to adhere to the treatment regimen. Individuals aged < 40 years old and the patients who should take medications several times a day are more likely to discontinue the treatment, and they should be specifically trained to adhere to the treatment. Also, medical managers should pay more attention and intervene in this regard to prevent the complications caused by non-adherence to therapeutic regimens.

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Footnotes

Authors' Contribution: AZ and MQQ prepared the first draft of the manuscript and made critical revisions to the paper, and responded to reviewers. VP, AA, PA, and SRJA helped in searching the literature and performing clinical research at the hospital.

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Ethical Approval: The study was approved by the research ethics committee of Babol University of Medical Sciences (IR.MUBABOL.REC.1399,151).

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Informed Consent: Information of the patients was collected after obtaining informed consent from the participants.

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