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Antibiotic misuse and compliance with infection control measures during COVID-19 pandemic in community pharmacies in Egypt

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Abstract

Background: Globally, antibiotics misuse by the public has been reported in the era of COVID-19, despite the discouraging instructions of the World Health Organization, especially for mild cases.

Objective: Is to describe this antibiotic misuse and its contributing factors. Also, to measure the pharmacists' application of infection preventive practices during the pandemic.

Methods: A cross-sectional study was conducted among randomly selected Egyptian community pharmacists (Center, East, Delta, and Upper Egypt) using a questionnaire and direct interviews from 1 to 30 August 2020. The questionnaire consisted of two parts, the first covered pharmacist's demographic data and their application of basic infection preventive practices (eg, wearing face masks, regular hand sanitization, etc), and the other part was related to antibiotic dispensing patterns. Data were descriptively analyzed and the impact of participant experience on the responses was evaluated using the χ^2 test.

Results: From 480 randomly selected Egyptian community pharmacists, 413 (87%) consented to participate in the study. 86.7% of the participants were keen to wear face masks (n = 358) and 86.2% kept regular hand sanitization (n = 356); whereas, 46.9% (n = 194) maintained adequate antibiotic stock supply during the pandemic. Nearly 67% (n = 275) of the pharmacists reported that patients were more likely to be given antibiotics for showing any sign or symptom of COVID-19 infection, and 82% (n = 74 278) of the dispensed antibiotics were given upon physician recommendation. Azithromycin, Ceftriaxone, and Linezolid were the major antibiotics dispensed to COVID-19 presumptive patients Azithromycin was given to ~40% of presumptive patients showing only mild or moderate symptoms for 5-10 days. Additionally, antibiotic combinations were given to 74% (n = 62 479) of home-isolated patients for a maximum of 2 weeks.

Conclusions: Pharmacists applied suitable sanitation and infection control protocols. Meanwhile, antibiotics were dispensed heavily during this pandemic without proper clinical indication and for long durations supporting the idea of antibiotic misuse.

1 | INTRODUCTION

Coronavirus Disease (COVID-19) is a viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of 11 March 2020, COVID-19 was considered a pandemic disease by the World Health Organization (WHO).[1,2] With the rapid spread and the emerging battle against this virus, the public went panic, and the global strategy now is to find a cure rapidly and to communicate accurate information to minimize the social and economic impact of the disease.[3]

The vital role of community pharmacists during the pandemic is to provide appropriate patient counseling and education about COVID-19 and the rational use of antibiotics; besides, they provided information concerning home isolation and dealing with contacts clarifying any misconceptions made about COVID-19.[4]

COVID-19 infections may progress to viral pneumonia, and antibiotics are effective in treating secondary bacterial complications that are related to moderate and severe pneumonia cases; therefore, antibiotics are not recommended for all COVID-19 patients.[3,5] The WHO guidance declared a strict recommendation against giving antibiotics in such cases and also reported that the massive increase in antibiotic resistance is mainly caused by the inappropriate use of antibiotics including, the unneeded antibiotic prescribing or using over-broad spectrum antibiotics with incorrect dosage or duration.[6,7] According to the Egyptian ministry of health and population, subjects with COVID-19 symptoms were classified into presumptive cases (no polymerase chain reaction (PCR) testing available), negative cases (negative PCR results), and confirmed cases (positive PCR results).[8] Most of the home-isolated cases had no PCR test and most of them are mild cases.

Despite prohibiting antibiotics sale without a prescription by the Egyptian pharmaceutical law, the situation is quite complicated, and antibiotics are available at patient request.[8] Among the obstacles that face community pharmacists in their daily practices is self-medication, especially antibiotics, and the patient's refusal to make adjustments to the dispensed drugs according to the clinical guidelines[8,9]; consequently, medication-errors are a major problem encountered in our daily practices.

Over the past few years, Egyptian patients suffered from antibiotics over-use, so the fear of developing antibiotic resistance and other unnecessary health problems motivate researchers to investigate and precisely assess these abuse patterns. Previous studies indicated that nearly 50% of the misused antibiotics are those used to treat upper respiratory tract infections.[6,7]

Antibiotic misuse is mainly related to mild and moderate patients with COVID-19, who are directly getting their medications from the community pharmacies as most of them are home-isolated. Therefore, the present study aimed to assess this antibiotic misuse during the COVID-19 pandemic, to illustrate the reasons behind this antibiotic misuse, and to investigate the alliance of the dispensed antibiotics to the reported guidelines. Also, the study evaluates the role of community pharmacists in dealing with the current pandemic through the application of infection control measures.

What's known?

- Antibiotic misuse is a common problem in our daily practices.

What's new?

- There was an antibiotic misuse related to COVID-19 expressed mainly as prescribing and dispensing antibiotics without indication.

2 | METHODS

2.1 | Study design

A cross-sectional study aimed to assess community pharmacist role and antibiotic misuse during the current pandemic. Data were gathered using a questionnaire addressed to Egyptian community pharmacists who were actively practicing during 1-30 August 2020, targeting one pharmacist in each pharmacy.

Investigators (authors) were trained to guide the participants in filling the questionnaire. To standardize the impact of participated pharmacist response, answers to each question were provided as multiple-choice questions in most cases and they were filled online using a pre-prepared form to prevent bias in response and facilitate the analysis of data. Regarding the preventive actions taken by the pharmacist to prevent the disease spread inside the pharmacy, the items were recorded according to what the investigator see in the pharmacy (floor marks, masks, gloves, and other precautions).

The development of this questionnaire was based on the existing literature, especially the WHO, the National Institute for Health and Care Excellence (NICE), and the Egyptian Ministry of Health and Population (version 1.4) guidance.[5,6,8,10]

In order to test the content and the face validity of this questionnaire, a draft consisting of 36 pilot questions was randomly distributed to 9 community pharmacists, following which modifications were made to develop this final version by deleting and merging some questions.

The final format was consisting of 31 questions divided into two sections (Supplementary data). The first section consisted of 10 questions covering pharmacist's demographics (pharmacy location, years of experience, and gender), with general questions concerning the application of infection control measures and items used to identify or suspect a COVID-19 infection. The other section contained 21 questions, mainly covering the antibiotics dispensing patterns from the community pharmacy (type, doses, duration, and availability). The questionnaire classified antibiotic doses into; the appropriate dose (according to community-acquired pneumonia (CAP),[11] NICE guidelines,[10] and the manufacturer's labels) and the non-appropriate dose (the dose that differs from the recommended one). The two sections included a variety of open,

closed-ended, and optional questions. The internal consistency of the questionnaire items was tested using Cronbach's alpha (=0.732).

2.2 | Selection of participants

For sample size calculations, the total population was 70 000 community pharmacies in Egypt, with a confidence interval of 95% and a limit of precision of 5%. As there were no similar studies related to COVID-19, the calculations were based on the assumption that the probability of dispensing antibiotics to a presumptive patient is 50%, and the calculated sample size was 383.

2.3 | Inclusion criteria

Only public community pharmacies were included. For the included pharmacies, only the working pharmacists could participate. The participating pharmacist should be working in the selected pharmacy from the start of the pandemic.

2.4 | Exclusion criteria

Hospital or private pharmacies were not included, also pharmacy technicians were not allowed to participate in this study. Newly working pharmacists were not allowed to participate, also pharmacy undergraduates were excluded.

2.5 | Data collection

The study divided Egypt into four major regions, selected the two governorates with the largest population to represent each region, and divided each governorate into four major areas. Pharmacies were discovered by releasing an online form to collect all pharmacies that want to participate, also through using global positioning system search engines to find the largest number of pharmacies that are not registered through the online form for each area. For each given area, pharmacies were selected randomly (not all pharmacies) by giving each pharmacy a number then a random number is selected through using the randomization website (random.org). The investigators started to contact this random sample to conduct (phone calls or messages through emails and social applications) a personal visit to fill the questionnaire. Each investigator asked all the pharmacists working in the same pharmacy to participate in the study, if more than one pharmacist decided to participate, one of them was selected randomly.

2.6 | Statistical analysis

Continuous variables were expressed as mean ± SD, while the categorical data were expressed as a percent. All participants were categorized into four groups according to years of experience as follow: the first group (pharmacist with experience <5 years), second group (pharmacist with experience <10 years), third group (pharmacist with experience <15 years), and fourth group (pharmacist with experience ≥15 years). The effect of different community pharmacist experience levels as a factor was compared with the response of the different questions concerned with antibiotic dispensing patterns and application of infection control practices using the χ^2 test ($P \leq .05$ were considered statistically significant).

3 | RESULTS

A total of 480 community pharmacists were visited and only 413 (87%) pharmacists successfully completed the study, with 50 pharmacists refused to participate in the current study, and 17 pharmacists were excluded for missing parts of the questionnaire.

The participants were 283 (69%) males and 130 (31%) females and ranged in experience from 1 to 20 years (mean ± SD=7.9 ± 4.8 years). The included pharmacies were in different locations to cover a wide range of different communities in Egypt (Table 1). Findings of the study were representing the period of 1 month (August).

TABLE 1 Demographic data of the participants

Characteristic	Description	Number (n)	Percent (%)	Mean ± SD
Gender	Male	283	69	
	Female	130	31	
Years of experience	<5	162	39	2.6 ± 1.4
	<10	145	35	6.9 ± 1.7
	<15	62	15	13.0 ± 1.2
	≥15	44	11	15.8 ± 1.5
Pharmacy location	East	12	3	
	Center	164	40	
	Delta	156	38	
	Upper Egypt	81	19	

3.1 | Dealing with the pandemic

The participants reported dealing with ~90 542 presumptive cases during August with COVID-19 infection. Pharmacists were able to identify and suspect 17 561 patients (19.4%) from the total presumptive cases. Most pharmacists (n = 350, 84.7%) admitted dealing with COVID-19 presumptive subjects in their pharmacies as they depend on the presence of reported signs and symptoms. On the other hand, 2.4% of the pharmacists (n = 10) denied dealing with COVID-19 subjects, while 12.8% (n = 153) could not confirm their suspicion about dealing with an infected case.

Regarding the application of infection control measures inside their pharmacies to minimize pharmacist–patient interaction and infection transmission: face masks, hand sanitization with ethyl alcohol 70% or soap, and regular sanitization of solid surfaces with disinfectants had the highest responses (86.7%, 86.2%, 93.5%, 89.9%), respectively. Most of the participants used more than one preventive tool.

For the surrounding workplace, 40.9% (n = 169) of the participants reported drawing visible floor marks for social distancing between customers and moving their counter in front of the door entrance to minimize contact with the patients. Moreover, 62% (n = 256) put a flexible plastic shield in front of their counters as a physical protective barrier between pharmacist and customers, and only 14.5% (n = 60) took other measures as wearing N95 face masks or face-shield.

The measures taken by the community pharmacist to deal with the health risks faced in the current pandemic were described in Table 2.

The majority of the participants (n = 398, 96.4%) offered education and counseling services for their customers inside their pharmacies about infection control, transmission patterns, and other information concerning disease symptoms and home isolation. Meanwhile, nearly half of the pharmacists (n = 222, 53.7%) offered patient counseling through pharmacy social-media pages or websites, 33.7% (n = 139) have printed posters and flyers with updated information about COVID-19, and only 29.3% (n = 121) offered contactless payment methods (Visa machines) for safety concerns. Table 3 summarizes the correlation between pharmacist's experience and Preventive measures and services provided by the pharmacies.

For purposes of case identification or suspicion: 87.2% of the pharmacists (n = 360) rely on the presence of COVID-19 signs and symptoms as; fever above 38°c with cough, sore throat, or breathing problems, also 96.6% (n = 399) depends on the presence of a clarified diagnosis on official physician prescriptions. Additionally, only 3.4% (n = 14) did not consider any criteria for suspecting an infected case, as shown in Figure 1. Furthermore, 61% (n = 252) reported ordering additional laboratory tests, 45.3% (n = 187) ordered a CT chest scan, and 27.8% (n = 115) ordered serological tests (IgG and IgM antibody tests) to confirm the identification of presumptive cases. Common laboratory tests usually ordered by the pharmacists were shown in Figure 2.

TABLE 2 Preventive measures and services provided during COVID-19 pandemic

Characteristics	Number (n)	Percent (%)
Preventive measures inside the pharmacy		
Wearing masks	358	86.70
Wearing gloves	224	54.20
Measure temperature before entering the pharmacy	25	6
Alcohol 70% available for personnel	356	86.20
Washing hand with soap regularly	386	93.50
Regular sanitization for surfaces	371	89.80
Visible floor marks	169	40.90
Putting plastic shield on the disk	256	62
Moving disk to the door entrance	169	40.90
Others	60	14.50
Services provided by the pharmacy		
Home delivery	265	64.20
Counseling inside pharmacy	398	96.40
Social media counseling	222	53.70
Printed poster or flyers	139	33.70
Contactless payment methods (Visa machine)	121	29.30
Others	52	12.60

Egyptian national guidelines do not directly allow pharmacists to order these highly diagnostic tests, nor diagnose diseases or prescribe drugs; however, pharmacists were imposed by the current situation to deal with patients as the first line and the only free destination. Their role is modified during the early times in the crisis to help patients with typical symptoms of COVID-19, they ordered some Lab. Tests and CT scans to aid them in the identification of presumptive cases. According to the centers for disease control and prevention (CDC), American pharmacists can order laboratory tests only if these tests are necessary (eg, per treatment guidelines, government mandates, prescribing information; clinical evaluation requirement).[12]

3.2 | Antibiotic misuse

From the 90 542 presumptive patients, about 93% (n = 84 205) received antibiotics either written on an official prescription (n = 74 278, 82%) or without a prescription (n = 9927, 18%) comprising both pharmacist recommendation and patient request. Notably, all prescriptions were issued from private clinics rather than governmental hospitals. Moreover, 74.2% (n = 62 479) of the presumptive COVID-19 patients received combined antibiotic therapy, while only 25.8% (n = 21 726) received antibiotic monotherapy.

Antibiotics were reported to be a part of a claimed therapeutic protocol; consequently, the majority of the participants (n = 275, 66.6%) indicated that patients received antibiotics for showing any

TABLE 3 Correlation between pharmacist's experience and Preventive measures and services provided by the pharmacies

	Experience (n (%))				
Criteria	**≤5 years**	**≤10 years**	**≤15 years**	**>15 years**	***P* value**
1. Wearing surgical masks1. Wearing surgical masks					
Available	151 (89.8)	114 (79.2)	52 (88.1)	41 (97.6)	.005
Not	17 (10.1)	30 (20.8)	7 (11.9)	1 (2.4)	
2. Wearing surgical gloves					
Available	86 (51.2)	76 (52.8)	32 (54.2)	30 (71.4)	.1 (n.s.)
Not	82 (48.8)	68 (47.2)	27 (45.8)	12 (28.6)	
3. Sanitization with alcohol 70%					
Available	141 (83.9)	126 (87.5)	50 (84.7)	39 (92.9)	.4 (n.s.)
Not	27 (16.1)	18 (12.5)	9 (15.3)	3 (7.1)	
4. Visible floor marks					
Available	70 (41.7)	56 (38.9)	26 (44.1)	17 (40.5)	.9 (n.s.)
Not	98 (58.3)	88 (61.1)	33 (55.9)	25 (59.5)	
5. Plastic shields					
Available	98 (58.3)	89 (61.8)	40 (67.8)	29 (69)	.4 (n.s.)
Not	70 (41.7)	55 (38.2)	19 (32.2)	13 (31)	
6. Moving disk to door entrance					
Available	72 (42.8)	63 (43.8)	22 (37.3)	11 (26.2)	.3 (n.s.)
Not	96 (57.2)	80 (55.6)	37 (62.7)	31 (73.8)	
7. Home delivery					
Available	116 (69)	93 (64.6)	30 (50.8)	26 (61.9)	.05
Not	32 (31)	31 (35.4)	29 (49.2)	11 (38.1)	
8. Counseling inside pharmacy					
Available	158 (94)	140 (97.2)	58 (98.3)	42 (100)	.1 (n.s.)
Not	10 (6)	4 (2.8)	1 (1.7)	0 (0)	
9. Social media counseling					
Available	97 (57.7)	75 (52.1)	27 (45.8)	23 (54.8)	.4 (n.s.)
Not	71 (42.3)	69 (47.9)	32 (54.2)	19 (46.2)	
10. Posters and flyers					
Available	61 (36.3)	46 (20.8)	21 (22)	11 (29.3)	.6 (n.s.)
Not	107 (63.7)	98 (73.8)	38 (64.4)	31 (73.8)	
11. Contactless payment methods					
Available	61 (36.3)	30 (20.8)	13 (22)	17 (29.4)	.005
Not	107 (63.7)	114 (79.2)	46 (78)	25 (70.7)	

sign or symptom of COVID-19 infection (sore throat, myalgia, loss of appetite, loss of taste and smell, fever, breathing problems, and cough). Meanwhile, 21.3% (n = 88) reported that patients received antibiotics due to the presence of pneumonia symptoms as; fever, cough, and shortness of breath (Figure 3).

None of the patients were asked by the physician or the pharmacist to do allergy testing before parenteral antibiotic administration. Furthermore, 46.97% (n = 194) of the participants did not complain from any antibiotic supply shortage during the pandemic, 37.7% (n = 156) reported Azithromycin stock deficit, while only 15.3% (n = 63) reported stock supply shortage in more than one antibiotic class.

Correlating the pharmacist's previous experience with the antibiotics dispensing patterns, the pharmacists with the least years of experience achieved the highest response related to delivering antibiotic monotherapy to patients showing pneumonia symptoms. On the other hand, they had the least responses for dispensing antibiotics for any presumptive case without proper indication. The previous results indicated that the more recently graduated from their faculties, the better their medical knowledge skills, and the more they are familiar with the recent guidelines (Table 4).

Azithromycin was the highest antibiotic prescribed by physicians for COVID-19 patients (n = 400, 36%), followed by ceftriaxone (n = 249, 23%), linezolid (n = 138, 13%), and finally levofloxacin

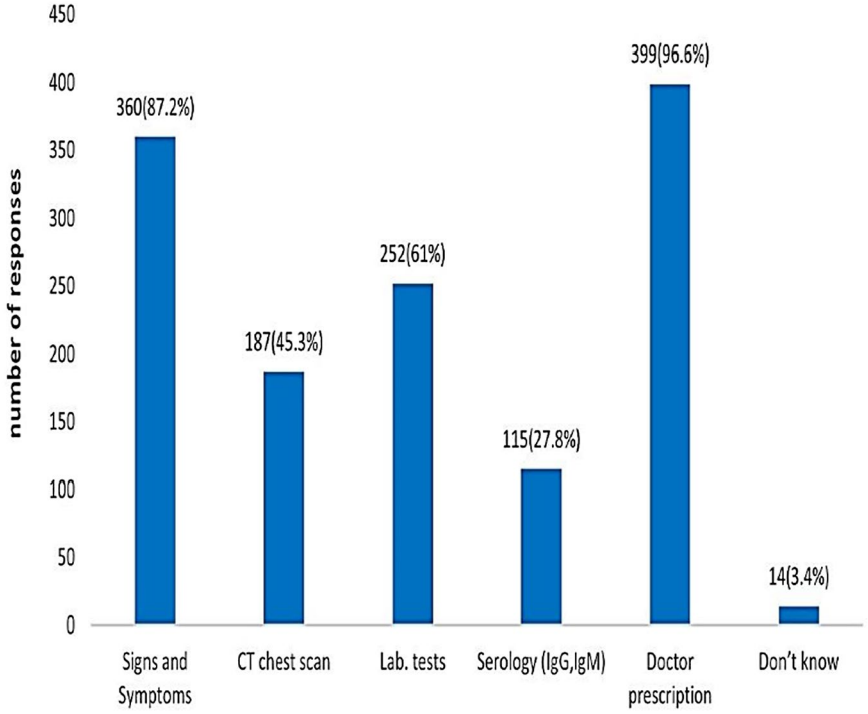

FIGURE 1 Items used by the pharmacists to identify COVID-19 infection. CT, computed tomography; IgG, immunoglobulin G; IgM, immunoglobulin M

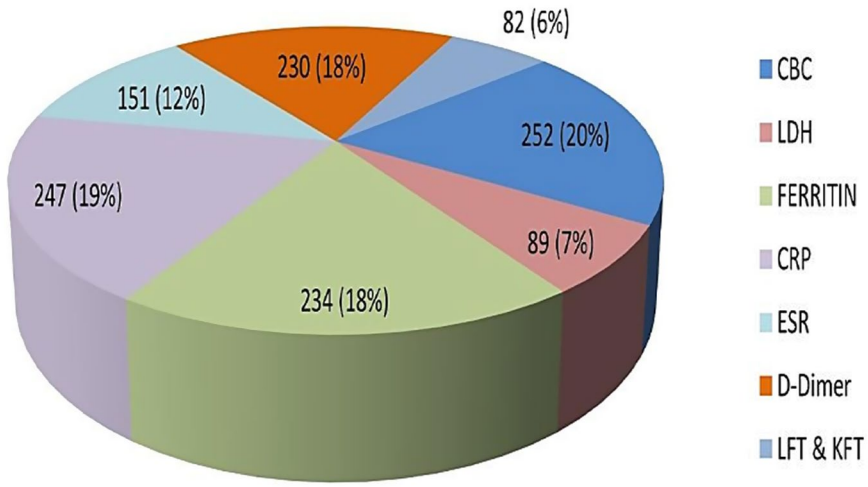

FIGURE 2 Commonly asked laboratory tests by community pharmacists. CBC, complete blood count; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; LDH, lactate dehydrogenase; LFT, serum liver function tests; KFT, serum kidney function tests

(n = 126, 11%). Also, azithromycin was the highest antibiotic dispensed by community pharmacists (n = 260, 48%) as shown in Table 5.

In terms of antibiotic dosage (Figure 4) given to the patients by either the physician or the pharmacist, the majority of the prescribed azithromycin doses were appropriate (500 mg P.O once daily) as identified by 389 pharmacists, and 29 pharmacists reported dispensing a non-appropriate dose of Azithromycin (250 mg P.O once daily or 500 mg P.O twice daily).

Considering Ceftriaxone dosing, 121 pharmacists reported dispensing the appropriate dose of 1 g I.M once daily, and 55 reported dispensing a non-appropriate dose (1 g I.M twice daily), while 88 indicated that ceftriaxone (1 g I.M twice daily) was combined with azithromycin (500 mg P.O once daily).

Besides, 120 pharmacists admitted dispensing the appropriate dose of levofloxacin tablets (500 mg P.O once or twice daily), and 27 reported dispensing a non-appropriate dose (750 mg P.O twice daily or 1 g P.O twice daily).

For linezolid tablets; 100 pharmacists admitted that patients received the appropriate dose of linezolid (600 mg P.O twice daily), 39 reported dispensing a non-appropriate dose (600 mg P.O once or three times/day), while 8 reported combining linezolid (600 mg P.O twice daily) with levofloxacin (500 mg P.O once daily), and 136 responses for combining linezolid (600 mg P.O twice daily) with azithromycin (500 mg P.O once daily).

Co-amoxiclav tablets were dispensed in the appropriate dose of 1 g P.O twice daily (n = 63), the non-appropriate dose of 2 g P.O twice daily or 1 g P.O once daily (n = 21), and combined with azithromycin (n = 36). Finally, the vast majority of the pharmacists (n = 380) claimed to recommend antibiotics for COVID-19 patients in the standard appropriate recommended doses. It is a little beyond the

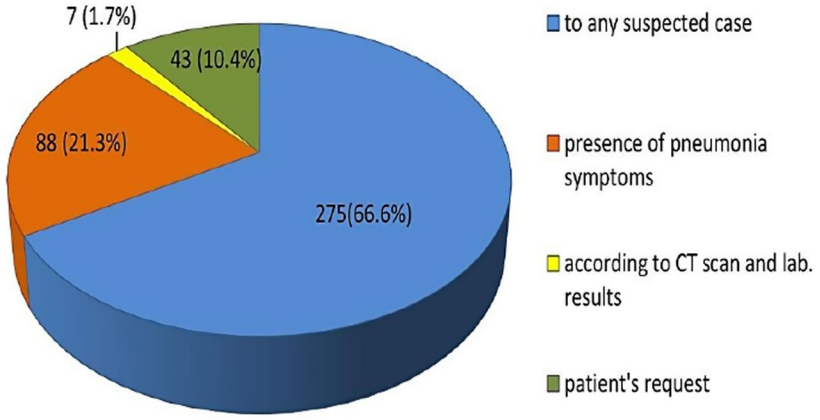

FIGURE 3 Criteria for recommending an antibiotic. CT, computed tomography

TABLE 4 Correlation between antibiotic dispensing and pharmacist's experience

	Experience (n (%))				
Criteria	**≤5 years**	**≤10 years**	**≤15 years**	**>15 years**	***P* value**
1. Antibiotic availability					
Available	73 (43.5)	79 (54.5)	26 (44.1)	16 (38.1)	.1 (n.s.)
Azithromycin shortage	71 (42.3)	45 (31.3)	25 (42.4)	15 (35.7)	
Multiple class shortage	24 (14.3)	20 (13.9)	8 (13.6)	11 (26.2)	
2. Antibiotic dispensing criteria					
All suspected cases	99 (58.9)	102 (70.8)	43 (72.9)	31 (73.8)	.1 (n.s.)
Laboratory tests and C.T scans	4 (2.4)	2 (1.7)	1 (1.7)	0 (0)	
Patient request	18 (10.7)	11 (7.6)	7 (11.9)	7 (16.3)	
Presence of pneumonia	47 (28)	29 (20.1)	8 (13.6)	4 (4.5)	
3. Antibiotic duration					
5 days	62 (36.9)	72 (50)	23 (39)	21 (43.1)	.5 (n.s.)
Week	63 (37.5)	48 (33.3)	20 (33.9)	12 (34.6)	
10-14 days	34 (20.2)	19 (13.2)	12 (20.3)	7 (17.4)	
Until full recovery	9 (5.4)	5 (3.1)	4 (6.8)	2 (4.9)	
4. Antibiotic combinations					
Monotherapy	99 (58.9)	63 (43.8)	22 (37.3)	10 (23.8)	.001
Combined	69 (41.1)	81 (56.3)	37 (62.7)	32 (76.2)	

pharmacist's control to change the dose or duration of an antibiotic dispensed on an official prescription.

Pharmacists reported receiving some interesting combinations prescribed on official prescriptions for home-isolated patients who were suffering from moderate respiratory symptoms; linezolid with azithromycin, levofloxacin, or ceftriaxone, and ceftriaxone with azithromycin or levofloxacin. Additionally, physicians may add meropenem and imipenem vials if the patient suffers from severe symptoms with moderate breathing limitations.

In terms of antibiotic duration (Figure 5), pharmacists reported that antibiotics were given to presumptive patients for a minimum of 5 days and a maximum of 30 days (mean ± SD=8.40 ± 5.55). Consequently, responses indicated that nearly 39 758 (47.2%) patients received antibiotics for 5 consecutive days, 22 250 (26.4%) patients received antibiotics for a week, 19 326 (23%) patients received antibiotics for 2 weeks, and finally, 2871 (3.4%) patients received antibiotics until full recovery.

Concerning repeating the previously dispensed antibiotic, 133 pharmacists reported that 33.4% of the patients (n = 28 097) requested to repeat the same antibiotic, and 167 indicated that 33% of the patients (n = 27 816) did not request a repeated dose. Because of the lack of patients' follow up, 113 pharmacists did not know whether the patient repeated the antibiotic dose or not.

TABLE 5 List of antibiotics dispensed upon physician/pharmacist recommendation

	Physician prescription		Pharmacist recommendation	
Antibiotic type	**Number (n)**	**Percent (%)**	**Number (n)**	**Percent (%)**
Azithromycin tablets	400	36	260	48
Doxycycline tablets	28	3	10	2
Ceftriaxone vials	249	23	99	18
Cefotaxime vials	46	4	33	6
Co-amoxiclav tablets	36	3	21	4
Levofloxacin tablets	126	11	45	9
Moxifloxacin tablets	49	4	22	4
Linezolid tablets	138	13	34	6
Other classes	37	3	17	3

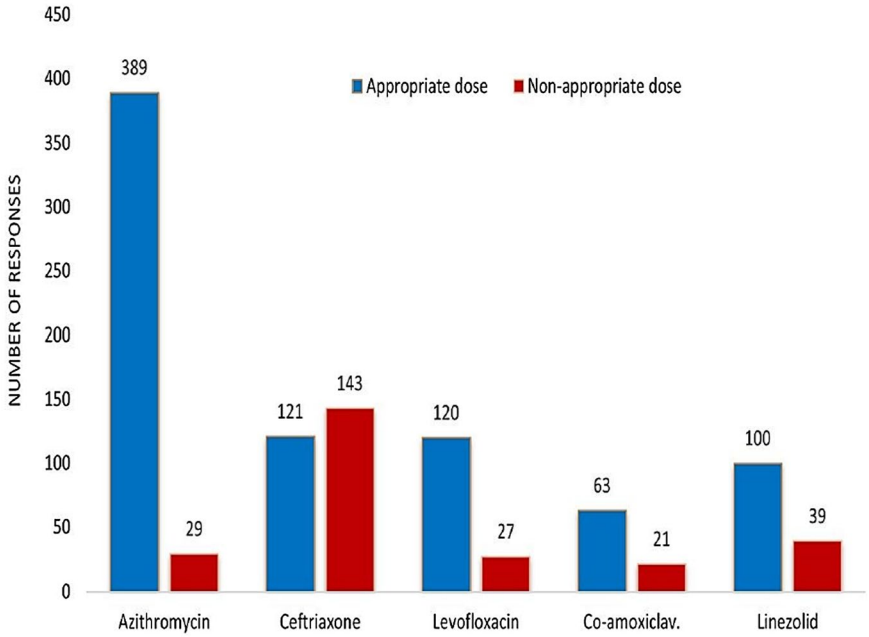

FIGURE 4 Antibiotic doses as prescribed by physicians

Upon asking community pharmacists about dealing with any recurrence cases after recovery, 332 (80.4%) pharmacists denied seeing a recurrence case, and 81 (19.6%) admitted dealing with recurrence cases. The majority reported dispensing the same antibiotic given previously for the patient (n = 42) or another antibiotic class (n = 30), while 9 pharmacists did not re-dispense antibiotics as the patients suffered from mild symptoms.

4 | DISCUSSION

Many studies investigated antibiotic consumption patterns inside hospitals during the pandemic,[13,14] with no previous study focused on community antibiotic consumption during COVID-19.

With this challenging situation, we need all healthcare professionals to collaborate in dealing with the current fight against COVID-19, and community pharmacists are considered key players and the first-line health care providers in such times.[4,15,16]

The majority of community pharmacists who participated in the study showed adequate awareness for infection control measures and provided reasonable alliance with the national infection control guidance that ensures minimal infection transmission, and therefore controlling the spread of COVID-19 viral infection inside the community pharmacy and between the healthcare professionals.

In such hard times, pharmacists have a huge responsibility towards their community being the nearest health care providers for their neighbors, so pharmacists tried to adopt and implement new services for their patients.[17] The majority of the respondents tried to provide patient counseling through social media groups with fewer responses for distributing posters and flyers with COVID-19 information to raise public awareness.

The WHO and NICE recommendations support that only symptoms are enough to suspect infected cases,[5,10] so the majority of the pharmacists relied on patient symptoms to identify COVID-19 presumptive cases, but the process of case identification and

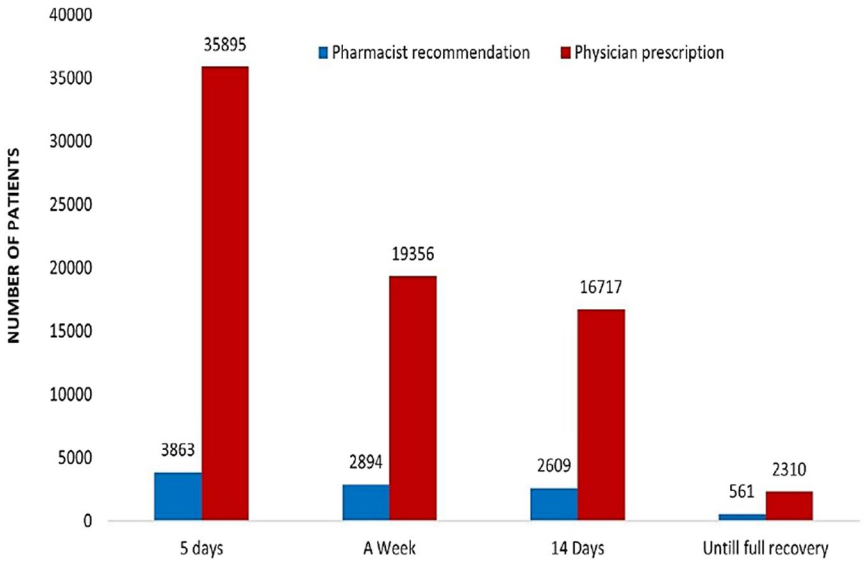

FIGURE 5 Antibiotic duration dispensed according to physician prescription and pharmacist recommendation

differentiating symptoms from common cold and flu or other respiratory diseases without the confirmation with the PCR swap may be very complex.[14,18] Moreover, patients with COVID-19 may experience leucopenia, thrombocytopenia, and lymphopenia; however, high levels of serum C-reactive protein (CRP), Erythrocyte sedimentation rate (ESR), lactate dehydrogenase (LDH), D-dimer, and kidney function tests may be seen.[18-20] Consequently, pharmacists ordered certain laboratory tests and chest CT scans to assess patient condition and define disease progression, which indicates that pharmacists can offer suitable guidance for patients and communicate proper clinical knowledge when possible.

As previously mentioned, antibiotics are easily accessible as over-the-counter drugs (OTC) or upon patient request, and this can be one of the major causes behind the massive antibiotic misuse happening among the population.[6,7]

In the current study, most of the presumptive COVID-19 cases received antibiotic therapy among their medication. Pharmacists' responses showed that the majority of the dispensed antibiotics were done upon official physician prescription; however, the results emphasized that the problem of the patient's self-medication is still evident.

According to WHO and NICE guidelines, patients with mild or moderate symptoms are not encouraged for antibiotic use unless showing signs of secondary bacterial pneumonia.[10,15,21] Therefore, COVID-19 patients could be managed according to recommendation for antibiotic use of CAP guidelines, however, this widespread of azithromycin and other broad-spectrum antibiotics is highly concerning and not supported by scientific evidence till now.[22] The previous guidelines support giving Azithromycin, doxycycline, or Co-amoxiclav. combined with clarithromycin as the first line option for an average period of 5 days.[5,11] In the case of previous therapy failure or severe symptoms, giving levofloxacin or ceftriaxone should be considered. Linezolid is added only if suspecting methicillin-resistant *Staphylococcus aureus* (MRSA) infection in case of hospital admission. [10]

Analyzing the data of the current study, the results conclude that more than 65% of the presumptive patients with COVID-19 administered an antibiotic due to suffering from only mild symptoms with no signs of pneumonia. Furthermore, neither the physician nor the pharmacist instructed patients to do a bacterial culture before antibiotic administration.

Both pharmacists and physicians tend to recommend azithromycin, ceftriaxone, and linezolid more than the other types of antibiotics. Several factors are influencing antibiotic dispensing patterns, most importantly fear and seeking patient compliance. Therefore, the choice of antibiotics was not made according to a bacterial culture or the degree of symptoms severity, but rather broad-spectrum and newer antibiotics were preferred, which also reflect a type of antibiotic misuse.

Many clinical studies investigated the safety and efficacy of azithromycin in COVID-19 patients. They claimed that azithromycin is not only an antimicrobial drug, but it may exhibit antiviral activity as well. It acts by decreasing viral cell entry and possesses immunemodulatory properties by inhibiting the release of proinflammatory cytokines,[23,24] and this may explain why physicians heavily prescribed azithromycin for presumptive cases with no signs of bacterial pneumonia.

Meanwhile, community pharmacists reported good adherence to recommend one type of antibiotic to each presumptive patient; however, physicians prescribed two or more antibiotics rather than antibiotic monotherapy to the majority of the presumptive patients. Ceftriaxone was commonly combined with azithromycin, clarithromycin, or levofloxacin, also linezolid was combined with azithromycin or levofloxacin. In case of severe symptoms, physicians may add meropenem and imipenem to the previously mentioned combinations. Unfortunately, the previous combinations were given without proper clinical evidence.

The problem of self-medication (antibiotics) without a prescription is evident among the public.[6] Moreover, in the first months of

the current crisis; social media presented azithromycin as a part of a therapeutic protocol for COVID-19. As a result of public panic buying and storing drugs from community pharmacies, many pharmacies suffered from azithromycin stock deficit early in the crisis.

It is worth noting that the most common antibiotics-prescribing-errors were prescribing broad-spectrum antibiotics for the inappropriate duration, improper antibiotic combinations, and wrong dosing schedules, while pharmacist-related-errors were recommending broad-spectrum antibiotics for the inappropriate duration. This supports the need to develop a national evidence-based antibiotic stewardship to improve rational prescribing among physicians and pharmacists.

The term recurrence, a re-appearance of COVID-19 symptoms, should be differentiated from the re-exposure to the virus or the symptoms of viral complications.[25] The COVID-19 subjects should be monitored to differentiate a recurrence of symptoms or appearance of the post-COVID-19 syndrome from reinfection, but few participants still reported the presence of recurrence cases (appearance of symptoms after their absence for a short time) with admitting re-selling antibiotics for the same previous duration. However, recurrence of the symptoms may be due to common cold or influenza.

In general speaking, antibiotics have no role or benefit in treating viral pneumonia, also the prevalence of bacterial co-infections, especially CAP, in COVID-19 patients is very low.[13,14] Hence, it is recommended for each country to have a consultation community that regularly evaluate the use of antibiotics and other medications in such situations, also to provide regular guidance based on published clinical trials. Besides a training and continuous education organization (involving academic professors and highly experienced pharmacists) should be established to facilitate continuous learning for postgraduate pharmacists. Policy efforts should be put in place to make antibiotic prescriptions less easy and thus would limit the indiscriminate dispensing of antibiotics.

5 | CONCLUSIONS

In the current pandemic circumstances, the role of community pharmacists is highlighted. The current study reported that pharmacists managed to apply appropriate sanitation and infection control measures.

The misuse of antibiotics during the COVID-19 pandemic may have many forms such as overuse of antibiotics, incorrect dose, incorrect combination, and wrong indication.

Most importantly, this is a pilot study that investigates the antibiotic prescribing and dispensing patterns during the COVID-19 pandemic. The previous results emphasized the need to raise public awareness considering the complications of using antibiotics without a proper clinical indication. Hence, the antibiotic policy or guideline is needed to guide the use of antibiotics during the COVID-19 pandemic.

DISCLOSURES

The authors have declared no conflict of interest.

ETHICS APPROVAL

The present study was approved by Beni-Suef University, Faculty of Pharmacy, and its ethics committee (REC-H-phBSU-20017). Pharmacist's anonymity and confidentiality were ensured. Written informed consent was taken from each participant.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

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