

Original Article

## Antibiotic prescribing and the risk of antibiotic-associated diarrhoea in Korle Bu Teaching Hospital, Ghana: a pilot study

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### Abstract

**Introduction:** This study sought to identify the association of antibiotic prescribing and the risk of antibiotic-associated diarrhoea (AAD) in Korle Bu Teaching Hospital (KBTH) in Ghana.

**Methodology:** Patients from the Male Urology Ward and Treatment Room of the Surgical Department of KBTH were followed up over three months to determine if they had experienced any unusual diarrhoeal illness after antibiotic therapy. 81 eligible patients (adults) were included in the study but a total of 70 patients (mean age of 56.71 years) were successfully followed up during the study period.

**Results:** The top conditions presented by patients were urological infection (66.7%), cancer (15.3%) and leg ulcer (18.1%). Ciprofloxacin (50%) and ceftriaxone (28.5%) were the most prescribed antibiotics. Eleven patients (more than 1 in 7) developed diarrhoea that could be associated with their use of antibiotics. The occurrence of AAD was significantly associated with type of antibiotic used by patient. 73% of patients who developed symptoms of AAD had received Clindamycin. Risk of AAD was not significantly associated with age and comorbidities.

**Conclusions:** The rate of AAD in the Male Urology Ward and the Treatment Room of the Surgical Department of KBTH during the period of this study was 15.7%. Clindamycin was identified as the most implicated antibiotic.

**Key words:** Antibiotic; diarrhoea; antibiotic-associated diarrhoea; antibiotic-associated diarrhea prevalence; Ghana.

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### Introduction

Antibiotic-associated diarrhoea (AAD) is a common side effect of antibiotic therapy. It refers to unusual diarrhoeal illness which occurs during or after antibiotic therapy [1]. It results from an imbalance in the colonic microbiota caused by the antibiotic therapy. The imbalance consequently changes carbohydrate metabolism with decreased short-chain fatty acid absorption and resulting osmotic diarrhoea [2]. AAD is typically benign and self-limiting when it occurs as osmotic diarrhoea but infectious cases may arise due to accretion of facultative enteropathogens, which release toxins and impair the gut mucosa [3,4]. Implicating enteropathogens in AAD include *Clostridioides (Clostridium) difficile*, Enterotoxin-producing *Clostridium perfringens*, *Klebsiella oxytoca*, *Staphylococcus aureus*, *Salmonella spp* and *Candida spp* [5].

Clinical presentations of antibiotic-associated diarrhoea may range from mild abdominal discomfort to severe and frequent watery stools with fulminant pseudomembranous colitis, depending on the presence

of an infectious organism [6]. Severe complications of antibiotic-associated diarrhoea include toxic megacolon, perforation and shock [6].

Global rates of antibiotic-associated diarrhoea vary between 5% and 39% depending upon the specific type of antibiotic used [7-9]. However, increased frequencies of the condition have been associated with children and the elderly [10]. Very few studies have been done in Africa concerning AAD though antibiotic consumption in Africa is very high [11]. Antibiotic-associated diarrhoea and pseudomembranous colitis caused by *C. difficile* was found in 19% of patients in a study done in Johannesburg, South Africa, to appraise antibiotic-associated diarrhoea and pseudomembranous colitis caused by *C. difficile* [12]. No study has been done in Ghana about AAD. However, a cross-sectional multicenter study done on *C. difficile* infections in representative regions of Germany, Ghana, Tanzania and Indonesia, showed that the prevalence rate of *C. difficile* infection (CDI) in Ghana and Tanzania ranged at 5% thereabout whereas the prevalence rate of this infection ranged between 15% and 27% in the other

countries [13,14]. Also, the non-toxigenic strains were more prevalent in Ghana (73.3%) and Tanzania (42.9%) whereas the toxigenic strains (TcdA+/TcdB+; TcdA+/TcdB+/CDT+; TcdA-/TcdB+; CDT) predominated Germany (100%) and Indonesia (81.8%) [14]. This study is important and gives an idea about the incidence of CDI in Ghana, however only one rural center was included and therefore, it is not possible to generalize the data to the whole country.

The incidence of AAD is influenced by a number of factors. These include compromised immune status, advanced age, abdominal surgery, comorbidity, types and prolonged use of antibiotics, reduced gastric acid, use of a nasogastric tube and the length of hospitalization [15] as well as the genetics and environment of an individual. Although some antibiotics such as clindamycin, cephalosporins, extended-coverage penicillins and fluoroquinolones are associated with a higher risk of AAD, studies have shown that virtually all drugs with an antibacterial spectrum of activity can be implicated [16-18].

In Ghana, a high percentage of patients receive one or more antibiotics daily [19-22]. However, studies to determine the risk and prevalence of antibiotic-associated diarrhoea in Ghana, which as aforementioned, is one of the common complications of antibiotic therapy is limited. Many excellent studies and reviews however, have been done in other countries [23-25]. Though these results may partially correlate with the prevalence and risk of AAD worldwide, they cannot be fully projected to Ghana. It is against this background that this study sought to identify the association of antibiotic prescribing and the risk of AAD in Korle Bu Teaching Hospital, the largest teaching and public referral hospital in Ghana.

## **Methodology**

### *Study Design and Site*

The study was a prospective study of adult patients. The focus of the study was to determine the association of antibiotic prescribing and the risk of antibiotic-associated diarrhoea among the Ghanaian population.

The study site was the surgical department of Korle Bu Teaching Hospital (KBTH) in Accra. KBTH is the largest teaching and public referral hospital in Ghana with an average daily attendance of 1,500 patients and about 250 patient admissions. The hospital has 2,000 beds and 17 clinical and diagnostic departments/units. The study took place at the Male Urology Ward (Ward G) and the Treatment Room of the Department of Surgery. Patients at the surgical wards are frequently subject to polymicrobial and broad-spectrum antibiotic

use. This is often to target mixed infections. The use of broad-spectrum antibiotics is one of the major predisposing factors to antibiotic-associated diarrhoea. Patients in the Treatment Room of the surgical wards were selected because they are often prescribed clindamycin for long periods.

### *Ethics approval and consent to participate*

Ethical approval was granted by the Noguchi Memorial Institute of the University of Ghana with an IRB number 041/16-17. Participants provided written consent. Permission was also sought from KBTH and from the heads of the Surgical and Medical Departments. Letters from the Head of Department of Surgery were given to the matrons of Ward G and the Treatment Room for access to the wards. Participants of the study were assured of confidentiality and anonymity. This was ensured by using a coding system to identify participants without using their actual names.

### *Study Participants*

The study involved both inpatients and outpatients from the Ward G and Treatment Room of the Department of Surgery. This was to avoid patients who have had abdominal surgery, as that might lead to bias. Patients were eligible for the study if they were 18 years of age or older, given antibiotics during admission or upon review. Patients were excluded if they were less than 18, were not given antibiotics during their stay or did not have a working phone number.

### *Study Protocol*

Questions about the patients' age, gender, medical history, medication, indication, antibiotic therapy given, patient complains were answered from the patients' medical folders on questionnaire for each patient. Patients' phone numbers were also noted on each questionnaire. Patients were interviewed if awake and could speak legibly about their health and whether they had experienced any case of diarrhoea since they were admitted, and also having received antibiotics.

A standardized survey was administered through telephone calls to each patient 14 days and also 28 days after they were sampled and included questions concerning the patient's antibiotic compliance, manifestation of symptoms of antibiotic-associated diarrhoea and any other complication from initial hospital treatment. The time of administration of the standardized interview span the time during which AAD symptoms usually occur after taking antibiotics, while trying to reduce recall bias [16].

### Case Definition

Antibiotic-associated diarrhoea was defined as three or more loose watery stools per day for one or more days during or after the antibiotic therapy, which is unusual to the patient and has no explicable cause.

### Data Analysis

Data were mostly analysed descriptively. The results were analyzed and presented in themes and tables. Fundamental statistical methods were employed through all steps in the research methods. The SPSS software, version 23.0 and Microsoft Excel were used for data analysis. Pearson Chi-square ( $\chi^2$ ) test was used to establish the relationships between certain variables. Logistics Regression analysis was used to measure the

variables effects. The Charlson comorbidity index (CCI) [26] of each patient was determined.

## Results

### Patient Characteristics

A total of 81 adult patients were sampled for the study. Sixty-five (80%) inpatients were from the Ward G) of the Department of Surgery, KBTH. Sixteen (20%) patients were from the Treatment Room of the Department of Surgery. Five (6%) of these patients were female, 76 (94%) were males. Four of the males died before the end of the study from non-diarrhoeal conditions and 7 of these patients did not have working phone numbers. Therefore, 70 patients were successfully followed up during the three-month study period. The characteristics of the study patients are

**Table 1.** Characteristics of Study Patients.

Demographics	All patients		Diarrhoea patients	
	<i>n</i> = 70	%	<i>n</i> = 11	%
<b>Age</b>				
≤ 20	2	2.9	0	0
21 – 40	11	15.7	1	9.1
41 – 60	22	31.4	6	54.5
61 – 80	32	45.7	3	27.3
> 80	3	4.3	1	9.1
<b>Gender</b>				
Male	66	94.3	10	90.9
Female	4	5.7	1	9.1
<b>Chronic comorbidity*</b>				
Diabetes	7	10	3	27.3
Hypertension	40	57.1	6	54.5
Cancer	8	11.4	2	18.2
Other	3	4.3	1	9.1
None	20	28.6	2	18.2
<b>Charlson comorbidity index</b>				
0	15	21.4	2	18.2
1 - 2	22	31.4	5	45.5
3 - 4	24	34.3	2	18.2
≥ 5	9	12.9	2	18.2
<b>Condition treated</b>				
Urological infection	46	66.7	7	63.6
Cancer	11	15.3	1	9.1
Leg Ulcer	13	18.1	3	27.3
Proton pump inhibitor use	3	4.3	0	0
<b>Antibiotic used for treatment*</b>				
Clindamycin	11	15.7	8	72.7
Ciprofloxacin	35	50	2	18.2
Gentamycin	15	21.4	3	27.3
Ceftriaxone	20	28.5	5	45.5
Meropenem	6	8.6	3	27.3
Amoxicillin/ clavunate	9	12.9	1	9.1
Levofloxacin	4	5.7		
Other	12	17.1		
Antibiotics given intravenously	35	50.0	7	63.6

\* Chronic comorbidity and antibiotic used for treatment more than 100% because of presence of multiple comorbidity and multiple antibiotic use in patients.

summarized in Table 1. The mean age of the patients was 56.71 years with 45.7% of them between the ages of 61 and 80. Fifty (71.4%) of the patients suffered from chronic comorbidities with hypertension (57.1%), cancer (11.4%) and diabetes (10%) being the most prevalent. Some of these patients suffered from more than one chronic comorbidity. Using the Charlson comorbidity index, (CCI), forty-six (65.7%) of patients had CCI between 1 and 4. Nine (12.9%) of patients had CCI  $\geq$  5. No comorbidities were reported in 15 (21.4%) of patients. Most of the patients were on amlodipine (25.9%) and metformin (8.6%). All these patients were treated for either urological infections or foot ulcers. The commonest urological condition presented was Benign Prostatic Hyperplasia (BPH; 12.3%). Other clinical condition presented included acute retention of urine (9.9%), haematuria (3.7%), bladder cancer (3.7%), metastatic prostate cancer (2.5%), scrotal abscess (2.5%), urethral stricture (2.5%), bladder calculi (2.5%), and leg ulcer (5%). The most common antibiotics prescribed were ciprofloxacin (50%), followed by ceftriaxone (28.5%) and gentamycin (21.4%). Patients were mostly given ceftriaxone and gentamycin as prophylactic therapy before surgery. Many of the patients followed up during the study were on more than one antibiotic. Almost 7% of the patients

sampled for this study suffered from dyspepsia. 40% of these patients were on H2-receptor antagonists while 60% of them were on proton-pump inhibitors. Other medications used by patients included paracetamol (15.2%), Tot'Hema, (Innotera Chouzy, France), (10.3%), Sc Clexane, (Sanofi, France), (9%) and tramadol (8.3%). No patient received enteral nutrition.

*Main Results*

Majority of the patients asserted, upon follow-up, that they had adhered to their antibiotic therapy and all other medications they had been given upon discharge. Some of these patients were on admission throughout the period of the study and thus were followed up in the hospital. Eleven (15.7%) of the patients complained of unusual diarrhoeal illness during the period of the study. Three of these patients were from the Treatment Room and were suffering from foot ulcers and the rest were from the Male Urology Ward. Eight of these 11 patients had been on clindamycin during admission.

63.6% of the patients developed the condition during the course of admission while 36.4% indicated that they developed it after they had been discharged. The AAD were observed between 2 and 7 days after start of antibiotic therapy. Only 36.4% had further review (laboratory test) to check for any likely

**Table 2.** Table showing Results of Logistics Regression.

Variable	Univariate				Multivariate*			
	p-value	Odds Ratio (OR)	95% C.I. for OR		p-value	Odds Ratio (OR)	95% C.I. for OR	
			Lower	Upper			Lower	Upper
<b>Gender (Ref = male)</b>								
Female	0.60	1.87	0.18	19.79	0.31	4.40	0.25	76.61
<b>Age (Ref = 81 years and above)</b>								
Age	0.25				0.29			
40 years and below	0.27	0.17	0.01	3.89	0.97	0.92	0.02	54.30
41- 60 years	0.83	0.75	0.06	9.87	0.62	2.24	0.10	51.87
61- 80 years	0.25	0.21	0.01	3.01	0.54	0.38	0.02	8.47
Comorbidities (Ref = None )	.67				0.35			
Comorbidities	0.79							
Hypertension	0.47	1.85	0.35	9.86	0.80	1.36	0.13	14.06
Diabetes	0.19	4.50	0.48	42.248	0.06	20.73	0.88	491.17
<b>High Risk Antibiotics ( Ref = Yes)</b>								
No	1.00	317,325,419.7 9	0.00	0.00	1.00	0.00	0.00	
<b>Medium Risk Antibiotics ( Ref = Yes)</b>								
No	0.32	0.50	0.13	1.95	0.50	0.43	0.04	5.07
<b>Low Risk Antibiotic therapy ( Ref = Yes)</b>								
No	1.00	335,287,173.6 0	0.00		1.00	935,798,511.9 0	0.00	
<b>High Risk Prophylactic therapy ( Ref = Yes)</b>								
No	0.02	0.21	0.06	0.82	0.03	0.05	0.00	0.79
<b>Medium Risk Prophylactic therapy ( Ref = Yes )</b>								
No	0.15	0.36	0.09	1.45	0.31	5.73	0.20	162.06

\*Nagelkerke's R<sup>2</sup> = 0.39.

implicating microorganism while 63.7% mentioned no such tests. No test was specifically done for *C. difficile*.

75.0% of the patients who complained of the diarrhoeal illness were given oral fluid replacement/ Oral Rehydration Salt (ORS) to replace the lost fluids while 25.0% of the patients were given loperamide to relieve the diarrhoeal illness. The infectious cases of AAD were managed with metronidazole (80%) and ciprofloxacin/tinidazole (20%). Majority of the patients were relieved within 48 hours and no patient complained of any relapse of AAD during the period of this study.

The level of dependency between antibiotic use and the risk of diarrhoea in KBTH was determined by the employment of the Pearson Chi-Square test. The test showed that the occurrence of AAD was dependent on the type of antibiotic the patient was on before the onset of the diarrhoea ( $p = 0.034$ ). However, all other dependency tests (age, comorbidities) conducted at the set level of significance (0.05) proved to be statistically insignificant.

A logistic regression was used to investigate the association of all the independent variables individually (age, gender, chronic comorbidities, class of antibiotic therapy used to treat or manage disease and prophylactic therapy given to patients) with the dependent variable (outcome of antibiotic usage). Table 2 summarizes the result of the logistic regression. The reference categories of the various response variables have been clearly displayed in the table. For the univariate analysis, some non-significant trends were observed. With respect to age, younger patients (40 years and below) were about one-fifth as likely compared to patients aged 81 years and above to develop unusual loose watery stools. Patients aged 41-

60 years were about four-fifth as likely, compared to patients aged 81 years and above to develop AAD whilst patients aged 61–80 years were about one-fifth as likely to develop AAD. With respect to gender, females were 1.87 times as likely as males to experience cases of AAD. Patients with hypertension were approximately twice as likely compared to patients with no comorbidities to develop AAD. Diabetic patients were seen to be about 5 times more likely to complain of AAD than patients with no chronic comorbidities. However, none of the associations of the independent variables with the dependent variable was statistically significant.

The antibiotics were grouped into high-risk (fluoroquinolone, cephalosporins, carbapenems, clindamycin, extended-coverage penicillins), medium-risk (penicillins, sulfonamides and trimethoprim, macrolides, streptogramins, aminoglycosides) and low-risk antibiotics (tetracycline) based on their ability to cause AAD [27]. The following trends were observed, although not statistically significant. Patients who had no low risk antibiotics had no likelihood as compared to patients who did take low risk antibiotics (100%) to develop unusual loose watery stools. Those who had no high-risk prophylactic antibiotics were about one-fifth likely as compared to patients who did have high-risk prophylactic antibiotics whilst patients given no medium risk antibiotics were half as likely as compared to patients who did take medium-risk antibiotics. Patients who had no medium risk prophylactic antibiotics were about one-third likely as compared to patients who did take medium risk prophylactic antibiotics.

For multivariate analysis, a test of the full model against a constant only model was statistically

**Table 3.** Table Characteristics of Patients who complained of Diarrhoea.

Patient	Age	Disease	Antibiotics Given	Treatment Given For AAD	Duration Of AAD
1	> 81	Fournier’s Gangrene	Ceftriaxone, PO Ciprofloxacin, PO Clindamycin, Meropenem	Fluid Replacement Therapy	1 Day
2	41 - 60	Scrotal Abscess	IV Amoxiclav, IV Clindamycin	Loperamide, Fluid Replacement Therapy	2 Days
3	21 - 40	Urethral Stricture	Gentamycin, Ceftriaxone, Meropenem	Fluid Replacement Therapy	1 Day
4	41 - 60	Urethral Calculi	Gentamycin, Ceftriaxone	Ciprofloxacin/Tinidazole, ORS	4 Days
5	61 - 80	Urosepsis	Ceftriaxone, Gentamycin	No Drug	1 Day
6	41 - 60	Fournier’s Gangrene	Clindamycin, Meropenem	Fluid Replacement Therapy	2 Days
7	61 - 80	Metastatic Prostate Cancer	PO Clindamycin	Loperamide, Fluid Replacement Therapy	1 Day
8	41 - 60	Scrotal Abscess	Ceftriaxone, IV Clindamycin	Metronidazole, Loperamide	2 Days
9	41 - 60	Right Foot Ulcer	PO Clindamycin	Fluid Replacement Therapy	1 Day
10	41 - 60	Right Foot Ulcer	PO Clindamycin, PO Ciprofloxacin	Metronidazole, Fluid Replacement Therapy	2 Days
11	61 - 80	Foot Ulcer Below Left Gluteus	PO Clindamycin	Metronidazole, Fluid Replacement Therapy	3 Days

insignificant ( $\chi^2 = 17.620$ ,  $df = 13$ ,  $p = 0.172$ ). The Nagelkerke's  $R^2 = 0.386$ , suggests that the model explains 38.6% of the variation in the dependent variable. The Hosmer and Lemeshow test indicated the model was a good fit to the data ( $\chi^2 = 1.694$ ,  $df = 8$ ,  $p = 0.989$ ). By controlling for all other predictors, the following trends were observed, although not statistically significant. Women were about five times as likely to develop AAD. Compared to patients aged 81 years and above, patients aged 40 years and below were just about equally (0.920) likely to develop unusual loose watery stools whilst patients aged 41-60 years and 61-80 years were about twice as likely, and one-third as likely respectively to develop diarrhoea. Diabetic patients were 20 times as likely to develop AAD.

The characteristics of patients who developed diarrhoea after antibiotic treatment are given in Table 3. Eight out of the eleven patients had received clindamycin. Five patients had received ceftriaxone (3 of these patients received it with gentamycin and the other 2 with clindamycin). The patients were relieved of diarrhoea between 1 day and 4 days of fluid replacement therapy and or treatment with metronidazole, loperamide or ciprofloxacin/tinidazole.

## Discussion

This study was done to produce baseline information about AAD in Ghana, since no study has been done in Ghana concerning the rates and risk of AAD.

We found the rate of AAD in this study to be 15.7% (thus, more than 1 in 7 patients developed diarrhoea that could be associated with the use of antibiotics). This rate falls within the global prevalence of AAD which is 5 – 39% [7]. The study involved a large proportion of male participants (94%) than females because of the nature of ward the participants were sampled from. Consequently, the effect of gender on the incidence on AAD could not be fully analyzed.

In this study, it was observed that many of the patients were on ciprofloxacin and ceftriaxone during admission. Patients who received ciprofloxacin were less likely to develop AAD whilst patients that received clindamycin or clindamycin antibiotic combinations were more likely to show symptoms of AAD. Clindamycin has been established to be the commonest cause of AAD in many studies [16,1,28] and the first antibiotic to be associated with colitis after antibiotic therapy [29,30]. Fluoroquinolones and cephalosporins are also mostly implicated in AAD [31], however, this study showed a lower association of flurooroquinolone

to incidence of AAD although the third generation cephalosporin, ceftriaxone constituted a higher risk of development of the AAD. Ciprofloxacin is the most commonly prescribed antibiotic in urological practice and also the most prescribed in this study. In a study by Ball [32], about the occurrence of adverse experiences in use of ciprofloxacin involving over 6,500 patients worldwide, the incidence of adverse reaction reported showed frequency variances based on geographic locations which may reflect differences in genetics/microbiota. The lower association of ciprofloxacin to incidence of AAD in this study may be attributed to probably better tolerance of the antibiotic amongst the study population.

The use of more than one antibiotic has been seen to increase the risk of AAD [16] and most of the patients who complained of symptoms of AAD had also been on more than one antibiotic. After analysis of the results, it could be inferred that the occurrence of AAD is dependent on the type of antibiotic the patient was on before the onset of the diarrhoea ( $p = 0.034$ ). Other studies on AAD have also reported this [16,23]. For instance, Wistrom and associates observed that treatment with cephalosporins, clindamycin or broad-spectrum antibiotics was associated with higher risk during their prospective study to determine the frequency of AAD [16]. The antibiotics were grouped into high, medium and low-risk antibiotics based on their previously reported ability to cause AAD [27]. Patients who were not given high or medium-risk antibiotics were less likely compared to those who were given high-risk antibiotic and medium risk antibiotics to develop AAD.

Immunocompromised status due to certain comorbidities such as diabetes and cancer and immunosuppressive drugs have been shown to increase the chance of developing AAD [33]. In this study, comorbidity was not significantly associated with incidence of AAD although some trends were observed. For instance, diabetic patients were seen to be 5 times more likely to report of AAD than patients who had no comorbidity. Diabetes mellitus has been highly associated with a higher risk of death in patients with AAD [34]. However, diabetes mellitus in patients receiving antibiotics has not been previously associated with higher risk of AAD unless other underlying diseases such as cancer, chronic renal disease and organ transplantation were present [16]. 50% of patients with diabetes mellitus were using metformin. All diabetic patients who experienced symptoms of AAD had received clindamycin or clindamycin combination

antibiotic and this may have contributed to the higher association of the condition to incidence of AAD.

With respect to age, although more than 45% of study participants were aged between 61 - 80 years, it was observed that patients between the ages of 41 - 60 years were associated with higher risk of AAD than patients aged 61-80 years or younger patients (below 41 years). Patients aged above 81 years were at equal risk as patients aged between 41 and 60 years. These associations were however not statistically significant ( $p > 0.05$ ). Elderly patients have traditionally been associated with higher risk of AAD [35,36] although no concrete definition of “elderly” has been universally agreed. The classification of elderly patients with most developed countries has been accepted as 65 years and above and the United Nations (UN) refers to older population as above 60 years but this is somewhat arbitrary. In Africa, this age has been proposed to be lower: 50 or 55 years [37]. In this work, a classification of elderly made to include patients 65 years and above, suggested that younger patients (below 65 years) could be at higher risk than the elderly unlike previous reports. The reason for this observation is not known but could be reasoned to be because in Ghana, most elderly patients are not resident in care homes and may not necessarily use greater amount of antibiotic (two of the main risk factors for AAD in elderly) because of high usage of traditional and alternative medicines in this age group relative to younger patients [38].

The duration of AAD ranged between 1 and 4 days. This was dependent on the treatment given to relieve the condition. In most cases, patients were relieved with fluid replacement therapy within 48 hours. However, while the antimotility agent, loperamide cured diarrhoea in the patients, the use of antimotility agents alone without antibiotics in patients with AAD with *C. difficile* infection have often resulted in complications or death [39] and should be used with caution.

## Conclusion

In conclusion, the rate of AAD in the Male Urology Ward and the Treatment Room of the Surgical Department of KBTH during the period of this study was 15.7%. The occurrence of AAD depended on the type of antibiotic the patient received before the onset of the condition. The use of clindamycin was associated with the highest risk for AAD like previous studies.

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