Original Research

Availability and prices of medications used during COVID-19 pandemic

Khansaa A.Ibrahim Albaroodi

Received (first version): 11-Jun-2023 Accepted: 07-Jul-2023 Published online: 04-Jan-2024

Abstract

Objectives: The present COVID-19 pandemic has impacted all of us, but the pandemic's impact and repercussions are perceived differently by individuals and governments. Locking down had an impact on pharmaceutical manufacturing, supply, and distribution, causing a medicine shortage. This study aimed to assess drugs used frequently during the pandemic in Iraq their availability and prices and determine how medications are affordable for patients. Study design: This was a pilot study. **Methods:** This study enrolled 30 pharmacies from rural and urban areas located in Babil governorate, Iraq; from 1 January until 1 March 2021. **Results:** According to the results, there was a difference between expensive and inexpensive medicines. Medication availability shows that many COVID-19 used medications had no local production like ipratropium, budesonide, Enoxaparin, remdesivir, and others. Levofloxacin vial 500 mg, cost more than 9000 Iraqi dinars, which is more than one day of Iraqi wage (1 day of salary = 8333 Iraqi Dinar; levofloxacin is normally given for seven days, so the total cost will be 583333 Iraqi Dinar for the entire course) that's rather than other medications and for one family member. Local production prices are high in comparison to imported ones, as in (levofloxacin and Favipiravir). Many medications had increased their prices after the pandemic due to demand, availability and exchange rate. **Conclusion:** The Iraqi government has to provide medications for the Iraqi people in public hospitals and clinics so that patients do not need to go to private ones. Medications prices have to be controlled uninformed by the government.

Keywords: availability; prices; medications; high price; local

INTRODUCTION

The coronaviral disease 2019, also known as COVID-19, is a virus that is made up entirely of ribonucleic acid. It acquired its name from the presence of glycoprotein spikes on its envelope, which gives it a classic crown-like look under an electron microscope.[1] Coronaviruses are a type of virus that can cause respiratory and gastrointestinal problems.[2] Middle East Respiratory Syndrome (MERS-CoV) and severe acute respiratory syndrome are examples of respiratory disorders (SARS-CoV). Cough, shortness of breath, fever, chills, muscle discomfort, sore throat, and loss of smell and/or taste are among the symptoms.[1] Others Diarrhoea, nausea, and vomiting are also reported by COVID-19 patients. Some people, on the other hand, are asymptomatic or have no symptoms at all.[3] A novel coronavirus (nCoV) is a new strain of coronavirus that has never been seen in humans.[2,4] When scientists determine out what type of coronavirus it is, they label it. For example, the virus that causes COVID-19 is known as SARS-CoV-2.[4] The present COVID-19 pandemic has impacted all of us. However, depending on our status as individuals and as members of society, the pandemic's impact and repercussions are perceived differently. While some people try to adjust to working online, homeschooling their children, and purchasing online, others are forced to get infected in order to keep society running. Our many social identities and the social groupings to which we belong define our social inclusion and, as a result, our vulnerability to epidemics. COVID-19 is a virus that is killing a lot of people. Many governments throughout the world went into lockdown, shutting down or restricting internal and international transportation. This has an impact on pharmaceutical manufacturing, supply, and distribution, causing bottlenecks in the worldwide medicines supply chain.[5, 6] Several drugs used in patients with COVID-19, including as anesthetics, antibiotics, and muscle relaxants, as well as some off-label treatments, saw a rise in demand. This lead to a shortage, which exacerbated the pandemic.[5] More than 7.7 million persons had tested positive with COVID-19 as of October 10, 2020, in every state and territory in the United States and its four territories.[7] At least 213,876 people in the United States have died from the virus, according to the New York Times database. According to the WHO report Iraq incidence rate 1483 in 2020 and 11000 in 2022.[8] These worrying figures, however, only reveal half of the story; a closer examination of data by different social identities reveals the full picture.[7] The Americas had a significant number of new cases and deaths with COVID-19 in WHO report, published in May 2021.[9] Meanwhile, there was an additional expense to the government in the treatment of its consequences before there was access to vital medications, which is one of the Millennium Development Goals of the United Nations (MDGs).[10] Furthermore, due to a lack of social insurance and inadequate publicly financed services, up to 90% of the population in low and middle-income nations must pay for medicines out of their own pocket.[10-13] Medicines are not only out of reach for significant segments of the worldwide population, but they are also a major drain on government expenditures. Under the influence of structural adjustment and reform programs,

Khansaa A.Ibrahim ALBAROODI*. Pharmacy Department, Khansaa Albaroodi Pharmacy Department, Al Zahrawi University College, Karbala Al-Najaf Highway, Karbala, 56001, Iraq. khansaa.albaroodi@hotmail.com

national drug pricing policies in many low- and middle-income nations have shifted from price controls to deregulation. Duties, taxes, mark-ups, distribution charges, and resulting fees are frequently considerable, accounting for 30 to 45 percent of retail prices on average, but up to 80 percent or more on rare occasions.[14,15] The higher the manufacturer's selling price, the higher the ultimate price will be. Prices are also influenced by factors such as whether a country respects patents and the level of flexibility allowed under international treaties – which is eventually incorporated into national patent law; the level of domestic medicine production; national policies on protecting local industries; pharmaceutical manufacturer competition; and price regulation policies.[15-17] The difficulty in obtaining trustworthy information on pharmaceutical prices and availability – and hence analyzing its components – makes it difficult for governments to develop appropriate medicine pricing policies or assess their impact. Some are frequently reported to be more expensive in developing countries than in developed countries.[18-19] Many researches have demonstrated that affordability has nothing to do with purchasing power. Ex-manufacturer pricing to countries – especially for the private sector – are frequently kept secret. Governments receive sales prices for generically identical drugs from large distributors.[20] They do not, however, reflect the price that patients must pay in the public or private sectors, and they frequently exclude new, critical, but patented drugs. Only a few countries have publicly available prices, but the use of this information is hampered by country-specific restrictions and linguistic hurdles. As a result, pricing monitoring and cross-country comparisons are critical.[21]

The results of these surveys revealed that in many low- and middle-income countries; treatments are often unaffordable (e.g. requiring over 15 days' wages to purchase 30 days' treatment); government procurement can be inefficient (e.g. buying expensive originator brands as well as cheaper generics); mark-ups in the distribution chain can be excessive; and numerous taxes and duties are being applied to medicines.[22-23] In Iraq, the government does not provide specified prices for medicines, hence prices vary from one provenance to another and even within the same state; also, Iraqi public sectors (hospitals and clinics) lack the majority of pharmaceuticals. This was clear, and it harmed people, particularly during the epidemic COVID-19. The minimum wage in Iraq is 250,000 Iraqi dinars (166.6 dollars), 2015 (updated date).[24] This study aimed to assess drugs used frequently during the pandemic in Iraq; its availability and prices, and determine how medications are affordable for patients who have been infected with COVID -19.

MATERIAL-METHODS

Study area and period

This was a pilot study carried out among pharmacists in private pharmacies in Babil, governorate of Iraq, from 1 January until 1 March 2021.

Study sample

The study enrolled 30 pharmacies from rural and urban areas. All of the pharmacists were asked about medications costs and its availability in their pharmacies (during pandemic). However, post pandemic prices were collected from big drug store directly that's why there was no mean ±SD. All the prices in the study were IQ 368 in accordance to ISO 249.[25]

Medications selection criteria

Ten professionals who directed and administered the hospital's COVID-19 department nominated medications for the study, which were based on their demands during the COVID -19 pandemic. After patients had been diagnosed with COVID -19 by PCR and blood tests, they were dispensed medications according to their condition and in accordance to the protocols followed.

Medications that were included in the study (dexamethasone tablet and ampule, azithromycin tablet 500 mg, vitamin tablet C, zinc tablet 25 mg, vitamin D tablet 5000 IU, N-Acetyl Cysteine 600 mg effervescent and tablet, Aspirin tablet 81 mg, Rivaroxaban (rivaxo) tablet 15mg, ipratropium (Atrovent) nebulizer, budesonide (Pulmicort) nebulizer, Enoxaparin 4000 IU, 6000 IU, 8000 IU S.C. injection, ceftriaxone vial 1g, Levofloxacin vial 500 mg, meropenem vial 1 g, remdesivir vial 100 mg, favipiravir (Favira) tablet 200mg, lopinavir/ritonavir (Kaletra) tablet 200/50 mg, prospan syrup, Terbutaline (brovolok) syrup, and bromhexine syrup).

Statistical analyses

All data was inputted and analysed using the SPSS (version 20) software package (SPSS Inc., Chicago, IL). Medications availability non-parametric variables was categorized as (yes or no), medications cost parametric variables were displayed as mean ±SD. Data was evaluated using descriptive statistics and presented in tables as needed.

RESULTS

Thirty private pharmacies were enrolled in the study, 12 of which were in rural areas and 18 in urban areas. Table 1 shows the availability of the study's drugs at high, low, and local production prices in private pharmacies. It demonstrates that key COVID -19 medicines, such as Rivaroxaban (rivaxo) tablet 15mg (inhibit clotting formation), ipratropium (Atrovent) nebulizer, budesonide (Pulmicort) nebulizer (bronchodilators), Enoxaparin 4000 IU, 6000 IU, 8000 IU S.C. injection, (inhibit clotting formation), ceftriaxone vial 1 g, meropenem vial 1 g (antibiotics), remdesivir vial 100 mg, and lopinavir/ritonavir (Kaletra) tablet 200/50 mg (antivirals); these medications were available in high and low prices but no local production. On the other hand, aspirin tablets were reported to be unavailable due to a lack of local production despite its production as a local product.

Medications prices (per injection and/or per tablet) in Iraqi Dinar are presented in Table 2. It demonstrates the difference in prices between different pharmaceuticals companies, such as dexamethasone ampule costs, which ranged from (144) Iraqi dinar for the high-priced product to (80) Iraqi dinar for the

low-priced product during pandemic however this price were increased after pandemic. On the other hand, the local price of Levofloxacin vial 500 mg (9500) Iraqi dinars is higher than the imported one's low price (9071) Iraqi dinars, Levofloxacin vial 500 mg prices were reduced after pandemic. Similarly, Favipiravir (favira) tablet 200 mg reduced its price from (1748) to (350) Iraqi dinars (Table 2).

Table 1. Medications availability in high, low prices and local products in the private sector

Availability		High price drug Freq (%)	Low price drug Freq (%)	Local product drug Freq (%)
Dexamethasone ampule	Yes	1 (3.3)	2 (6.7)	5 (16.7)
	No	29 (96.7)	28 (93.3)	25 (83.3)
Dexamethasone tablet	Yes	17 (56.7)	15 (50)	20 (66.6)
	No	12 (40)	15 (50)	10 (33.3)
Azithromycin tablet	Yes	30 (100)	28 (93.3)	23 (76.7)
	No	0	2 (6.7)	7 (23.3)
Vitamin C tablet	Yes	27 (90)	19 (63.3)	13 (43.3)
	No	3 (10)	11 (36.7)	17 (56.7)
Vitamin D tablet 5000 IU	Yes	25 (83.3)	24 (80)	0
	No	5 (16.7)	6 (20)	30 (100)
Zinc tablet 25 mg	Yes	26 (86.7)	22 (73.3)	0
	No	4 (13.3)	8 (26.7)	30 (100)
N-Acetyl Cysteine tablet 600 mg	Yes	20 (66.7)	2 (6.7)	0
	No	10 (33.3)	28 (93.3)	30 (100)
N-Acetyl Cysteine effervescent 600 mg	Yes	21(70)	1 (3.3)	0
	No	9 (30)	29 (96.7)	30 (100)
Ipratropium (Atrovent) nebulizer	Yes	17 (56.7)	3 (10)	0
	No	13 (43.3)	27 (90)	30 (100)
Budesonide (Pulmicort) nebulizer	Yes	14 (46.7)	2 (6.7)	0
	No	16 (53.3)	28 (93.3)	30 (100)
Rivaroxaban (rivaxo) tablet 15mg	Yes	21 (70)	10 (33.3)	0
	No	9 (30)	20 (66.7)	30 (100)
Acetylsalicylic acid (Aspirin) tablet 81 mg	Yes	27 (90)	2 (6.7)	0
	No	3 (10)	28 (93.3)	30 (100)
Enoxaparin S.C. injection 4000 IU	Yes	29 (96.7)	24 (80)	0
	No	1 (3.3)	6 (20)	30 (100)
Enoxaparin S.C. injection 6000 IU	Yes	23 (76.7)	18 (60)	0
	No	7 (23.3)	12 (40)	30 (100)
Enoxaparin S.C. injection 8000 IU	Yes	3 (10)	2 (6.7)	0
	No	27 (90)	28 (93.3)	30 (100)
Ceftriaxone vial 1g	Yes	30 (100)	29 (96.7)	0
	No	0	1 (3.3)	30 (100)
Levofloxacin vial 500 mg	Yes	19 (63.3)	15 (50)	7 (23.3)
	No	11 (36.7)	15 (50)	23 (76.7)
Meropenem vial 1 g	Yes	18 (60)	13 (43.3)	0
	No	12 (40)	17 (56.7)	30 (100)
Remdesivir vial 100 mg	Yes	10 (33.3)	3 (10)	0
	No	20 (66.7)	27 (90)	30 (100)
Favipiravir (favira) tablet 200 mg	Yes	12 (40)	6 (20)	11 (36.7)
	No	18 (60)	24 (80)	19 (63.3)
lopinavir/ritonavir (Kaletra) tablet 200/50 mg	Yes	2 (6.7)	0	0
	No	28 (93.3)	30 (100)	30 (100)
Prospan syrup	Yes	30 (100)	8 (26.7)	19 (63.3)
	No	0	22 (73.3)	11 (36.7)
Brovolek syrup	Yes	14 (46.7)	4 (13.3)	2 (6.7)
	No	16 (53.3)	26 (86.7)	28 (93.3)
Bromhexine syrup	Yes	26 (86.7)	13 (43.3)	25 (83.3)
	No	4 (13.3)	17 (56.7)	5 (16.7)

Table 2. Comparison between medications prices in Iraqi dinars during and after pandemic

Medications	**Price IQ mean ± SD (high price)**		**Price IQ mean ± SD (low price)**		**Price IQ mean±SD(local product**	
	*During COVID	**Post-	*During COVID	**Post-	*During COVID	**Post-
Dexamethasone ampule	144.8±45	1800	91.1±27.3	985	80±27.4	-
Dexamethasone tablet	122.1±186.4	-	30.0±10.3	-	31.3±11.11	1100
Azithromycin tablet	1855.5±299.2	1666	946.4±256.8	140	847.8±166	-
Vitamin C tablet	1181.5±706.7	1166	306.6±278.6	-	94.2±25.3	73.4
Vitamin D tablet 5000 IU	1294±323.5	378	964.6±566.9	166.6	-	-
Zinc tablet 25 mg	1223.1±576.4	391	647.7±887.4	195	-	-
N-Acetyl Cysteine tablet 600 mg	30425±11636.2	604	750±212.1	-	-	-
N-Acetyl Cysteine effervescent 600 mg	869±307.2	4500	500	-	-	-
Ipratropium (Atrovent) nebulizer	1847.1±3133.6	-	2166.7±1040	-	-	-
Budesonide (Pulmicort) nebulizer	967.8±9322.4	-	350.0±70.7	-	-	-
Rivaroxaban (rivaxo) tablet 15mg	2876.2±2147.7	1250	1320±621.9	-	-	-
Acetylsalicylic acid (Aspirin) tablet 81 mg	-	150	150±70.7	-	25±5	15

Enoxaparin S.C. injection 4000 IU	8672.4±3033.4	14000	5166.7±1449.6	2500	-	-
Enoxaparin S.C. injection 6000 IU	10000±3532.3	16500	7055.6±2013.8	11000	-	-
Enoxaparin S.C. injection 8000 IU	17000±6244.9	24500	10000±4242.6	-	-	-
Ceftriaxone vial 1g	9766.6±3019.3	9750	2844.8±464.9	900	-	-
Levofloxacin vial 500 mg	17105.3±8717.1	16500	9071.4±3371.8	3000	9500500	-
Meropenem vial 1 g	20944.4±4345	23000	11538.5±2817.1	8000	-	-
Remdesivir vial 100 mg	161900±76836.7	15000	-	-	-	-
Favipiravir (favira) tablet 200 mg	3829.2±95.7	-	1748.4±802.6	350	3988.6±531.7	-
lopinavir/ritonavir (Kaletra) tablet 200/50 mg	508.33±695.32	-	-	-	-	-
Prospan syrup	5366.7±693.9	6000	2875±582.5	2000	2710.5±508.7	-
Brovolek syrup	3321.4±1048.9	7000	2250±957.4	-	1500±707.1	-
Bromhexine syrup	3076.9±1119	-	1730.7±695.7	-	1120±415.3	690

*During pandemic prices were collected from the 30 enrolled pharmacies
** post pandemic prices were collected from drug stores

In general, medications that had been on demand during pandemic their prices were reduced after pandemic are (Azithromycin tab high and low-price product, vit. D 5000 IU high and low-price product, Zinc 25 mg high and low-price product, N-Acetyl Cysteine tablet 600 mg high price product, Rivaroxaban tablet 15mg high price product, Acetylsalicylic acid (Aspirin) tablet 81 mg local product, enoxaparin 4000 IU low price product, Ceftriaxone vial 1g low price product, Remdesivir vial 100 mg high price product, bromohexine syrup local product).

However, other medications increased their prices after pandemic are (Dexamethasone ampule high and low-price, Dexamethasone tablet local production, N-Acetyl Cysteine effervescent 600 mg high price, Enoxaparin S.C. injection 4000 IU high price, Enoxaparin S.C. injection 8000 IU high price, Enoxaparin S.C. injection 6000 IU high and low-price, Meropenem vial 1 g high price, Brovolek syrup high price). On the other hand, few medications from those were included in the study keep almost the same price after pandemic (Vitamin C tablet high and low-price, Ceftriaxone vial 1g high price).

DISCUSSION

Prices send forth signals about consumer preferences, encouraging companies to produce more of what they desire. However, the presence of insurance and patents, as well as layers of regulation, insufficient consumer information, and, most importantly, the need to ensure access to effective products regardless of people's ability to pay, mean that prices in the traditional sense do not serve their usual function of reflecting consumers' willingness to pay. This is especially true in the event of a pandemic. This study shed light on the cost of pharmaceuticals for Iraqi citizens with a minimum wage of 250,000 Iraqi dinars who do not have access to medical insurance or medications provided for free at government hospitals. According to the results, there is a significant price difference between expensive and inexpensive medicines because many companies (known and unknown) export pharmaceuticals to Iraq regardless of their efficacy. Furthermore, local production prices can be high in comparison to imported ones, as in the case of (levofloxacin vial and Favipiravir (favira)), which raises an exclamation mark about the prices of the local product that had no taxes and no export cost; from the other side, the exclamation mark can be bigger towards imported drugs and their quality and effectiveness. In Bangladesh, Antibiotics (65.3%), analgesics (54.7%), and vitamins (51.8 %) did not see any price increases. Personal protection equipment, on the other hand, usually sees price hikes (over 90 % of stores). Medicine and personal protective equipment (PPE) shortages were observed, with PPE shortages being the most severe.[26] However, the availability and costs of PPE were not measured in our study. On the other hand, a study in Saudi Arabia found that over 70% of participants said the epidemic had little impact on the prices of prescription pharmaceuticals in limited supply (e.g., ≥25%).[27] According to Iran's food and drug administration, the monthly sale volume of lopinavir+ritonavir has increased by 23 times; however, medicine shortages for emergency supplies have not reported any shortages of the aforementioned medicines and/or the drugs required by pneumonia-related hospitalized COVID-19 patients. One reason for this could be the huge stock of raw materials, which is justified by market uncertainty caused by Iran's economic and political factors, causing enterprises to overstock.[28] In such cases, a cost recovery technique reimburses product makers for their manufacturing and distribution costs, as well as any additional research and development costs. This concept has a lot of appeal: In the event of a national emergency, governments may take exceptional measures, such as seizing industries or paying critical producers "cost-plus" prices to ensure that millions of people who require treatments, tests, or immunizations have access to them at a reasonable cost.[29,30] That's all, but don't forget about the significant costs that patients had to bear if they were infected with COVID-19 alone or with their family.[31] For example, if he was prescribed Levofloxacin vial 500 mg, it cost more than 9000 Iraqi dinars, which is more than one day of his wage (1 day of salary = 8333 Iraqi Dinar; levofloxacin is normally given for seven days, so the total cost will be 583333 Iraqi Dinar for the entire course). Based on these figures, we may deduce that pharmaceuticals in Iraq are expensive for

patients infected with COVID-19, and even more so when there are multiple patients in the same household. Not to mention the cost of I.V. administration. Let's have a look at another medication: budesonide is an anti-inflammatory drug that's often used to treat respiratory disorders like adult and pediatric asthma, bronchial asthma, and moderate-to-severe chronic obstructive pulmonary disease (COPD).[32,33] Budesonide, in conjunction with glycopyrronium and formoterol, was found to have an inhibitory impact against the seasonal human coronavirus (HCV)-229E in a previous investigation.[34] Budesonide can considerably reduce SARS-CoV-2 titers in vitro, according to a study.[35] Budesonide (Pulmicort) nebulizer is used for patients with COPD and asthma, as well as those who have COVID -19 infection, in a dose of two to four times per day; assuming two times per day, it will cost between 750 Iraqi Dinars for the cheap brands and around 1900 Iraqi Dinars for the expensive ones per day for COVID-19 treatment. Let's look at the commonly used corticosteroid dexamethasone, which has a low-cost manufacturing process due to economies of scale. The most common recommendation for dexamethasone treatment in COVID-19 is a 7- to 10-day course of 6 mg oral or I.V. dexamethasone.[36] A 10-day I.V. treatment was employed in the study as a reasonably producible for roughly US $2.58 and $0.19 in the US. The higher cost of injectables reflects the possibility of more loss during production, as well as the cost of vials and transportation. Additionally, substantial non-drug costs related with I.V. delivery were not included.[36] When compared to the findings of this study, dexamethasone ampule costs 1445 Iraqi Dinars for the imported and 800 Iraqi Dinars for the local one, however both are quite expensive when compared to tablets (1220 and 312 Iraqi Dinars), all the prices were estimated for ten days course. The injections require additional costs for I.V. administration as mentioned previously.

During pandemic, many new companies (known and unknown) entered legally and illegally the Iraqi markets. Unknown companies' illegal were available for the cheaper drugs prices but brands had fixed prices with shortages in their availability like what we had the case with enoxaparin (Sanofi) there was a shortage and fixed price which is not affordable for everyone while enoxaparin from other generic companies was cheaper and illegal. Unknown companies were, however, available for cheaper drug prices. However, those generics are not always accessible and their prices are not fixed (as consumer demand increased, prices increased), and they can be replaced by other generics from unidentified companies who may or may not be legally allowed to sell their products in the Iraqi markets. Iraq's health ministry or the Syndicate of Iraqi Pharmacists have little control over the market, which contributes to problems with costs and availability of both brand and generic products. Unfortunately, a lack of medications at government hospitals and health care units usually worsens the situation for Iraqi citizens. For sure this price changes of drugs affect to some extend the accessibility and duration of treatment. Not forgetting some medications that had been on demand during pandemic their prices were reduced after pandemic; others increased their prices after pandemic as their demand not related to the pandemic and only few medications from those were included in the study keep almost the same price after pandemic finished. These differences in prices during and after pandemic related not just for their demand but also to the variation in the Iraqi Dinar exchange against Dollar.

Study limitations

In our study, neither the cost nor the accessibility of PPE were assessed. Additionally, the researcher was unable to include all generic medications in the study due to the fact that their availability, costs, and legal entry into the Iraqi market varied.

CONCLUSION

In conclusion, assuming medical production with lower associated costs and no capital investment in new, dedicated facilities; however, after supply chain disruptions such as those seen earlier in the pandemic, countries may accept higher upfront costs and over-heads in order to establish domestic production with greater supply security. The prices we provide are subject to change and are a snapshot of publicly accessible information at the time of writing due to fluctuating exchange rates and confidential in-country negotiated discounts for public healthcare providers. The Iraqi government has to provide medications for the Iraqi people in the hospitals and clinics so that patients do not need to go to private ones. Medications prices have to be controlled uninformed by the government. This research paves the way for a bright future in Iraq, where local production is encouraged and drug prices are controlled in both the public and private sectors.

CONSENT

I have read and agree to the privacy policy

ACKNOWLEDGMENTS

The author would like to thank all pharmacists who accepted to be part of this study and support us with information.

FUNDING

None.

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

ETHICS STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Institutional Review Board of Al-Zahrawi University College (ZUC Approval at 01-12-2020). All pharmacists provided informed consent before participating in the study.

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