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The Impact of COVID-19 Pandemic on the Pharmaceutical Supply Chain in Freetown: A Phenomenological study

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Abstract

Background

The world economy, particularly the pharmaceutical industry, was negatively impacted by the past COVID-19 pandemic. The impact was worst for countries with limited resources like Sierra Leone, where the pharmaceutical supply chain found it extremely difficult to keep up with the rising demand for essential medications. The main aim of this study was to identify the impact of the COVID-19 pandemic on the pharmaceutical supply chain in Freetown, Sierra Leone. Specifically, the study examined supply chain disruptions and demand volatility during the COVID-19 pandemic, as well as investigated the government's response to the pandemic, and how it affected the pharmaceutical supply chain.

Methods

A purposive study using a phenomenological approach was conducted to identify lived experiences of key informants on the impact of the COVID-19 pandemic on the pharmaceutical supply chain in Freetown. The study was conducted between September 2022 to February 2023. One hundred key pharmacy professionals working within the pharmaceutical supply chain system were recruited in the study and interviewed using structured questionnaires for data collection. Qualitative data from questionnaire responses were double coded using thematic content analysis according to Tesch's approach. Descriptive statistics was used to calculate frequency counts and percentages for respondent characteristics.

Results

One hundred eligible and consented participants took part in the study. Most of the participants were from public institutions (60%), while 76% were males. Majority (44%) of the participants were within the age bracket of 40–49 years. All the participants confirmed to have observed change in delivery lead times during the pandemic. Ninety-five percent (95%) of the participants experienced more stock-outs for products during the COVID-19 pandemic period compared to the period before. Out of the total, 98% of the participants experienced fluctuations and increase in product prices during the pandemic. Low stock out levels, border restrictions and lock downs were the key thematic issues.

Conclusion

Availability of pharmaceutical products was negatively affected during the COVID-19 pandemic. This study highlighted essential concepts and draws attention to key ideas that can aid pharmaceutical businesses, industries, and government institutions in managing supply interruptions and demand volatility in future pandemics.

1. Background

Globally, pandemics and health emergencies in general are becoming a bigger hazard to public health. The World Health Organization (WHO) declared COVID-19 (Coronavirus Disease 2019) – a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 infection (SARS-CoV-2), a pandemic on March 11, 2020, following the discovery of an epidemic of a unique flu-like illness in Wuhan, China, in early December 2019. Since then, about three million deaths and 140 million illnesses have been reported globally [1]. In Sierra Leone, the first case of COVID-19 infection was reported on 31 March 2020 and since then, the country recorded about 7,682 confirmed cases and 125 verified deaths [2].

The probability of pandemics is predicted to rise with increased globalization and migration of humans [3]. Pandemics such as COVID-19 are associated with high rates of morbidity and mortality, and negatively impact the socioeconomic status and livelihoods of communities, particularly in resource-limited countries. The Pharmaceutical industry is critical to the delivery of high-quality healthcare, especially during pandemics when the supply chain for medicines can be overwhelmed or shut down for a variety of reasons [4]. One of these reasons is an excessive dependence on established production and distribution networks, such those in China and India [5]. In this context, the pharmaceutical industry was not an exception, restricting access to high-quality and

reasonably priced medications to manage illnesses in settings with high prevalence of infectious diseases and inadequate health services [6, 7].

Also, pharmaceutical commodities are usually hoarded and not released to buying countries during emergencies or disease outbreaks, resulting in shortages or disruptions in the pharmaceutical supply chain. [8, 9]. Lockdowns during the early days of the COVID-19 pandemic also limited in-country and cross-border travels. This significantly impacted on how pharmaceutical commodities were transported and delivered during the pandemic.

Supply networks and logistics became more vulnerable as the COVID-19 pandemic spread across countries. Health supply chains were interrupted, including effects on active medicinal ingredients, transportation, purchases, finished medical items, and more [11]. The term "logistics supply chain" refers to more than just shipping goods between countries. It undoubtedly addresses regional issues such as workers leaving industrial facilities, the prohibition on transportation, particularly trucks, the lack of cooperation between various administrations, and the tardiness of couriers and transporters. All of these elements contributed to supply chain delays and disruptions, which affected the availability of vaccines, hand sanitizers, testing kits, personal protective equipment (PPE), medications, medical equipment, raw materials, and a variety of other items [12].

There are several ways to look at how the epidemic affected the pharmaceutical industry. COVID-19 may have been viewed as a once-in-a-century opportunity for the pharmaceutical industry given the growing demand for prescription medications, vaccines, and medical equipment [13]. However, the pharmaceutical sector as a whole experienced both immediate and long-term consequences of the COVID-19 pandemic. Changes in regulations, fluctuations in demand, supply shortages, panic buying, stockpiling, changes in communication and marketing to remote contacts with technology, and adjustments to the research and development process are examples of short-term repercussions of COVID-19. Long-term impacts included approval delays, moving towards self-sufficiency in pharmaceutical production supply chain, slow-down in industry growth, and possible changes in consumption trend [14]. Although the complete effect of COVID-19 on supply chains is not yet fully understood, it is undeniable that the epidemic had a significant financial and economic impact on the world economy, affecting everything from raw materials to finished goods [15].

This study pursued several key objectives. First, it aimed to evaluate the impact of the COVID-19 pandemic on the pharmaceutical supply chain in Freetown between September 2022 and February 2023. Second, it identified supply chain disruptions during the COVID-19 pandemic. Third, the study assessed the demand volatility during the COVID-19 pandemic; and lastly, it investigated the government’s response to the pandemic, and how it affected the pharmaceutical supply chain in Freetown.

2. Materials and Methods

Study design

A purposive study using a phenomenological approach was conducted to identify lived experiences of key informants on the impact of the COVID-19 pandemic on the pharmaceutical supply chain in Freetown, Sierra Leone, between September 2022 and February 2023.

Study setting

The study was conducted in Freetown, Western Area Urban district of Sierra Leone. Western Area Urban district is one of the 16 districts in Sierra Leone and is the most populated. It recorded the first case confirmed case and had the highest number of COVID-19 cases in the entire country. Western area urban is the hub for majority of the pharmacist practicing in Sierra Leone and most of the law enforcement strategies were enhanced after the first case was reported. The district is also home to most of the big imports and wholesales pharmaceutical outlets – making it a major player in the pharmaceutical industry in Sierra Leone. The response mechanism in this region was swift with the activation of the Emergency Management System by the National Public Health Agency (NPHA) at the National Public Health Emergency Operation Centre (EOC).

Population and sample

Pharmacy professionals working within the pharmaceutical supply chain system in the public sector—including hospitals, the Pharmacy Board of Sierra Leone (PBSL), the National Medical Supplies Agency (NMSA), and the Directorate of Pharmaceutical Services (DPS)—and the private sector, including retail and wholesale pharmacy outlets in Freetown, were invited to participate in the

study. Eligible participants were pharmacy professionals who met the study's inclusion and exclusion criteria and were knowledgeable about the pharmaceutical supply chain system in Sierra Leone.

A purposive sampling approach with predefined quotas was used to recruit participants from key stakeholder groups within the pharmaceutical supply chain. A total of 100 pharmacy professionals were recruited: 20 from PBSL, 10 from NMSA, 10 from DPS, 10 from wholesale pharmacy outlets, 30 from retail pharmacy outlets, and 20 from six hospitals (Connaught Teaching Hospital, Princess Christian Maternity Hospital, Ola During Children's Hospital, King Harman Road Satellite Hospital, Lumley Government Hospital, and Rokupa Government Hospital). The predefined quotas were used to ensure representation of the key public- and private-sector stakeholder groups included in the study.

Inclusion criteria

All licensed pharmacy professionals working within and conversant with the pharmaceutical supply chain system in Sierra Leone were included in the study. Participants 18 years or older were included in the study.

Exclusion criteria

Pharmacy professionals working outside the Western Area Urban district during the COVID-19 outbreak and those with less than one (1) year of working experience were excluded from the study.

Data collection tool

A semi-structured study questionnaire (interview guide) was used to collect data. The interview guide was developed based on available literature from similar studies done in Namibia [1].

The drafted questionnaire was pretested among 10 pharmacy professionals working within the pharmaceutical supply chain system through a pilot study. Based on the feedback from this study, changes were made on the initial draft to get the final version used in the actual study. The 10 participants in the pretest were exempted from the main study to avoid bias.

The study questionnaire comprised four (4) sections: Socio-demographics information of respondents; Supply disruptions; Demand volatility; and finally, a section on Government response to the pandemic [Appendix A].

Data collection and procedure

The data was collected by active follow-up and face-to-face administration of the questionnaire to participants. Eligible individuals within the pharmaceutical sector with lived experiences were selected. The study was explained to the participants and those who consented were interviewed. Each participant was assured of the confidentiality of the study and given the liberty to opt out of the study at any time of the interview.

Data analysis

Qualitative data from questionnaire responses were double coded using thematic content analysis according to Tesch's approach. Descriptive statistics was used to calculate frequency counts and percentages for respondent characteristics and other categorical variables using Excel package version Microsoft 365 (office 16).

Ethical clearance

Ethical clearance for this study was sought and obtained from the Research Ethics Committee of the University of Makeni (UniMak) administration. Administrative approval was further obtained from PBSL, NMSA, DPS, the pharmacy outlets, and the six hospitals (Connaught Teaching Hospital, Princess Christian Maternity Hospital, Ola During Children's Hospital, King Harman Road Satellite Hospital, Lumley Government Hospital, and Rokupa Government Hospital). Written informed consent was obtained from each participant before participating in the study. Participants were informed about the objectives of the study, voluntary participation, confidentiality, anonymity, and their right to withdraw at any stage. Data confidentiality was maintained throughout the study and the information used only for this study. The study complied with the ethical principles outlined in the Declaration of Helsinki.

3. Results

Summary of respondents' sociodemographic information

One hundred eligible and consented participants participated in the study. Most of the participants were from public institutions (60%), while 76% were males (Table 3.1). Majority (44%) of the participants were within the age bracket of 40–49 years (Table 3.1). Most participants (57%) had more than 10 years of experience, while participants from PBSL were 20% (Table 3.1). Participants from government hospitals were also 20% (Table 3.1) and this was recorded from six hospitals: Connaught Teaching Hospital, Princess Christian Maternity Hospital (PCMH), Ola During Children's Hospital (ODCH), King Harman Maternal and Child Hospital, Lumley Government Hospital and Rokupa Government Hospital (Table 3.1).

Table 3.1
Participants' Information

Variables	Sub-variables	Frequency	Percent (%)
Age groups (Years)	< 20	0	0
	20–29	8	8
	30–39	42	42
	40–49	44	44
	≥ 50	6	6
Sex	Male	76	76
	Female	24	24
Highest education	Diploma in Pharmacy	10	10
	B. Pharm degree	49	49%
	Masters	39	39%
	Others	2	2%
Years of Experience	0–9	22	22%
	10–19	57	57%
	20–29	15	15%
	30–49	5	5%
	≥ 40	1	1%
Facility type	Public[a]	60	60%
	Private[b]	40	40%
a = PBSL = 20 (20%); NMSA = 10 (10%); Govt. Hospitals = 20 (20%); and DPS = 10 (10%)			
b= Retail pharmacy outlets = 30 (30%); and Wholesale pharmacy outlets = 10 (10%)			

PBSL = Pharmacy Board of Sierra Leone; NMSA = National Medical Supplies Agency; DPS = Directorate of Pharmaceutical Services.

Summary of Supply Disruptions

All the participants (Table 3.2) confirmed to have observed change in delivery lead times during the pandemic and 98% of the participants orders were negatively affected (Table 3.2). Seventy percent (70%) of the participants – mainly in the public sector, stated that the average lead time before the pandemic was one (1) month. The remaining 30% - mainly in the public sector, confirmed that their average lead time was seven (7) days (Table 3.2). Ninety-five percent (95%) of the participants experienced more stock-outs of products after the COVID-19 pandemic started compared to the period before. From this percentage, 74.7% of the participants observed very serious stock-out of commodities, while 18.9% of the participants experienced extremely serious stock-out levels of products (Table 3.2). Out of the total respondents, 98% confirmed to have experienced manufacturing gap/challenges during the

COVID-19 pandemic (Table 3.2). Participants' experiences with manufacturing gaps and challenges during the COVID-19 epidemic are highlighted in Table 3.3.

Table 3.2
Supply Disruptions During the COVID-19 Pandemic

Variables	Sub-variables	Frequency	Percent (%)
Experienced changes in delivery time	Yes	100	100
	No	0	0
How delivery lead time was affected	Positive	2	2
	Negative	98	98
Average lead time before the pandemic	Private	30	30
	Public	70	70
More stock-outs during COVID-19	Yes	95	95
	No	5	5
Stock-out severity	Extremely serious	18.9	18.9
	very serious	74.7	74.7
	Serious	6.3	6.3
	Not Serious	0	0
Manufacturing gaps/challenges	Yes	98	98
	No	2	2

Table 3.3
Manufacturing Gaps and Challenges Faced by Respondents During the COVID-19 Pandemic

Themes	Sub-themes	Quotes
Low stock out levels		*"YES! Manufacturers kept complaining about the lack of APIs for manufacturing during the pandemic."*
		"YES, in summary, there was consistent decrease in product availability and price fluctuation during the pandemic."
		"YES, due to the limited inflow of pharmaceutical product in country and lack of manufacturing companies in Sierra Leone."
	Lead time	*YES, Manufacturers were worried about the negative change in lead time during the pandemic.*
Border restrictions and lock downs	clog in the bureaucracy	*"YES! Due to administrative and regulatory bureaucracies, there was scarcity of shipping containers prior and during COVID-19 pandemic, which caused transportation and supply chain delay."*
		"YES, Manufacturers kept complaining about stock pillage at the queue due to border restrictions and lockdowns."

Summary of Demand Volatility

Out of the total respondents, 98% experienced fluctuations and increase in product prices during the pandemic (Fig. 3.1); and 85% confirmed reduction in profit during this period (Fig. 3.2). All participants observed increase in customers choices for specific drugs and pharmaceutical commodities during the outbreak (Fig. 3.3). Table 3.4 highlights participants' observation in customers choice for specific drugs during the pandemic.

Table 3.4
Participants' Observation of Customers' Preferences for Specific Drugs During the Pandemic

Themes	Sub-themes	Quotes
Sales of Vitamin C, Azithromycin, Zinc tablets, immune boosters, hand sanitizers and face masks		*"YES! Sales was higher on vitamin C, azithromycin, hand sanitizers and face masks."* *"Sales volume went up on zinc tablets and immune boosters' medications during the outbreak.*
	Profit margins	*"Yes, we observe a decrease in profit margin during the pandemic"* *"Reduction in profit margin as only the COVID-19 related commodities were on demand while other stock was left piling.* *"Increase in profit margin as stock were sold to customers overpriced"* *"Profit depletion as most commodities were not manufactured and available in the market, the quarantine and lockdown reduce sales in pharmacy and also lead to expiration and deterioration of most products."*

Summary of Government Response

According to 93% of participants, the government handled the COVID-19 pandemic well (Fig. 3.4). Additionally, participants reported how well-prepared the government was to deal with the epidemic (Fig. 3.5). Table 3.5 highlights participants' thought on how the government responded to COVID-19 pandemic and Table 3.6 highlights the participants' thought on what the government can do to improve the pharmaceutical sector in Sierra Leone, in order to handle a pandemic better in the future.

Table 3.5
Respondents' Views on the Government's Response to the COVID-19 Pandemic

Themes	Sub-themes	Quotes
Government preparedness	Public health awareness	*"Positive, the EOC was established in readiness before the first case was reported and the public were well informed about the COVID-19 outbreak via TV, radio, and social media platforms."* *"School visitations, street campaigns, hospital visitations and inter-district campaigns were mounted to raise public health awareness about the pandemic."* *"Various pillars such as the logistics, case management, IPC, surveillance, psychosocial, risk management & communication, and laboratory were trained and on standby in readiness for the first case."*
	Stock positioning	*"Stocks were sent to various districts through NMSA. These commodities were piled in District Medical Stores (DMS) / warehouse and borders in preparedness of the pandemic."* *"Vehicles were available to help with the transportation of commodities."*

Table 3.6
Participants' Recommendations for Strengthening Sierra Leone's Pharmaceutical Industry for Future Pandemics

Themes	Sub-themes	Quotes
Strengthen the health system	Improve hospitals settings	*"Capacitate the hospitals with more trained and qualified health care workers to handle outbreaks and pandemics."* *"Improve on hospitals capacity to better accommodate enough patients in cases of an outbreak."* *"The pandemic exposes our fragile health system and shows the need for adequate medical equipment's in hospital settings."* *"Need for more infrastructure and improved hospital structures. Modern hospital structures with epidemic structures in preparedness for an outbreak."*
	Improve the pharmaceutical supply chain	*"Need for an improved medical and pharmaceutical supply chain, enforcing the pull system in logistics management."* *"Ensure adequate availability and supply of commodities to facilities in consistent manner and reduce dependent on donations to better handle an outbreak."*
Enforce local manufacturing	Establish local pharmaceutical industry	*"To ensure we have a pharmaceutical industry/company will improve on product availability and reduce stock rate."* *"Provision of local pharmaceutical industries will broaden the supply chain, reduce the lead times and improve response to demand."*
Training	Capacity building	*"Health care workers need more training to handle outbreaks"* *"Knowledge on supply chain management needs to be broadened and cascaded to staffs, especially support staff.*

4. Discussion

Findings on this study show that the pharmaceutical supply chain was disrupted during the COVID-19 pandemic, thereby affecting the lead times, causing stockouts, and manufacturing gaps. There were lots of demand volatility observed during the pandemic, such as fluctuations and increase in product prices and reduction in profit margins. It was also observed that there were increase in customers choice for specific drugs or pharmaceutical commodities during the pandemic. The study observed that the government responded well to the COVID-19 outbreak. To the best of our knowledge, no studies on the impact of COVID-19 pandemic on the pharmaceutical supply chain in Sierra Leone have been carried out previously. However, limited studies [16] have reported the impact of COVID-19 among populations in Sierra Leone but there are insufficient data concerning its impact on the pharmaceutical supply chain. Thus, this study was specifically designed to address this gap in the literature.

Out of the 100 participants that took part in this study, unlike similar studies conducted by Tafadzwa et al., where the majority were females (57.1%) [1], in our study, majority of the respondents were males (76.0%). This huge gender imbalance may be due to the years of studies and differences in countries where the studies were conducted. In this study, majority (60%) of the participants were from the public sector (government institutions) unlike similar studies in Namibia, Saudi Arabia, and United States, where the majority of the participants were from private settings (mostly community Pharmacists) [1, 17]. This may be due to the increase in pharmacy professionals in government institutions.

Similar to a study conducted by Ming et al., changes in the delivery lead times during the pandemic were observed and they were negatively affected [18]. The average lead time for retail pharmacy outlet changed from their (3) days to seven (7) days and that for hospitals changed from two (2) weeks to one (1) month [18]. Similar to a study conducted in India by Anu and colleagues, 95% of our study respondents revealed high (stock-out levels of products during the pandemic and 74.7% reported that the stock out was very serious. This might be due to border restrictions, lock downs, customers preference for certain commodities, delay in lead times and lack of Active Pharmaceutical Ingredients (API) for manufacturing [19].

Our study also revealed that 98% of respondents reported manufacturing gap / challenges during the COVID-19 pandemic. This is in line with a similar study conducted in the USA by Sydney et al. [20]. Similar to a study conducted by Galanakis in 2020, our study

revealed that 98% of the participants experienced fluctuations and increase in product prices during the pandemic and 85% experienced reduction in profit margin during this period [21]. In this study, customers choice for specific drugs or pharmaceutical commodities was observed at maximum (100%). Sales of essential drugs and commodities such as Vitamin C, Azithromycin, Zinc tablets, immune boosters, hand sanitizers, and face masks were seen to be on high demand during the pandemic. Similar to a study in Namibia [1], sales of essential commodities such as multivitamins, immune boosters, and personal protective equipment (PPE) were seen to increase at the beginning of the pandemic while sales of other drugs such as antibiotics went down. This was similar to what was reported by Aljadeed et al. in Saudi Arabia [17]. This might be linked to business closures, restricted commerce and movement across borders, and lockdowns that forced a decrease in social connections and gatherings.

In this study, majority of the participants (93%), thought that the government responded well to the COVID-19 pandemic. This is contrary to similar studies conducted in Namibia and India [22]. However, studies in Germany [23] and Ethiopia [24] support our findings. From this study, it may be inferred that governments must play crucial roles in guaranteeing a functional supply chain system, particularly during crises like the COVID-19 pandemic and Ebola epidemic. It will take political will and astute leadership to create policies that promote domestic and foreign investments in industries that produce PPEs, hand sanitizers, and important medications such as immune boosters and other medical items. The apparent systemic frailties can be improved by ensuring favorable working conditions for private-public partnership (PPP) activities in various pharmaceutical systems and supply chains. In a sector where even, minor disruptions can result in loss of livelihoods and lives, multisectoral partnerships become essential for the government and other governmental or non-governmental actors to provide long-lasting solutions to substandard medicines and medical services [1].

Relevant issues including the over-reliance on importing drugs and medical supplies from China, India or other countries, as well as the fact that Gbalamuya land crossing point in the Guinea axis and the Freetown International Airport in lungi are the main non-sea port of entries in Sierra Leone, call for government intervention. As suggested by the respondents in this survey, the government may need to adopt practical actions in order to alleviate or plan for any future epidemic that has the potential to jeopardize the existence of an entire population. It was stated that the lockdown affected patients' and pharmacists' psychosocial status in addition to the involvement of policymakers. Besides the social exclusion strategy, some people experienced psychological distress as a result of job lose or their inability to work during the lockdown. The consequences of the pandemic on pharmaceutical employees, patients, and customers were compounded by these variables. However, amidst these challenges, pharmacists assumed a new responsibility: counselling patients on issues beyond their area of expertise. This comprehensive approach to patient care is consistent with the recommendations of the Bloom Program. [25].

Although many participants in this study were satisfied with the government's response to and management of the COVID-19 outbreak, they also made recommendations for strengthening the pharmaceutical sector in Sierra Leone to better prepare for and respond to future pandemics. These recommendations are not limited to:

1. Strengthening of the health system: this can be achieved through improvements of health infrastructure including adequate hospital space, improved hospital facilities with modern equipment, and qualified healthcare workers – HCWs.

The health system can also be strengthened by improving the pharmaceutical supply chain to ensure adequate and consistent supply of commodities to healthcare facilities while transitioning to the use of push system for logistics management.

1. Enforce local manufacturing: establish local pharmaceutical industry. This will improve product availability and reduce stock out rate.
2. Training: capacity building of HCWs. There is knowledge gap with some HCWs in handling outbreaks and managing logistics. Therefore, capacity building of HCWs will improve preparedness for future outbreaks and pandemics.

Limitations

There were some limitations observed in interpreting the results of this study. The study was only conducted in the western area urban part of Freetown and thus the findings cannot be generalized for the whole country. The study relied on self-reported experiences, thereby increasing the risk of reporting and social desirability bias. The respondents may have forgotten pertinent details or may have over or underestimated them to avoid revealing classified information.

5. Conclusions

The study found that the COVID-19 pandemic significantly disrupted the pharmaceutical supply chain in Freetown, resulting in medicine shortages, delayed deliveries, increased procurement costs, and challenges in inventory management. Demand volatility, driven by panic buying and increased demand for essential medicines and personal protective equipment, further strained the supply chain. Although the Government of Sierra Leone implemented measures to maintain the availability of essential health commodities and strengthen emergency response, several weaknesses in supply chain resilience remained evident. The study concludes that strengthening supply chain information systems, improving forecasting and inventory management, diversifying procurement sources, promoting local pharmaceutical manufacturing, maintaining strategic medicine reserves, and enhancing coordination among stakeholders are essential to building a more resilient pharmaceutical supply chain capable of responding effectively to future public health emergencies.

Abbreviations

Acronym
Meaning
COVID-19
Coronavirus disease 2019
API
Active Pharmaceutical Ingredient
PPE
Personal Protective Equipment
PBSL
Pharmacy Board of Sierra Leone
NMSA
National Medical Supplies Agency
DPS
Directorate of Pharmaceutical Services
EOC
Emergency Operations Center
HCW
Healthcare worker
UniMak
University of Makeni
WHO
World Health Organization
SARS-CoV-2
Severe Acute Respiratory Syndrome Coronavirus 2

Declarations

Ethics approval and consent to participate:

The study protocol was reviewed and approved by the research ethics committee of the UniMak administration. Informed consent was obtained from all eligible participants. Data confidentiality was maintained throughout the study and the information used only for this study. The study complied with the ethical principles outlined in the Declaration of Helsinki.

Consent for publication:

Not Applicable

Competing Interests:

The author(s) declare no competing interests.

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Author Contribution

Conceptualization: AT, and JSK, methodology: AT, and JSK, validation: NB, SNK, SA, BL, ENS, FUT, AMK, RJS, OTA, formal analysis: AT and JSK, investigation: AT, NB, SNK, BL, ENS, VVK, AMK, OTA, resources: AT, data curation: AT, and VVK, writing original draft preparation: AT, and JSK, writing review and editing: AT, JSK, RJS, FUT, SA, visualization: AT and JSK. All authors have read and agreed to the published version of the manuscript.

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Data Availability

Data is available upon request by emailing the corresponding author.

References

1. Tafadzwa Tirivangani B, Alpo D, Kibuule J, Gaeseb BA, Adenuga. Impact of COVID-19 pandemic on pharmaceutical systems and supply chain – a phenomenological study. http://dx.doi.org/10.1016/j.rcsop.2021.100037 2667–2766/© 2021 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/ 4.0/).
2. WHO - Looking back on progress as Sierra Leone marks two years since first COVID-19 case. 31. March 2022. https://www.afro.who.int/countries/sierra-leone/news/looking-back-progress-sierra-leone-marks-two-years-first-COVID-19-case
3. Musso D, Rodriguez-Morales AJ, Levi JE, Cao-Lormeau VM, Gubler DJ. Unexpected outbreaks of arbovirus infections: Lessons learned from the pacific and tropical America. Lancet Infect Dis. 2018;18(11):e355–61. https://doi.org/10.1016/S1473-3099.
4. International Federation of Pharmaceutical Manufacturers &, Associations IFPMA. The Pharmaceutical Industry and Global Health - Facts and Figs. 2014. https://www.farmaindustria.es/web/wp-content/uploads/sites/2/2014/12/IFPMA_-Facts_And_Figures_2014-2.pdf. Accessed 28 October 2022.
5. Morris P, Sweeney E. Responding to disruptions in the pharmaceutical supply chain. Clin Pharm. 2019;11(2). https://doi.org/10.1211/PJ.2019.20206058.
6. The Economist. Has COVID-19 killed globalisation? The Economist May 14th 2020. https://www.economist.com/leaders/2020/05/14/has-covid-19-killed-globalisation. Accessed 15 November 2022.
7. van Barneveld K, Quinlan M, Kriesler P, et al. The COVID-19 pandemic: Lessons on building more equal and sustainable societies. Econ Labour Relat Rev. 2020;31:133–57. https://doi.org/10.1177/1035304620927107.
8. Betti F, Ni J. How China can rebuild global supply chain resilience after COVID-19 | World Economic Forum. World Econ Forum; 2020.
9. Lozano-Diez JA, Marmolejo-Saucedo JA, Rodriguez-Aguilar R. Designing a resilient supply chain: An approach to reduce drug shortages in epidemic outbreaks. EAI Endorsed Trans Pervasive Health Technol. 2020;6(12):1–12. https://doi.org/10.4108/eai.13-7-2018.164260.
10. PYMNTS, What. COVID-19 means for logistics, now and in the future. April 15, 2020. https://www.pymnts.com/news/b2bpayments/2020/covid-19-logistics-supply-chain/. Accessed 28 October 2022.

11. Hannah Balfour (European Pharmaceutical Review). COVID-19 update: Coronavirus and the pharmaceutical supply chain. European Pharmaceutical Review. |1 April 2020| https://www.europeanpharmaceuticalreview.com/article/116145/COVID-19-update-coronavirus-and-the-pharmaceutical-supply-chain/. Accessed 7 November 2022.
12. Teena Thacker, ET Bureau -The Economic Times. (2020a). COVID-19 impact: Drugs essential, ancillaries not so, means supplies take a hit. The Economic Times. https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/drugsessential- ancillaries-not-so-means-supplies-take-a-hit/articleshow/75038462.cms?from = mdr (2020b). Accessed 28 November 2022.
13. Emanuel EJ, Persad G, Upshur R, Thome B, Parker M, Glickman A, Zhang C, Boyle C, Smith M, Phillips JP. Fair allocation of scarce medical resources in the time of COVID-19. New England Journal of Medicine; 2020. pp. 2049–55.
14. Ayati N, Saiyarsarai P, Nikfar S. Short- and long-term impacts of COVID-19 on the pharmaceutical sector. DARU J Pharm Sci. 2020;28(2):799–805.
15. Kilpatrick J, Barter L. COVID-19: Managing supply chain risk and disruption. (Deloitte). https://www.deloitte.com/global/en/services/risk-advisory/analysis/covid-19-managing-supply-chain-risk-and-disruption.html. Accessed 27 September 2022.
16. Shana Warren D, Parkerson E, Collins. RECOVR Sierra Leone: Tracking the Effects of the COVID-19 Pandemic. June-October 2020. https://www.poverty-action.org/recovr/recovr-survey
17. Aljadeed R, AlRuthia Y, Balkhi B et al. The impact of COVID-19 on essential medicines and personal protective equipment availability and prices in Saudi Arabia. Healthcare. 2021;9(3). 2021;9(3):290. 10.3390/healthcare9030290
18. Ming LC, Mathews A, Abbas SA, Lee KS. Time to explore pharmacy career opportunities in the private sectors. J Young Pharm 2019;11(3). https://www.researchgate.net/publication/334837732_Time_to_Explore_Pharmacy_Career_Opportunities_in_the_Private_Sectors
19. Anu Sharma1, Pankaj Gupta1 and Rishabh Jha1. COVID-19: Impact on Health Supply Chain and Lessons to Be Learnt. August 2020. J Health Manage 22(2):248–61. 10.1177/0972063420935653
20. Sydney Strong P, Delzell W, Trygstad G, Fitzpatrick P, Haley-Hyer. Ashley Bates and Mohamed Awwad. The Impact of COVID-19 on the Pharmaceutical Supply Chain. © IEOM Society International. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://www.ieomsociety.org/detroit2020/papers/187.pdf
21. Galanakis CM. 2020. The food systems in the era of the corona virus (COVID-19) pan- demic crisis. Foods 9 (4), 523. 2020;9(4):523. 10.3390/foods9040523
22. Amesho A, Ahmadi JN, Lucero-Prisno DE. The calculated responses against COVID-19 in Namibia. Pan Afr Med J. 2020;37(Suppl 1):25. 10.11604/pamj.supp.2020.37.1.25697.
23. von Armgard S, Kolluru, Sager I. COVID-19: Supply Chain Impacts and Insights from Germany. © Digital Supply Chain Institute 2020. https://www.thecge.net/app/uploads/2020/06/Covid-Germany_D2_Final.pdf
24. Arkebe Oqubay. Ethiopia's unconventional COVID-19 response, Jun. 5, 2020. Project Syndicate: https://www.weforum.org/stories/geographies-in-depth/ethiopia-COVID19-response/
25. Murphy AL, Gardner DM, Jacobs LM. The patient experience in a community pharmacy mental illness and addictions program. Can Pharm J 2019;152(3).

Figures

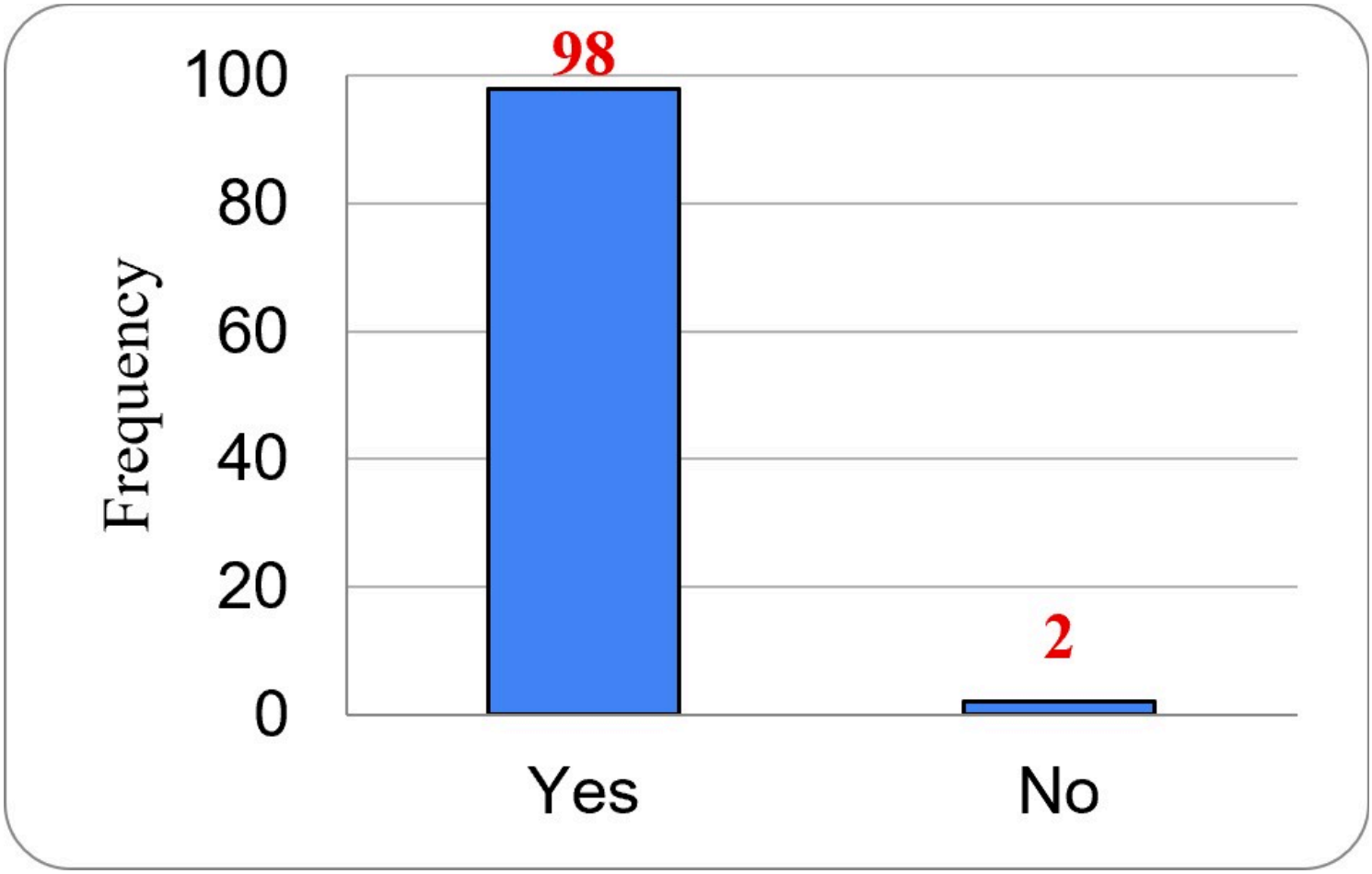


Figure 1

Figure 3.1: Product price fluctuations

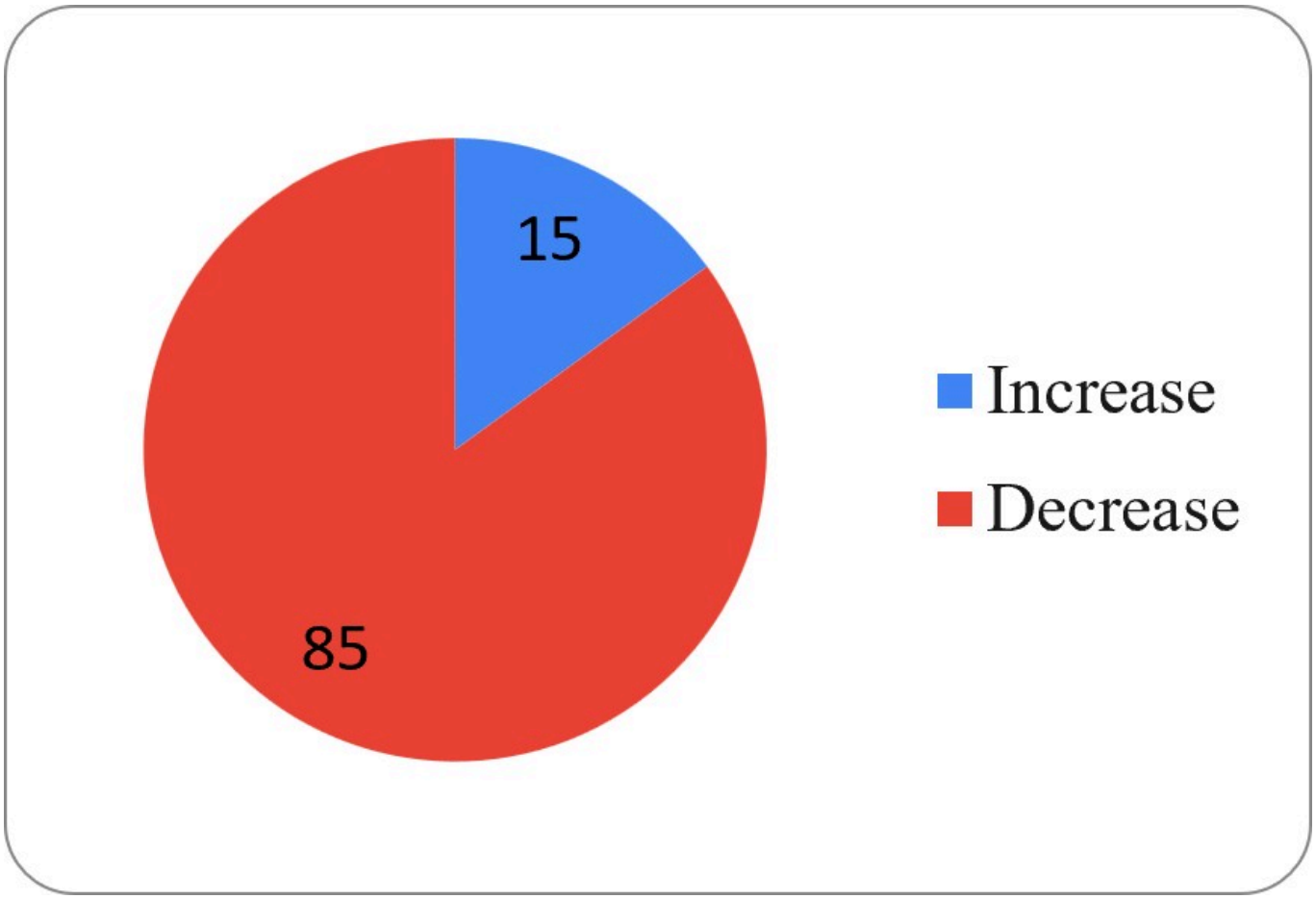


Figure 2

Figure 3.2: Respondents experience Profit margin

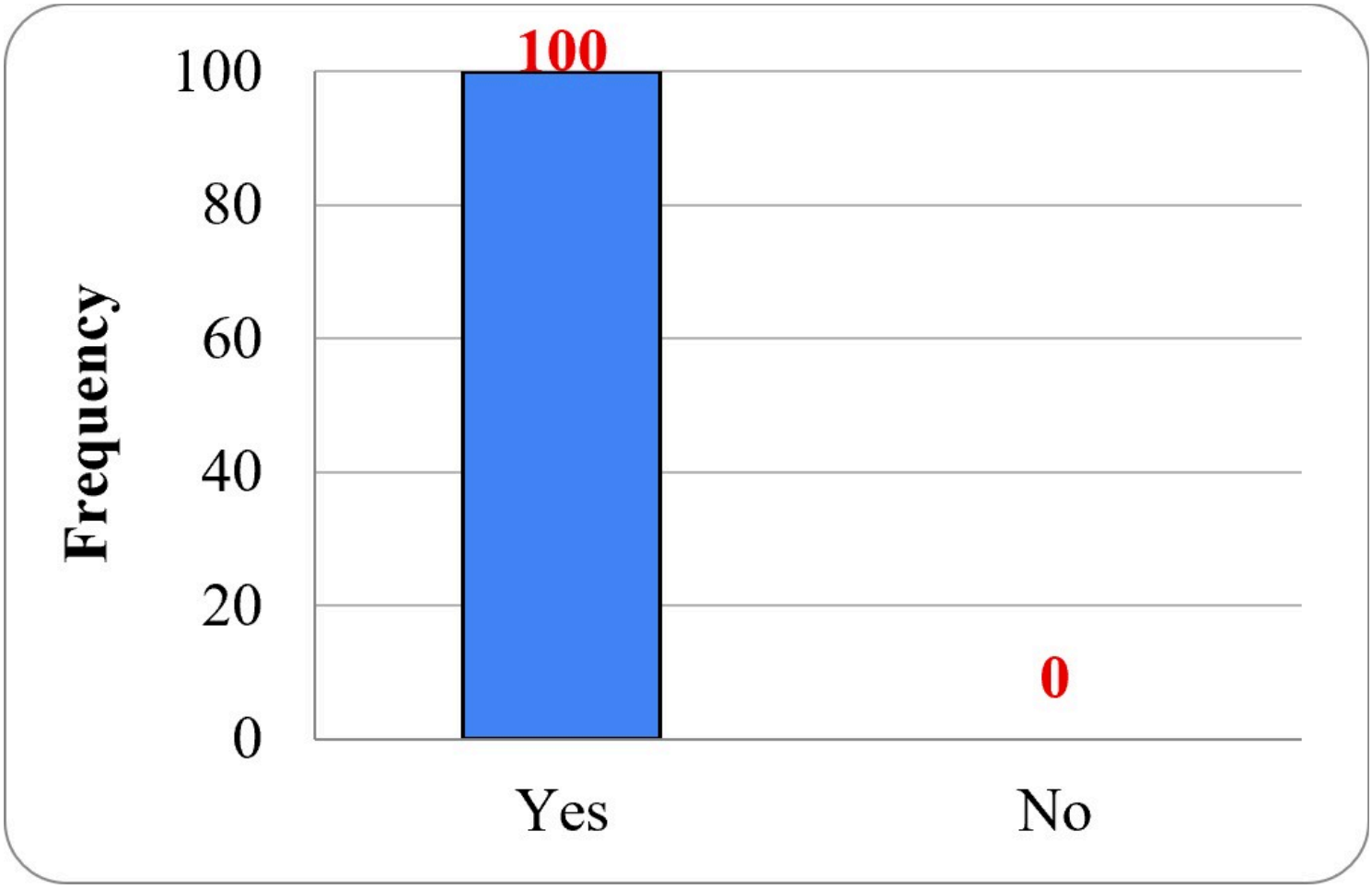


Figure 3

Figure 3.3: Customers choice for specific drugs during the pandemic

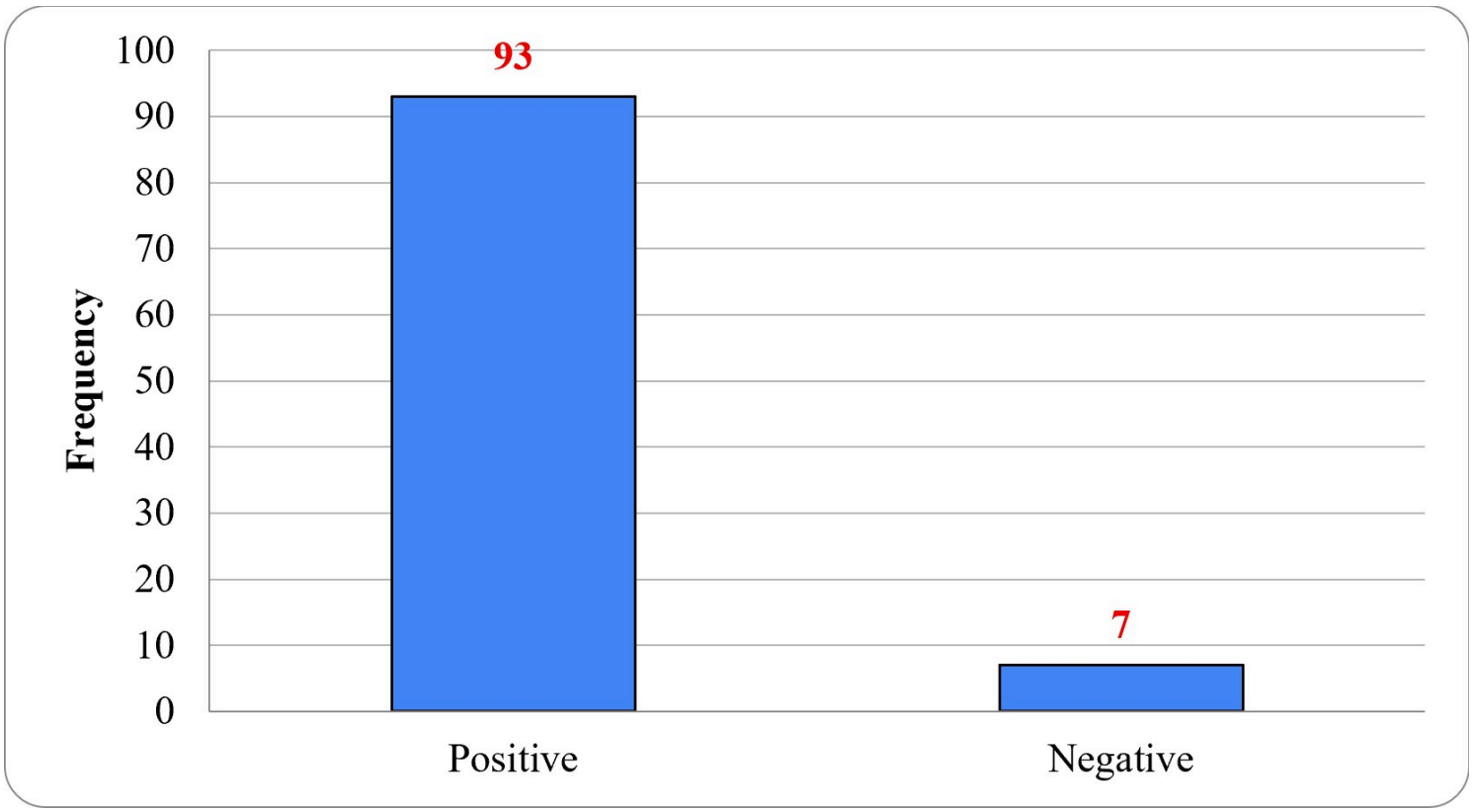


Figure 4

Figure 3.4: Government response to the COVID-19 pandemic in Sierra Leone

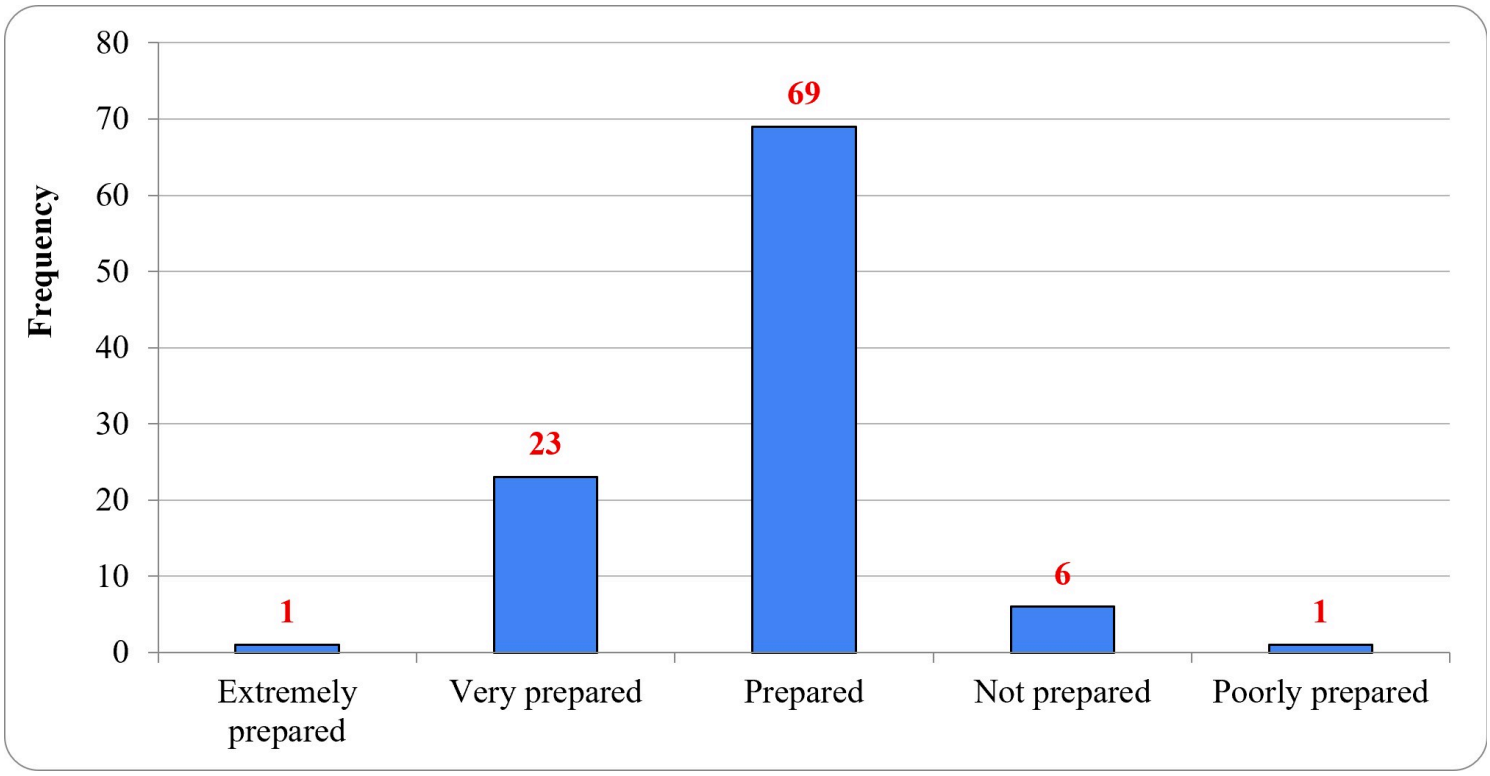


Figure 5

Figure 3.5: Government preparedness to handle the pandemic

Supplementary Files

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