

RESEARCH ARTICLE

SHORTAGE OF ESSENTIAL MEDICINES DURING THE COVID-19 PANDEMIC:
CROSS SECTIONAL STUDY FROM COMMUNITY PHARMACIES

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ABSTRACT

Background: The drug shortage is a very serious issue regarding the quality of Health System of any country. The problem is increased in the pandemic causing serious issues to the health system. **Objectives:** The objective of current study was to evaluate the factors responsible for the drug shortages in Pakistan and way forward to avoid these problems in the future. **Methodology:** A cross-sectional observational study was carried out in different cities of Pakistan. An online form was designed after thorough literature review. The study population included Staff pharmacists, Pharmacy managers and pharmacists self-owning pharmacies. Data was then collected, analyzed using SPSS-26. **Results:** The majority of pharmacists agreed that Global restrictions on trade activities added to drug shortage during COVID-19. The knowledge was relatively higher in pharmacists of Punjab as compared to pharmacists of other provinces. Majority of pharmacist (52%) from Punjab province of Pakistan strongly believed that Provincial drug regulatory department should play its role effectively during the emergency crisis to prevent drug shortages during the pandemic. **Conclusion:** In order to prevent the problem of drug shortages, efforts should be made to control the factors responsible for the drug shortages and local production should be enhanced along with proper control by regulatory authorities.

Keywords: Drug shortages, COVID-19, Pandemic, Cross-sectional observational study.

INTRODUCTION

According to WHO, Coronavirus disease first outbreak was reported in year 2019 in Wuhan, China and exponential increase in pandemic curve was observed during March 2020 throughout the world (1, 2). The Coronavirus disease (COVID-19) has penetrated out of Wuhan in 221 nations with more than 122 million confirmed cases and 98,863,619 deaths worldwide till 19/03/2021 (3). Successively, COVID-19 expanded in Pakistan due to its travel and merchandising with neighboring countries especially China (4). The sudden outbreak of COVID-19, with no definite treatment has unveiled the flaws of our health care system significantly concerning crises of drug shortage.

The Food and Drug Administration (FDA) has been keeping an eye on entire supply chain with this hypothesis that COVID-19 pandemic has potential to hit drug supply chain which could lead to further health consequences (5). The dilemma of augmentation in shortage of drugs during COVID-19 is a national distress that speaks for literal crises for pharmacists around the world. The novel coronavirus has exposed significant number of pits in health care system of developing countries including Pakistan. Variety of reasons can lead to drug shortage during Coronavirus disease (COVID-19). In this enigmatic state of emergency, unexpected rise in demand for first-line medications was observed accompanying drug shortage. Global travel limitations on trade activities amid pandemic outsourced supply of generic drugs from China to manufacturing sites (6). Government induced pandemic shutdown of factories in major industrial areas of Pakistan has disrupted routine services mobilization (supply/delivery chains of medications) especially the supply of narcotics. The unwillingness of certain generic companies on selling un-profitable products gave rise to drug shortage. Lack of local production units and manufacturing plants in Pakistan added to drug shortage in this hour of COVID-19 crises. Poor coordination between government and medical staff, lack of proper strategy to install manufacturing units has found to be one of causations of drug shortage. The sudden diversion of all available resources towards saving COVID patients revealed the scarcity of drugs in pandemic. Drug shortage

has potential to influence patient care ultimately on whole health care system. Treatment of COVID-19 initially involved the use of bronchodilators as virus infects lungs. Shortage of inhalers and nebulizers and escalated demand of health commodities were seen (7). Moreover, drug shortage also constitutes a threat to patients other than COVID infected raising mortality risks. (8) Taking into account the crises by drug shortage, we performed the survey of community pharmacies in Pakistan to assess the factors responsible for the essential drug shortages and possible key recommendations to prevent these problems in future.

METHODOLOGY

Ethical approval and consent to participate

All the procedure performed in this research was in accordance with ethical guidelines of the institution (IRB approval no. IRB/10/03-2019.PICP.Ph).

Study design

To evaluate the state of drug shortage during COVID-19 pandemic, the contributing factors and possible solutions in this hour of crises, the authors performed an online as well as in person cross sectional multicenter survey during months of January and February 2021 which was filled by staff pharmacists, pharmacy managers and pharmacy owners of chain and independent pharmacies.

Study settings and population

The study population was comprised of staff pharmacists, pharmacy managers and self-owned pharmacies from major cities of all provinces (Punjab, Sindh, Balochistan, Khyber-Pakhtunkhwa) and from Islamabad Capital Territory of Pakistan. In the regard of pandemic lockdown, the survey questionnaire was distributed to community pharmacies of major cities in Pakistan either physically where possible or through online means. The 348 community pharmacies participated online as questionnaire was circulated among them via electronic means.

Survey instrument

The authors designed a questionnaire after a thorough literature research. The initial questionnaire consisted of three sections with a total of 7 questions on demographics and 42 questions on drug shortage during COVID-19. However, after content and face validity by three experts in the field which included

professionals of pharmacy practice, the questionnaire was validated and reduced to 36 questions on drug shortage during COVID-19. An initial study was also conducted on 50 community pharmacies of Lahore city to determine the reliability of the questionnaire by using Cronbach's alpha value. The alpha coefficient of the pilot study results was 0.957 which indicated an excellent consistency of the validated questionnaire. The final questionnaire was partitioned into three sections. The first section consisted of seven questions about demographics including gender, age, marital status, city, type of pharmacy, designation at pharmacy and years of experience in the field. The second section contained eighteen questions to evaluate the awareness of community pharmacists about factors responsible for drug shortages during COVID19 on the scale of 'yes' or 'no'. Likewise, the third section consisted of eighteen queries about way forward for drug shortages during COVID19, assessed utilizing a Likert scale of: 'strongly agree', 'agree', 'neutral', 'disagree', and 'strongly disagree'.

Sampling strategy

The sample size of the study was calculated by the formula $n = (z)^2 p (1 - p) / d^2$, where z is the level of confidence, p is the prevalence and d is the relative precision. The z-value for 95% confidence interval is 1.96, prevalence was taken as 20%, and precision was taken as 20% of the prevalence. By putting the values in the formula, the final sample size came to be 384 participants. However, considering the non-response rate and lockdown situation, a total of 1000 forms were distributed to community pharmacies either physically or through electronic means.

Inclusion criteria

Community pharmacists, Staff pharmacists, pharmacy managers and pharmacy owners
Hospital pharmacists who are involved in out-patient pharmacy services

Exclusion criteria

Pharmacy technicians, who run medical stores and only contain OTC products.

Individuals who expressed unwillingness to participate in this study

Data collection

Data were collected using a questionnaire comprising of 3 sections. A total of 1000 forms were circulated among pharmacists by well-trained research assistants. The research assistants were undergraduate students who were properly trained on how to perform the data collection. The assistants were briefed about objectives of the study and were counseled to provide all useful information on the intentions of the study to the participants. The oral consent and approval were also taken from respondents to ensure their voluntary participation. An electronic version of questionnaire was also designed and forwarded to community pharmacists who were not accessible during the COVID lockdown.

Statistical analysis

Data were implied, recorded, and evaluated using statistical package for social sciences SPSS (IBM, version 26). Demographic findings were stated by using descriptive statistics (frequencies and percentages). Likert questions were analyzed using multilevel responses. Association among variables was analyzed using Chi square test and statistical significance was considered if the p-value was <0.05 .

RESULTS

Four twenty-six staff pharmacists and 132 pharmacy managers as well as 153 persons who self-owned pharmacies having mean age (± 0.3404) and mean experience (± 0.3010), completed the survey with a response rate of 71% (Table 1).

Table 1. Demographic characteristics of participants (N = 711)

Particulars	Frequency (n)	Percentage (%)
Gender		
Male	469	66
Female	242	34
Age		
20 – 30	358	50.4
31 – 40	300	42.2
41 – 50	37	5.2
51 and above	16	2.3
Marital status		
Un-married	378	53.2
Married	333	46.8
City		
Punjab	531	74.7
Sindh	118	16.6
Balochistan	46	6.5
Khyber-Pakhtunkhwa	15	2.1
Islamabad	1	1
Type of Pharmacy		
Chain pharmacy	475	66.8
Independent	236	33.2
Designation in Pharmacy		
Staff Pharmacist	426	59.9
Manager	132	18.6
Self-owned	153	21.5
Experience		
0 – 5 years	560	78.8
6 – 10 years	101	14.2
11 – 15 years	37	5.2
16 years and above	13	1.8

n= Frequency, %= Percentage

Table 2. Awareness of Essential Drug Shortages during COVID (N=711)

Parameters	Yes n (%)	No n (%)	P-value
Global restrictions on trade activities added to drug shortage during COVID19?	701 (98.6)	10 (1.4)	0.337
Unexpected rise in drug demand caused drug shortage during COVID19 in Pakistan?	702 (98.7)	9 (1.3)	0.308
Varying levels of law enforcement activities has increased the risk of interception of drugs?	695 (97.7)	16 (2.3)	0.016
Regulatory actions: industry, factory shutdown, can be cause of drug shortage during pandemic?	693 (97.5)	18 (2.5)	0.002
Inappropriate/ off-label use of medicines contributed to drug shortage during COVID19?	684 (96.2)	26 (3.7)	0.081
Diversion of all available resources towards COVID-19 patients lead to the shortage of drugs during COVID19?	683 (93.1)	28 (3.9)	0.001
Self-medication of drugs, panic buying and hoarding of drugs by public caused shortage of medicines at pharmacies during COVID19?	693 (97.5)	18 (2.5)	0.405
Overall economic loss has impact on drug shortage?	688 (96.8)	23 (3.2)	0.000
Change in price of drugs during COVID19 contributed to drug shortages?	696 (97.9)	15 (2.1)	0.047
Banning imports/ border restrictions contributed to drug shortage during COVID19?	694 (97.6)	17 (2.4)	0.034
Increased patient load on hospitals due to improper diagnosis or screening during COVID19 elevated the shortage of drugs?	699 (98.3)	12 (1.7)	0.051
Excessive parallel exporting with respect to currency fluctuation during COVID19 raised the drug shortage?	692 (97.3)	19 (2.7)	0.004
Rationing of essential medicines caused drug shortage during COVID19?	691 (97.2)	20 (2.8)	0.010
Unwillingness of certain generic companies on selling unprofitable product impacted the drug shortage during COVID19?	689 (96.9)	22 (3.1)	0.021
Lack of local production units during COVID19 lead to the shortage of drugs?	691 (97.2)	20 (2.8)	0.003
Relying on old resources contributed to drug shortage during COVID19?	684 (96.2)	27 (3.8)	0.003
Poor coordination between government and medical staff contributed to drug shortage during COVID19?	692 (97.3)	19 (2.7)	0.003
Irresponsible behavior of DRAP is a contributing factor of drug shortage during COVID19?	691 (97.2)	19 (2.7)	0.103

n= Frequency, %= Percentage

Table 3. Recommendations to avoid Essential Drug Shortages during pandemic (N=711)

Recommendations	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)	p-value
DRAP should play its role effectively during emergency crisis?	552 (77.6)	137 (19.3)	19 (2.7)	3 (4)	0 (0)	0.016
Provincial drug regulatory department should play its role effectively during the emergency crisis.	481 (67.7)	211 (29.7)	17 (2.4)	2 (0.3)	0 (0)	0.000
Enhanced regulations by drug inspectors to discourage hoarding of drugs.	490 (68.9)	205 (28.8)	14 (2)	2 (0.3)	0 (0)	0,012
Improve coordination between government and pharma industries, suppliers to take initiatives to overcome drug shortages during crisis.	284 (39.9)	394 (55.4)	31 (4.4)	2 (0.3)	0 (0)	0.000
Lockdown affected the logistic supply of essential/life-saving drugs.	509 (71.6)	179 (24.6)	22 (3.1)	5 (0.7)	0 (0)	0.029
Improvise possible/alternate ways to overcome transportation issues during pandemic.	483 (67.9)	206 (2)	21 (3)	1 (0.1)	0 (0)	0.005
Communicate with local companies to ensure their drug supply in the hour of crisis.	27 (39.2)	403 (56.7)	26 (3.7)	3 (0.4)	0 (0)	0.000
There is dire need of improvising new technologies and new projects to enhance our drug industry to overcome shortage.	480 (67.5)	184 (25.9)	45 (6.3)	2 (0.3)	0 (0)	0.013
Health authorities should ensure the lawful/legal practice regarding proper distribution of medication to all pharmacies and distribution networks.	292 (41.1)	377 (53)	38 (5.3)	6 (0.4)	0 (0)	0.000
Health sector and pharmaceutical industries should accept their responsibility in this hour of medicine crises.	499 (70.2)	177 (24.9)	32 (4.5)	3 (0.4)	0 (0)	0.014
Health care system should be prepared for the crises situation.	497 (69.9)	188 (26.6)	24 (3.4)	1 (0.1)	0 (0)	0.000
The authorities should take proper initiative for crisis situation to avoid drug shortages in future.	474 (66.5)	212 (29.8)	21 (3)	4 (0.6)	0 (0)	0.007
Transportation of raw material by e commerce will reduce the demand as well as support social distancing.	466 (65.5)	212 (29.5)	28 (3.9)	5 (0.7)	0 (0)	0.029
Minimizing the price fluctuations to prevent the panic buying thus preventing the shortage of drugs.	259 (36.4)	415 (58.4)	32 (4.5)	5 (0.7)	0 (0)	0.000
Proper penalties should be imposed on persons responsible for hoarding the drugs and selling in black market.	289 (40.6)	395 (55.6)	20 (2.8)	7 (1)	0 (0)	0.000
Enhancement of local production units can overcome shortages of drugs during pandemic.	484 (68.1)	205 (28.8)	18 (2.5)	4 (0.6)	0 (0)	0.000
Production of raw material locally in Pakistan will decline the drug shortages.	491 (69.1)	198 (27.8)	21 (3)	1 (0.1)	0 (0)	0.005
Government should impose proper legislations to minimize drug shortages.	506 (71.2)	186 (26.2)	16 (2.3)	3 (0.4)	0 (0)	0.000

n= Frequency, %= Percentage

Out of 711 respondents, majority of staff pharmacists (59%), managers (18%) and pharmacy owners (20%) agreed that the global restrictions on trade activities added to the drug shortage during COVID 19. Major respondents were from the province Punjab of Pakistan. More males (65%) agreed to this statement. 420 staff pharmacists out of 711 strongly believed that unexpected rise in drug demand became the reason of drug shortages during the pandemic. Majority of pharmacists agreed to this statement has experience less than 5 years. 66% out of 711 pharmacists working at chain pharmacies believed that varying levels of law enforcement activities increased the risk of interception of drugs during the pandemic (Table 2). The majority of male respondents (64%) agreed that regulatory actions: factory shutdown, can be cause of drug shortages during pandemic ($p=0.002$) 414 out of 426 staff pharmacists having skills >5 years, considered that Unsuitable/ off-label use of medicines contributed to drug shortage during COVID19. 130 pharmacy managers and 139 self-owned pharmacists believed that diversion of all available resources towards COVID19 lead to drug shortage during pandemic ($p=0.001$). 693 (97%) out of 711 respondents believed that Self-medication of drugs, panic buying and hoarding of drugs by public caused shortage of medicines at pharmacies during COVID19. Overall economic loss impacted drug shortage during pandemic, 688 (96%) of total respondents agreed to this statement, majority were staff pharmacists (58%). 97% of respondents believed that change in price of drugs during COVID19 contributed to drug shortages during pandemic. 66% out of 711 pharmacists working at chain pharmacies believed that banning imports/ border restrictions contributed to drug shortage during COVID19, majority of respondents were of the age 20 – 30 years. 59% of staff pharmacists believed that increased patient load on hospitals due to improper diagnosis or screening during COVID19 elevated the shortage of drugs during pandemic. Majority of respondents 97.3 % agreed that excessive parallel exporting with respect to currency fluctuation during COVID19 raised the drug shortage ($p=0.004$). 97.2 % respondents agreed that lack of local production units

during COVID19 lead to the shortage of drugs ($p=0.003$). 684 respondents (96.2%) believed that relying on old resources contributed to drug shortage during COVID19 ($p=0.003$). Moreover, the majority of respondents (97.3%) also believed that poor coordination between government and medical staff contributed to drug shortage during COVID19 ($p=0.003$) (Table 2).

Majority of male pharmacists (51%) having age between 31 – 40 years, strongly agreed that DRAP should play its role effectively during emergency crisis. Majority of pharmacist (52%) from Punjab province of Pakistan strongly believed that Provincial drug regulatory department should play its role effectively during the emergency crisis to prevent drug shortages during the pandemic (Table 3), 48% of chain pharmacies and 20% of independent pharmacies strongly agreed that enhanced regulations by drug inspectors to discourage hoarding of drugs is effective way to control drug shortages during pandemic. Majority of chain pharmacies agreed that coordination between government and pharma industries, suppliers to be improved to overcome drug shortages during crisis. 44% staff pharmacists, 13% pharmacy managers and 13% pharmacy owners strongly believed that lockdown affected the logistic supply of essential/life-saving drugs causing drug shortages. Majority staff pharmacists strongly agreed to improvising possible/alternate ways to overcome transportation issues during pandemic ($p=0.005$). 38% chain pharmacies agreed that Communicating with local companies to ensure their drug supply in the hour of crisis would prevent drug shortages. Majority of chain pharmacies strongly agreed that there is dire need of improvising new technologies and new projects to enhance our drug industry to overcome shortage. 46% pharmacists having experience >5 years, agreed that health authorities should ensure the lawful/legal practice regarding proper distribution of medication to all pharmacies and distribution networks to prevent drug shortages. 70% pharmacists strongly agreed that health care system should be prepared for the crises situation. Majority of staff pharmacists 41% strongly agreed that the authorities should take proper initiative for crisis situation to avoid

drug shortages in future. 41% staff pharmacists having experience >5 years strongly believed that transportation of raw material by e commerce will reduce the demand as well as support social distancing. 38% chain pharmacies agreed that price fluctuations should be minimized to prevent the panic buying thus preventing the shortage of drugs. 38% pharmacists of chain pharmacies agreed that proper penalties should be imposed on persons responsible for

DISCUSSION

Drug shortages have been a major public and professional health concern on global table that has wreathing for last few years creating a significant risk to overall healthcare system (9-12). Developed as well as under-developed countries are experiencing growing tendency in drug shortages, which have engendered to numerous problems like strain in health care resources, endangering patient health, difficulties for health care workers as well as community federal regulators (13). The unprecedented COVID-19 pandemic has fabricated health challenges including lack of access to essential medicines and basic health commodities on global scale (14).

The dilemma of COVID -19 impacted drug shortage can be the global threat to health care system. Drug manufactures all over the world have voiced their concern about COVID induced drug shortages and term the situation as 'alarming'. Owing to COVID-19 pandemic, disruption in supply chains for vital drugs, hoarding of drugs and distribution of counterfeit drug products aggravated this once made drug shortage global health challenge (15). The ever-endangered drug supply chain is being further burdened by COVID pandemic (16). With rapid surge in COVID cases health care authorities worldwide noticed a respective spike in drug shortages during initial 8 months to 12 months of COVID pandemic (17).

During Pre-COVID times almost 2 billion people were already facing unavailability of medicines that is still standing in way of standard health (18). Drug shortage in middle and low-income countries is not a newfangled issue (19), unexpected demand changes and fluctuations, disturbance in supply chain management during COVID-19 reportedly augmented this issue in middle income

hoarding the drugs and selling in black market. 51% pharmacists of Punjab agreed that enhancement of local production units can overcome shortages of drugs during pandemic. 29% pharmacists of age between 21 – 30 years agreed strongly to the statement that production of raw material locally in Pakistan will decline the drug shortages ($p=0.005$). 44% of staff pharmacists strongly agreed that government should impose proper legislations to minimize drug shortages (Table 3).

countries at this once in whole century (20). Over the past years many reports from Pakistan revealed shortage of essential first-line anti-TB drugs, drugs for common cold and minor ailments, anti-thyroid medicines, neural medications and hepatic regulatory drugs (21-24).

In a low, middle-income country like Pakistan, dilemma of drug shortage is very likely to increase during pandemic which represents a notable public health hazard (25). The unavailability of life-saving medications has mercy for no one, including COVID and non-COVID patients (26). This issue has received increasing attention during pandemic due to lockdown in major cities of Pakistan, pharmaceutical production shutdowns affecting supply chains inordinately reliant on ingredients from China (27), (28). The current situation calls attention to the Pharma industries of under developed countries that warns of COVID medicine shortages as the prices of raw materials has surged to 200 percent lately (29).

The WHO reported that drug shortages as least-examined issue in low-income and middle-income countries, (19) and this multifaceted study is done in Pakistan for in depth understanding of drug shortage issue. In this study, the main themes highlighted the ongoing scenario of drug shortages in Pakistan, its associated factors and possible way forwards. As it became the subject of intense debate and argument, authors wanted Pakistan's government intervention at this issue which could prevent or manage new or existing drug shortages in midst of COVID crises by this study (30).

For an economically endangered country like Pakistan, drug shortages have aptitude to influence patient care which demands to think about leverage points in our health care system

(31). Our study concluded that COVID-19 situation has introduced before us the significant fluctuations when pharmacies ran out of drugs and decreased supply of drugs was anticipated. The interferences in drug supply negatively impact overall efficiency of health care system in this hour of crises (32).

Considering all possible reasons for shortage of drugs all government drug dealers and drug inspectors, pharmaceutical shareholders, pharmaceutical suppliers, medicine regulators, drug insurance companies, pharmaceutical wholesale distributors, international and national pharmaceutical distributors and DRAP (Drug Regulatory Authority of Pakistan) should urgently take note of these issues and must take initiative to overcome drug shortage during crises situations (33).

Pakistan government with participation of pharmacists should devised long-term policy on “upraising awareness on drug shortage to general public” making sure proper means to implement the policy. There is dire need of improvising new technologies and new projects to enhance our drug industry. Communication should be made with local companies to ensure their drug supply in the hour of crisis. Enhancement of local production units can overcome shortages of drugs during pandemic. Production of raw material locally in Pakistan will decline the drug shortages to ensure continuity of drug supply. It is mandatory to identify all possible stakeholders, nip the evil in bud and take proper initiatives to sequence again the broken supply-chains network of medicines.

Provincial drug regulatory department should play its role effectively during the emergency crisis. Health authorities should ensure the lawful/legal practice regarding proper distribution of medication to all pharmacies and distribution networks to enhance regulations by drug inspectors to discourage hoarding of drugs. Moreover, proper penalties should be imposed on persons responsible for hoarding the drugs and selling in black market. Manufacturers should notify FDA at least 6 months before complete clean out of medications which will help to identify problems in healthcare system (34). There should be communication of information among manufacturers, emergency coordination staff and FDA as soon as drug

shortage is expected or drug supply demand ratio gets imbalanced.

DRAP should play its role effectively during the emergency crisis. Governments should improvise alternate ways to overcome transportation issues during pandemic. Transportation of raw material by e commerce will reduce the demand as well as support social distancing. Minimizing the price fluctuations to prevent the panic buying thus preventing the shortage of drugs (31).

CONCLUSION

According to our study, it is comprehensible that Pakistan is witnessing multiple crises along with corona virus emergency situation. An immediate end to end approach should be conducted to ensure throughout smooth supply of life-saving medicines during emergency situation. While COVID-19 is not departing soon, a quick approach should be directed to strengthen health care system on the horizon of patient-centered care. Taking into account all fundamental causes of dilemma of essential drug shortage during COVID-19 in Pakistan drug supply authorities should pay attention to this progressing issue to avoid further consequences of imminent COVID-19 crises and to ensure stable supply of medications in the near future. We believe that the government of Pakistan along with health care professionals of private sector should counter this situation in coordinated unbiased and transparent manner.

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DECLARATIONS

Authors' contribution

FH designed and supervised the study. GMH and MA conducted the study. MM compiled the data and prepared manuscript. MI and HS prepared manuscript and revised it. All the authors read and approved the final manuscript and contributed equally.

Ethical approval

All the procedure performed in this research was in accordance with ethical guidelines of the institution (IRB/10/03-2019.PICP.Ph).

Conflict of interest

The authors declared no conflict of interest among them.

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