RESEARCH ARTICLE

Managing the supply chain disruption of essential commodities supply in health care systems during emergency Lagos state, Nigeria

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Abstract

2019 birthed the Coronavirus endemic in China and in 2020, it became an established pandemic across the world. While supply chain analysts had predicted a disruption to the flow of commodities across all sectors, curiosity and concern led us to study the effect of disruptions such as Covid-19 on the supply chain of essential commodities in Africa precisely Lagos, Nigeria. The two types of data sources utilized were; the primary source and secondary sources of data. The data collected was collated and analysed using 2016 Microsoft excel sheet and Statistical Products and Services Solution (SPSS 25.0.0.0) for data analysis. The interview with pharmaceuticals company representative, suggested hiccups in the distribution of vaccines by a major pharmaceutical company to their respective customers. The Covid-19 situation and the necessary lockdown in Lagos state caused a slight disruption in the availability and distribution of essential commodities across the state, the major issues were the lack of a means of accessing transportation to health care facilities and the increment in the price of medicines. While most pharmaceuticals and health service delivery points were not prepared to curb the impact of the emergency situation. In this regard, pharmaceutical companies should ensure flexibility in supply chain by creating supply chain emergency plans, the government should look into establishing a drug bank for essential commodities in the state, while last mile service deliveries should employ the use of telemedicine and patient home delivery services.

1.1 Introduction

Covid-19 Pandemic and Lagos, Nigeria

As the infamous coronavirus of the Covid-19 strain continues to graze through the world disrupting the normalcy we once knew, every aspect of human life: health, employment, food, socialization and movement amongst others have suffered disruptions and of utmost concern is the impact of the pandemic on global economy [1]. Currently there is not yet an evident solution to curtail this virus thus, while some experts suggests the world waits until a vaccine is produced , some others suggest that we learn how to live and cope with the virus thus curb its spread [2].

In Africa, Nigeria being the most populous African country, ranks 2nd position in the total numbers of cases with a record of over 22,020 cases as at the 24th of June and Lagos her most populous city tops the chart in the number of reported cases with over 9323 cases (see fig 1.) and the number of recorded deaths accounting for

45% of the death cases with the other percentage scattered across other states [3].

"Eko oni ba je" is a famous phrase typical of Lagos state [4], a state in Western Africa with the motto "justice and peace", created in May 1967. Lagos state is considered one of the smallest and yet most populated state in Nigeria having served as the federal capital territory of the country from April 1968 to 1991. This mega city comprises of 37 local government areas and is the home of global, national and regional socio-economic activities and is among the top 4 GDP in Africa [5] with an international airport and large functioning seaports to boast of, such that a blow to Lagos state is felt by the whole of the country.

The brunt of this dilemma is the incomparable effect on global supply chain. The typical African economy (as is obtainable in Lagos state) depends substantially on importation of commodities ranging from food items and medicines and therefore is a

candidate for the disruptions and risks to supply chain of essential commodities by the Covid-19 pandemic. Currently, the reeling volatility in demand, rush or cancelled orders, downsizing, production reduction, decreased capacity utilization and productivity are strokes upstream the supply chain [6]. Whereas, scarcity of commodities, uncertainty of demand, increased cost of procurement, wastage due to expiry of drug product rocks downstream supply chain of health commodities.

While we believe that an effective supply chain management can help improve disaster response in emergency situations [7], this study focuses on understanding how disasters and emergencies take a toll on supply chain management especially for essential medical commodities.

The aim of this study is to assess the disruptions to stock availability across board of essential medicines in public and private facilities in Lagos State during emergency situations. However, the study seeks to achieve the following objectives.

- Review the current availability of target essential drugs in private and public health facilities and the ability of patients to access care
- Design a questionnaire and conduct quantitative and qualitative surveys to find out the pre and during covid-19 challenges faced by these facilities and the patients
- Report on the findings and mitigation plans employed by facilities and patients during the Covid-19 period to ensure patients care
- Recommend next steps to be taken by...

1.2 Baseline Assessment

Baseline assessment was conducted at two hospitals (Eze-Udo and Henrietta hospitals) and a primary healthcare centre located at the rural settlement of Lagos State and report from the Central Bank of Nigeria. This assessment was adapted to serve as a benchmark for examining the state of availability of essential commodities and to understand the current state of the healthcare system.

1. Eze-Udo and Henrietta hospitals do not keep data
2. No supply chain trained personnel employed at Eze-Udo and Henrietta hospitals
3. No knowledge about forecasting and inventory management at Eze-Udo and Henrietta hospitals
4. The hospitals procured medicines for the treatment of their patients from any pharmacies close-by when there is stock-out during the height of the pandemic as a result of restriction on movement and high cost of medicines.
5. At Eze-Udo hospital, there are currently experiencing shortage of antibiotics and surgical face mask.
6. Ojo Primary Hospital is currently out of stock for Artemisinin-based combination therapy.
7. Temporary suspension of cheque clearing in the Nigeria clearing system by the central bank of Nigeria [8], this had a serious impact on the local

pharmaceutical companies procuring essential commodities from international focal point.
8. They was reduction in footfalls in XX Private hospital, the hospital was having up to 300 to 320 daily in February then footfalls declined to between 10 to 20 daily during the month of March and by June it was at 80 to 100 daily.

2.1 Literature Review
Supply Chain Disruptions of Essential Commodities

Supply Chain disruption is any occurrence caused by a breakdown such as natural disasters or act of human which has harmful consequences for regular Supply Chain operations and hence, causes some degree of "disorder" within the supply chain flow. The seemingly relentless pressure of availability of essential commodities in emergency situation has produced a paradigm shift in supply chains. Over the last decade, upsurge competitive pressure, insurgencies, natural disasters and disease epidemics (such as the Covid-19) have revealed the vulnerability in Supply chains in the healthcare system.

Review on the effects of supply chain disruptions of essential commodities in the healthcare system in Puerto Rico [9], study revealed the challenges faced on drug availability during the 2017 hurricane season.

The hurricane ravaged the drug manufacturing companies located in the country; this led to drug shortages at the point of care. Outcome from this menace was the 47% increase in death due to sepsis because of the lack of antibiotics, 45% increase in deaths due to pneumonia and a 43% increase in death from other respiratory issues due to lack of oxygen. Recommendation from the research include the use of website RxOpen.org which shows which pharmacies are operating in a disaster zone and Healthcare Ready (formerly Rx Response, is an organization that coordinates government agencies and private business efforts to safeguard patient health before, during and after disaster strikes) to keep distribution flow from the focal point to the point of care. But does it matter if you know which pharmacies or hospitals open without the real time information showing the availability of the drugs from the focal points.

The fourth United Nations interagency mission to Tripoli, Al-Gharyan (in the Western Mountains), Zlitan and Al-Khoms (East of Tripoli) in which the World Health Organization participated in 2011 during the emergency situation. According to the report from the mission it stated that there were shortages of medical supplies and medicines as a result of the unrest. Also life-saving products including insulin, antiretroviral drugs, chemotherapy regimens, immunosuppressive drugs, hypnotic and psychiatric drugs as well as vaccines, blood products, dialysis supplies and laboratory reagents and consumables are needed but were widely unavailable due to the lack of inventories at the pharmaceutical companies. In many pharmacies and hospitals, antiretroviral drugs

and laboratory consumables were already out of stock. All other essential supplies are expected to be out of stock by September, 2011. The report also recorded the increment in psychosocial trauma especially among women and children and the drugs not been readily available to treat them effectively. The unavailability of these drugs would have been minimal if the country operates in an effective supply chain model that reflects on disruption discovery, disruption recovery, and Supply Chain redesign. Considering the study [10] to understand three critical aspects of supply chain (disruption discovery, disruption recovery, and Supply Chain redesign) relative to the improvement and analysis of negative effect of supply chain disruptions in a global environment. Based on this research, they stipulated that supply chain networks are intrinsically vulnerable to disruptions and the breakdown of any network section may cause the whole network to fail. Findings from the study revealed that: to aid discovery process, the organization needs to focus on enhancing visibility across the Supply Chain, build adequate slack capacity (supply, operations, channel, and transportation) into the Supply Chain, and also develop rigorous predictive tools to more accurately forecast certain types of disruptions. To hasten the disruption recovery process, there should be real-time response and controlled dent system should be put in place and to enable the redesign of supply chain in organizations, understanding the tools for trade-off design and supply chain redesign models should be available without delay.

In Africa, the epidemic's consequences of Ebola virus disease were devastating, total of 28,616 cases of EVD and 11,310 deaths were reported in Guinea, Liberia, and Sierra Leone by the Centre for Disease Control in 2016 [11]. In a continent where malaria alone takes half a million lives, the impact of Ebola on the health systems and the social and economic stability of the region suggest that the crisis is far from over. The epidemic scared patients away from healthcare facilities and disrupted the supply chain flow thereby drastically reducing the possibilities of the health system to meet the needs of other diseases such as malaria and infection. A study [12] estimates an additional 11,000 deaths from malaria, HIV and tuberculosis in these three countries for 2014 during the Ebola Virus pandemic. In Guinea, it is estimated that 74,000 cases of malaria were reported at the health facility [13], and that the number of under five children seen for diarrhea and Acute Respiratory Infection (ARI) showed a large decrease during the both hospitals (60% for diarrhea and 58% for ARI) and healthcare centers (25% and 23%), respectively [14] because of the shortage of medicines. Therefore, the patients do not see the need to visit the hospital.

Nigeria is not left behind in this disruption of essential commodities as research by World Health Organization in 2017 revealed that there was increased number of malaria cases and morbidity in the northeast region of Nigeria as a result of unavailability of Artemisin-based Combination Therapy (ACTs) in Adamawa, Borno and Yobe states. The three states are those mostly affected by insurgency, which has led to significant displacement of people which left the affected states' health system weakened.

2.2 Availability of Essential Commodities

According to a report by World Health Organisation in 2013, it stipulated that Low-income countries experience poor availability of essential commodities in health facilities, substandard-quality treatments, frequent stock-outs and suboptimal prescription and use of medicines". Africa's inept and administrative public sector supply system is often plagued by poor procurement practices that make drugs much expensive or unavailable . Added to these are the poor transportation system, lack of storage facilities for pharmaceutical products and a weak manufacturing capacity15. Only 37 out of 54 African states have some level of pharmaceutical production except South Africa, which boasts some active local pharmaceutical ingredients, most countries rely on imported ingredients but Egypt, Morocco, South Africa and Tunisia have made progress in local pharmaceutical productions. Morocco is Africa's second-largest pharmaceutical producer (after South Africa), and has 40 pharmaceutical manufacturing companies that supply 70% of products for local consumption and also exports to neighbouring countries. Countries such as Ghana, Kenya, Nigeria and Tanzania are currently developing production capacity [15].

Medicines stock-outs and poor availability have been considered the commonest causes of health programs underperformance. For instance, in most states where the DRF scheme was introduced, facility level stock outs of almost sixty percent were recorded at the beginning of the program in 2003 (Erhun, 2000). Findings were reported from research[16] that was carried out at the Directorate of Pharmaceutical services, Federal Ministry of Health (F.M.O.H) Abuja and Federal Medical Stores, Oshodi, Lagos. The research set out to identify the policies and procedures for public medicine supply in Nigeria; evaluate its functionality, and recommend suitable strategies that will guarantee regular availability of safe, effective, good quality and affordable essential medicines at public health facilities [17]. The key project methods used in this study were structured questionnaires and Semi structured interview which was conducted with employees of the Department of Food & Drugs, Drug procurement unit and Central Medical store. The research indicated that public medicine supply in Nigeria is governed by a National Drug Policy -NDP which was introduced in 1990 and was not reviewed after several years which perhaps one can argue is against assessment policies. The Central Medical Store -CMS system was also identified as the current public medicine supply scheme in Nigeria. The study also revealed that public medicine supply is mainly bankrolled by governments and this creates a lot of backlogs and not enough to guarantee sustainable availability of essential medicines [18]. Their

findings further indicated that the main procurement procedures in use are open tender and direct procurement. These procedures as currently operated, suffer from late order placement, delay in payment and poor supplier lead-time largely attributable to delayed payment for previous medicine supplies. These have contributed to stock out of essential medicines at public health facilities. Major losses due to expiration and rot are recorded at both central and peripheral storage points despite appropriateness of storage facilities and personnel. The project cited road transportation as the major mode of medicine distribution from central to peripheral storage points and shortage of vehicle as a key factor affecting medicine distribution. Further reports from the study showed that there was an obvious lack of a functioning medicine management information system to efficiently coordinate public medicine supply. Furthermore, there were no clearly defined systems for monitoring and evaluating staff performance [19].

A project finding revealed that the primary health care facility in Zaria often recorded high stock outs of health supplies such as glucose, band aids and cough syrups and this resulted in loss of confidence by patients leading to low patronage. In a secondary facility in Abuja, TB treatments were not available in December 2013, coupled with strike actions by health personnel and as a result, some patients died while others either transferred to private facilities / herbalists or went home to await death. One in every three facilities visited in Nassarawa and Kaduna states at the time of this study recorded high stock outs of ten out of twenty selected essential medicines. While one out of every five facilities visited in Abuja had a significant availability of thirteen out of twenty selected essential medicines. Although sixty percent of the essential medicines were physically available but most patients complained about having to purchase same medicine, pediatric vitamin and anti-malarial at a high cost in private medicine outlets due to stock outs in public facilities [20].

Carren A Watsierah and Collins Ouma (2014) study on access to artemisinin-based combination therapy (ACT) and quinine in malaria holoendemic regions of western Kenya sampled 288 outlets (126 public, 96 private, 66 not-for-profit) and made findings about Information on access (availability, price, affordability). The study reviewed that more public 88.1% and not-for-profit 40.9% outlets stocked subsidized ACT (artemether-lumefantrine, AL). Other artemisinin-based combinations were widely available for both children 96.9% and adults 85.0% in private outlets. Frequent stock-outs were in public in 84%, reporting three times or more stock-outs in three months. Subsidized ACT (AL) was sold at median price of $0.94 and $0.75 in private and not-for-profit outlets respectively. The costs was higher than recommended price of $0.5 and requiring up to 0.20-0.25 days of disposable income for households in lowest economic status [21]. These statistics revealed that there is low availability of subsidized ACT and higher frequency of stock-outs in government facilities, while private sector sells ACT at higher prices, thus making it less affordable to many households [22].

According to Kumurya, A. S (2015) in his project postulated that a well-functioning supply chain system will improve how health commodities are available in the healthcare centres, he further stated that an effective supply chain can promote proper flow of information. This information can help to deter stock-out and expiration of essential drugs in the healthcare centres, however the research only made reference to the laboratory alone as a substitute for the whole healthcare centre [23]. The appropriate management of health commodities ensures that they are available and accessible to all medical staff serving patients at a health facility to enable quick recovery and treatment. Thus all staff has an important role to play in ensuring good health commodity management even if they do not directly handle the commodities [24].

3. METHODOLOGY
3.1 Research Design

This study made use of a cross-sectional and longitudinal study design because the study seeks to understudy the previous and continuous inventory data, this enabled the researchers obtain reliable data that makes it possible to generate candid conclusions [25]. The use of Lagos state as a case study was because of the high population density and it has a good representation of rural and urban dwellers with daily disposable incomes representative of regions in others state, and a confluence of different Nigerian tribes and this again is representative data of the target population. This allowed the researchers to effectively extrapolate findings rather than a far-reaching statistical survey of an entire situation. The project selected specific downstream such as the pharmaceutical company, executive chain, retail pharmacies and hospitals for sampling; data was inputted into the 2016 Microsoft Excel sheet and Statistical Package for the Social Sciences (SPSS 25.0.0.0) for analysis [26].

3.2 Sources of Data

In this project two types of data source were used; they include both the primary and secondary data source [27].

3.2.1 The primary source of data

The method for primary data collection was from well-structured questionnaire and interviews.

3.2.2 Secondary Data

The use of secondary data was pivotal to this project as was sourced from online journals, points of care data (opening & close stock, price list).

3.3 Study Population and Sample Size

The population study is made up of downstream

and upstream of the health care system. Therefore, relevant data would be taken using the stratified random sampling method for the project in order to have a balanced representation of the vast population.

Lagos state is a state that has a division of the urban and rural settlement. The rationale for choosing four hospitals and pharmacies was to have randomly selected proportional amounts of the healthcare centres in Lagos state, with a vast representation of the different settlement in Lagos state. The study would also entail the interviewing of local pharmaceutical companies such as XX Pharmaceutical Industries Limited and Philip Pharmaceutical (Nigeria) Limited, the interview would be based on the impact of temporary suspension of flight and cheque clearing in the Nigeria clearing system by the Central Bank of Nigeria on the procurement of vaccines and active pharmaceutical ingredient from international focal point.

The key commodity and data collection point for this project is as follows:

3.4 Research Instruments

The project will make use of the following instrument in the gathering of data:
1. Microsoft Excel.
2. Statistical Package for the Social Sciences.
3. Structured Questionnaires for gathering data from hospitals and Pharmaceutical companies

The questionnaire used for this project contains two different sections that are relevant to this project:

- **Section A**: contains the demographic and socio-economic characteristics of respondents. It was designed to collect information about hospitals and Pharmacies social profiles to know the category of the respondents.
- **Section B**: This segment deals with questions pertaining the supply level of essential medicine to hospitals/pharmacies
- **Section C**: This include questions on inventory stock level, patients' accessibility and availability of essential commodities from hospitals/pharmacies.
4. Digital Camera for taking snapshot during fieldwork.

3.5 Techniques of Data Gathering or Sampling Procedures

This project utilized stratified random sampling to determine the data gathering:

i. **Stratified sampling technique** - This technique was used because of the need to divide the respondents into strata due to the high population in Lagos state.

3.6 Criteria for Choosing the Selected Essential Medicines

For the purpose of this project, the following essential commodities listed below would be traced in order to study the disruptions that occurred at pre and during covid-19 in the healthcare system in Lagos state.
1. Anti-Malaria
2. Anti-Biotic
3. Vaccine
4. Analgesics
5. Personal Protective equipment

The rationale for choosing the following essential commodities is to trace the supply disruptions that occur from local pharmaceutical companies that procure active pharmaceutical ingredient for the production of analgesics, anti-biotic and anti-malaria medicines from international focal point and also pharmaceutical distributors that import personal protective equipment and vaccines.

3.7 Techniques of Data Analysis

Data collected through field survey would be analysed as follows:
1. The result was analysed using Microsoft Excel tool. The Microsoft Excel analysed the data using descriptive analysis and the results was presented using graphs, tables. The tables presented 'at a glance' information gathered from questionnaire administered to the points of care.
2. The secondary data collected from the points of care was analysed using simple data analytics from Microsoft Excel. This statistical tool enabled the analysis of the monthly data and running a year on year comparison to take out seasonality effect.

4.1 Data Analysis and Interpretation

The project also made use of secondary data gathered at the service delivery points.

Two questionnaires (Service providers and patients) were used for this project and the data were analysed descriptively, the descriptive analysis involves qualitative and quantitative analyses. The qualitative analyses involve verbal interpretation of the result and the quantitative analysis was equally used to mass data and information generated in the course of the data collection for the study. Also, the review period for this questionnaire is from March-June, 2021.

Section 1: Patients Survey

4.1.1 Patients Data Analysis and Presentation According to Project Questions

Responses to the 50 questionnaire were analysed and questionnaire was divided into two sections namely: section A for socio-demographic characteristics of the respondents and section B, which highlights the operational data entered on the project questions.

4.1.2. Analysis of Socio-Demographic Characteristics of the Respondents

This segment analysed the socio-demographic characteristics of the sampled respondents in the study area. Demographic characteristics of the respondents are very important in the analysis of socio survey related to human behaviour. In this particular project, it helped in understanding the background of the patients, whose responses are germane to this study. Data gathered in this segment include the Age group and gender.

Figure 4.1 presented the age group of the patients; it deduced that 2.0% of the respondents who participate in the project work are under 18years old, 12.0% are within the age limit of 18-24 years, 58.0% are within 25-40 years, 24.0% are with the age limit 40-60years while 4.0% are 60 years & above. This age distribution shows that majority of the respondents were between the age group of 25-40 years old.

4.1.3. Analysis on the Operational data of Patient Respondents

This segment shows the analysis of the operational data that were obtained using questionnaire, with emphasis on the availability of the respondents needed medications at their various service delivery points and accessibility of the hospitals/pharmacies.

Table 4.1: Cross tabulation of Age group of Respondents and Accessibility to the service delivery points.

Table 4.1 revealed the level of patients' accessibility to their healthcare services. Hence, it deduced that 16.0% females had access to healthcare services, while only 12.0% of male had access to the healthcare facility. The table further revealed that 50.0% of females and 22.0% of males could not have access to their various service delivery points. This implies that more female visited their service providers more during the review period of the project.

From figure 4.2, it shows that up to 44.0% and 36.0% of respondents had no underlying health condition and recurring treatment. Also, 56.0% and 64.0% had an underlying health condition and were currently recurring treatment.

Figure 4.3, revealed the respondents percentage distribution of accessibility to their needed services. From the analysis, it was deduced that 72.0% of respondent with both underlying health conditions and current recurring treatment did not have access to their various service delivery points while 28.0% had access to their point of care. From the open ended question in the questionnaire, a pregnant respondent stipulated she went to a public hospital but was denied treatment because the hospital was only attending to only emergency cases.

Figure 4.4 highlight the various means respondents used in arriving at their point of care. The analysis shows that respondents used either their own vehicles or ridesharing to arrive at their service delivery points more. The basis for respondent not using public buses can be attributed to the fear of contacting covid-19 and also the temporary stoppage of public transportation in Lagos State restricted people from using public buses, thereby optioning for ride sharing or using their own vehicle.

Figure 4.5 revealed the opinion of the patient towards difficulty in accessing transportation to their PoCs. From the result, 52.0% revealed that there were difficulties accessing a means of transportation to the hospital while 48.0% said that there was no

difficulty. The analysis indicate that a high percentage of patients that tried to access the facility could not because of difficulties experienced in getting a means of transportation, this was majorly due to the lockdown which occurred that led to mobility restriction in Lagos State.

Figure 4.6, which is a graphical representation of patients' response about where they visit when ill? Revealed that 30.0% of the Patients visit pharmacy, 2.0% visits the patent medicine stores, 24.0% visit the hospitals/pharmacy and 36.0% visit the hospital, physically while 8.0% prefer the use of telemedicine. This implies that most respondents prefer visiting the hospital and their pharmacy physically to get treatment for their various ailments.

Figure 4.7, the analysis deduced that 62.0% of respondent did not get their medication available at their various point of care. The non-availability of essential commodities at the point of care can bring rise to the purchase of counterfeit medicines from unauthorized medical source, which would worsen the health condition.

Figure 4.8 gives details of the options respondent were given at their point of care. It shows that majority of them were told to purchase their essential commodities in other service delivery points. This case can be likened unto the rise of the purchase of fake chloroquine that happened in Nigeria, solely because this medicine was not available at the Point of care.

The figure 4.9 revealed that only 56.0% know about telemedicine and 44.0% are not aware about the use of telemedicine.

The figure 4.10 revealed the percentage distribution of respondent who have utilized telemedicine. From the analysis, it shows that 68.0% did not make use of this service while 32.0% made use of the services. This implies that there is low usage of telemedicine by respondents.

4.1.3. Analysis on the Operational data of Point of Care Respondents

This segment analyzed the sampled points of care respondents in the study area. It contains responses on availability and accessibility of essential commodities at the points of care.

The figure 4.11, revealed the essential commodities that the various healthcare service providers have in stock. From this chart we can deduce that all SDPs stock Artemisinin-based combination therapy, paracetamol and surgical face mask, also three SDPs stated that they do not stock Azithromycin (these SDPs explained that they use other antibiotics to treat their patients). The chart further revealed that only five (5) SDPs stock vaccines in their facility for the treatment of their patients.

The figure 4.12 revealed all point of care experienced initial artificial scarcity of their essential commodities during the peak of covid-19 in Lagos State, except Amuwo-Odofin General Hospital. The chart

further revealed that the pandemic did not affect the supply rate of essential commodities to Amuwo-Odofin General Hospital. The general hospital stipulated that the footfall drastically reduced during that period due to fear of pregnant mothers contacting covid-19.

Amongst the points of care as shown in figure 4.12, Eze-Udo Medical Center, Ajeromi General Hospital, Divine Seed, Lopez and Peter and sons pharmacy had commodities shortage during this period with most of them reporting that they were unable to get Surgical Face Mask, Anti-Malaria and Antibiotics from their normal suppliers. However they were able to get from other sources which affected prices .The Private hospital chain, Amuwo-Odofin MCC & Ajeromi General Hospital and Ojo PHC have never experienced expiration of drugs in the last two years (Ajeromi General Hospital operates on a drug recall model with their distributors).

Figure 4.13 revealed that amongst the points of care that experienced shortage of commodities in their facility, surgical face mask was the commodity that was mostly not available, followed by Anti-malaria and Anti-biotic.

Figure 4.14, explains the major scarcity issues faced by the service delivery providers. The major reason behind the scarcity as stipulated by the SDPs is the lack of stock by the focal points, some SDPs believed that the commodities were being hoard in the warehouse to create artificial scarcity while others stated that it was due to logistics issues that most delivery companies face that is why they was scarcity.

The logistics issue is one of the major problems Philip Pharmaceutical Nigeria Company (PPNL) was facing and this affected the distribution of essential commodities to the various point of care.

Figure 4.15 shows the various reasons why the essential commodities prices were increased at the point of care. Majority of the service delivery providers stated that lack of stock at the focal points were the reason why they was upshot in price level, as the commodity became scarce and the commodities available were on high demand by patients thereby leading to increase in prices. Other SDPs stipulated that increased dollar, increased cost of transportation played a major role in the upshot of price and hoarding by distributors led to the spike in essential commodities at the last mile.

Figure 4.16 revealed that most of the service delivery points transport their essential commodities through their private transport while others revealed that they use both private & courier services and Public & private transport.

From the figure 4.17, it revealed that only 20.0% of the points of care had a regular supply rate from their normal vendors, and this PoCs are Amuwo-Odofin General Hospital and Ajeromi General Hospital. Other hospitals resorted to purchasing from multiple sources which affected prices

SECTION 2: Analysis of the Secondary Data Collected from the Points of Care

4.2 Hospital and Pharma survey

We carried out deep dive into the effect of the irregular supplies in figure 5.17 on stocks and consumption at hospitals and pharmacies. We had 4 hospitals and 3 pharmacies in scope and collected their January to June 2019 and January to June 2020 closing stock and consumption data.

The hospitals analysed were as follows
Ojo primary Hospital
Amuwo General Hospital
Ajeromi General Hospital

We also compared our findings with a private hospital with 3 hospitals in its chain.

The closing stock data from the Hospitals below show and increased stock availability towards the end of the study period starting May-June 2020 versus last year. The reason given was that after the initial scarcity, the hospitals bough their normal stock quantities, however they were now faced with low foot falls. One of the hospitals stated that around February this year their standard foot fall was around 300 to 320 daily, After the index case was discovered in March, there was an initial rush by their long term patients to stock up on medications and after that, footfall declined to between 10 to 20 daily and by June was at 80 to 100 daily.

Figure 4.2.1 Closing stock ACTS Hospitals

Ojo Hospital and Ajeromi, hospitals had some stock availability issues but it was comparable to last year so it was not necessarily due to covid-19 disruptions.

Ojo Hospital and Ajeromi, hospitals had some stock availability issues but it was comparable to last year so it was not necessarily due to covid-19 disruptions. The pricing survey showed that antibiotics price grew +97% in some cases from average price of N320 to N630.

All hospitals under review had surgical face masks during the period over review though demand and utilization increased. In public hospitals, the surgical face masks are still being used for surgery and for seeing patients while the rest of the staff mostly uses reusable face masks. In the private hospital all staff uses disposable masks so the demand had increased significantly.

Another interesting insight we got through interviews was that during the Ebola outbreak, some people imported machines for local production of surgical face masks but stopped because long term demand was not there. These were the source of the first relief in scarcity of facemasks. Additional study is needed to understand the installed production capacity in Lagos and other states.

Apart from Ojo PHC where they had huge stocks, there was not much difference in stock availability so Covid-19 had minimal impact.

The Pharmacies in scope are as follows:
• Divine seed pharmacy
• Lopez pharmacy
• Wellness Pharmacy

The Closing stock of ACTs in pharmacies showed same trend as Hospitals. There were minimal disruptions in drug availability for patients though prices fluctuated.

The closing stock of antibiotics in pharmacies followed the same trend of fluctuating pricing initially but the prices later stabilized. The reasons given were initial scarcity due to hoarding, then transport issues during the lock down (Costs of transportation increased significantly). After that everything normalized.

There was no significant different in stock availability during the period.

4.3 Research Findings

1. Females visited their service providers more during the review period of the project.
2. 72.0% of respondent with both underlying health conditions and current recurring treatment did not have access to their needed services in public hospitals.
3. 36.0% of respondent used ridesharing while 26.0% used public transport to arrive at their service delivery points. The basis for respondent not using public buses can be attributed to the fear of contacting covid-19 and also the temporary stoppage of public transportation in Lagos State restricted people from using public buses, thereby optioning for ride sharing or using their own vehicle.
4. 52.0% revealed that there were difficulties accessing a means of transportation to the hospital
5. 62.0% of respondent did not get their medication available at their various point of care
6. Majority of the respondent were told to purchase their essential commodities at other points of care. This case can be likened unto the rise on the purchase of counterfeit chloroquine that happened in Nigeria, solely because this medicine was not available at the point of care.
7. 32.0% respondents made use of telemedicine services. This implies that there is low usage of telemedicine by respondents.
8. The points of care that had regular supply were Amuwo-Odofin General Hospital and Ajeromi General Hospital.
9. Majority of the service delivery providers stated that lack of stock at the focal points were the reason why they was upshot in price level, as the commodity became scarce and the commodities available were on high demand by patients thereby leading to increase in prices.
10. The major reason behind the scarcity as stipulated by the SDPs is the lack of stock by the focal points
11. Surgical face mask was the commodity that was mostly not available, followed by Anti-malaria and Anti-biotic.
12. All point of care experienced artificial scarcity of their essential commodities during the peak of covid-19 in Lagos State, except Amuwo-Odofin General Hospital.
13. The pricing survey showed that antibiotics price increased by 97% in some cases from average price of N320 to N630.

5.1 Recommendations

The Covid-19 pandemic took the world by surprise, and most pharmaceutical companies and point of care were not prepared for the disruption in supply chain that occurred. Supply chain disruptions create scary and uncertain times for pharma-companies and last miles alike, the Covid-19 global pandemic has caused a major upheaval in the supply chains of many last miles in Lagos, Nigeria.

In this study, lack of stock and transportation services played a major role behind the non-availability of essential commodities at the last mile. Also, respondent who stated their drugs were not available were giving prescription to buy elsewhere giving rise to the purchase of fake and counterfeit drugs.
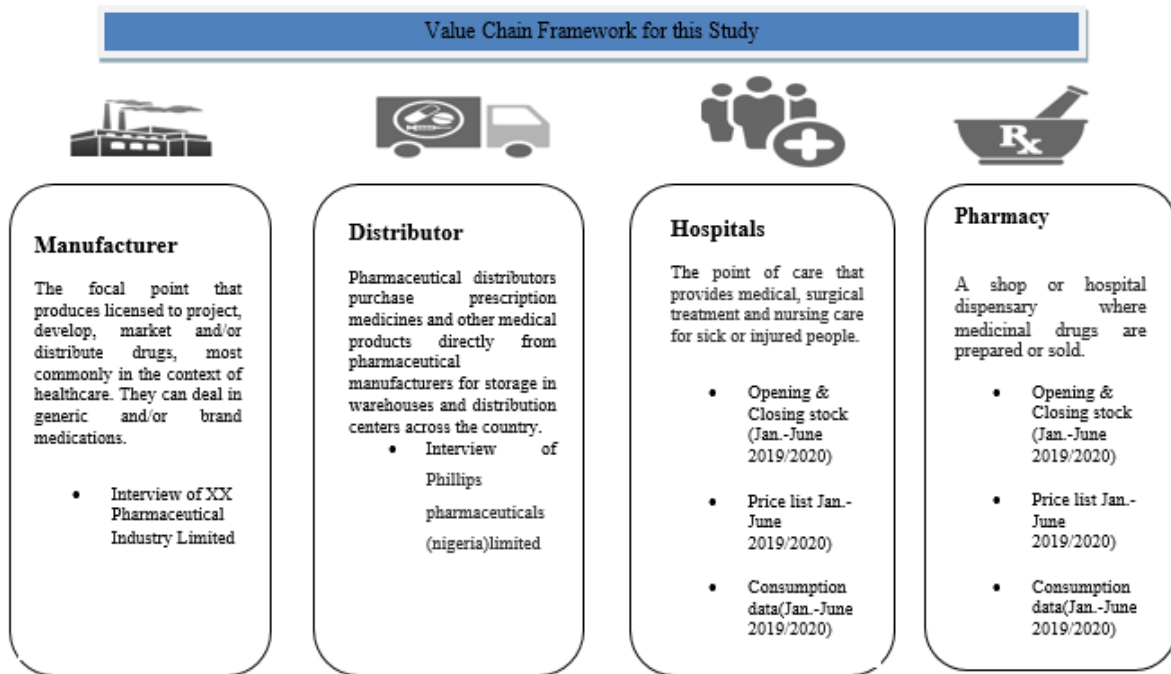
This disruption led to unavailability of essential commodities (Due to drugs being available at the point of care patients may purchase counterfeit medicines from unconfirmed source) and poor accessibility to facilities, thereby making the patients to suffer.

The subsequent recommendations are made on the basis of the researchers' findings to point out a better approach the Government, Pharma-companies and point of care can use to mitigate supply chain disruptions in the future.

5.1.2 Pharmaceutical Companies

1. **Create a supply chain emergency plan**: To prevent disruption in your organization it is always important to have a backup plan, especially when it comes to supplies. Taking cue from Phillips Pharmaceuticals (Nigeria) Company that operates on a letter of credit for the procurement of medicines internationally, this is important on issues such as the temporary suspension of cheque clearing in Nigeria by the central bank of Nigeria would not be a problem for pharma-companies in the future.

2. **Conduct a supply chain vulnerability audit**: Focal points need to do a risk analysis survey and identify the weakest links in the supply chains. This will enable the pharma-companies focus on where there need to find alternatives. Also, in cases such as Phillips Pharmaceuticals (Nigeria) Limited were their weakest link was their logistic system, the company need to change their model and operate on a supply chain resilience/redundancy system. Although the company is currently buying more vehicles to help distribute their vaccines to the last mile but when the covid-19 pandemic is over and things return to normal, customers would begin transporting their commodities themselves. In such situation, what would happen to those vehicles?. The company can lease off the vehicles to logistic firms which would serve as an added source of revenue for the organization.

3. **Diversify Distribution Hubs**: One of the major issues PPNL had was on the distribution of vaccines

Value Chain Framework for this Study

Manufacturer

The focal point that produces licensed to project, develop, market and/or distribute drugs, most commonly in the context of healthcare. They can deal in generic and/or brand medications.

- Interview of XX Pharmaceutical Industry Limited

Distributor

Pharmaceutical distributors purchase prescription medicines and other medical products directly from pharmaceutical manufacturers for storage in warehouses and distribution centers across the country.

- Interview of Phillips pharmaceuticals (nigeria)limited

Hospitals

The point of care that provides medical, surgical treatment and nursing care for sick or injured people.

- Opening & Closing stock (Jan.-June 2019/2020)
- Price list Jan.-June 2019/2020)
- Consumption data(Jan.-June 2019/2020)

Pharmacy

A shop or hospital dispensary where medicinal drugs are prepared or sold.

- Opening & Closing stock (Jan.-June 2019/2020)
- Price list Jan.-June 2019/2020)
- Consumption data(Jan.-June 2019/2020)

Age Distribution

- Under 18 years old
- 18-24 years old
- 25-40 years old
- 40-60 years old
- Above 60 years old

Figure 4.1: Age distribution

Source: Field Survey, 2021

Respondents Health Conditions

- Do you have any underlying health condition?
- Do you have a current recurring treatment
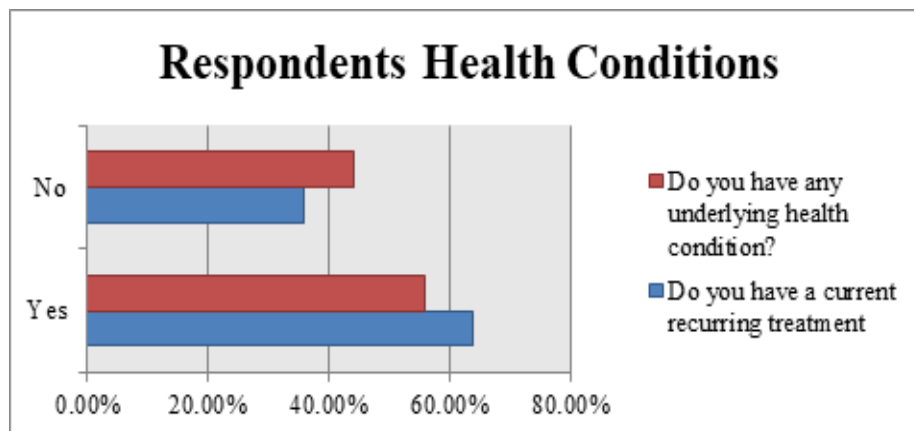
Figure 4.2: Respondents health conditions

Source: Field Survey, 2021

Accessibility Distribution
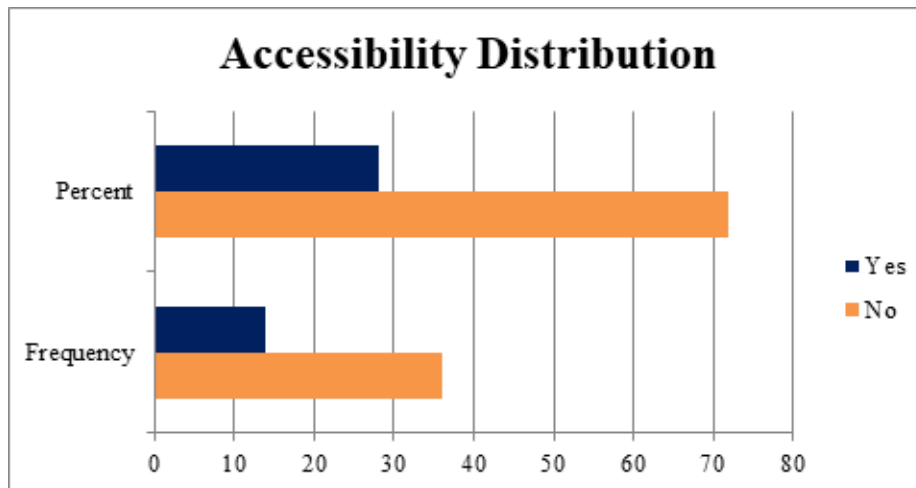
Figure 5.3: Accessibility distribution

Source: Field Survey, 2021
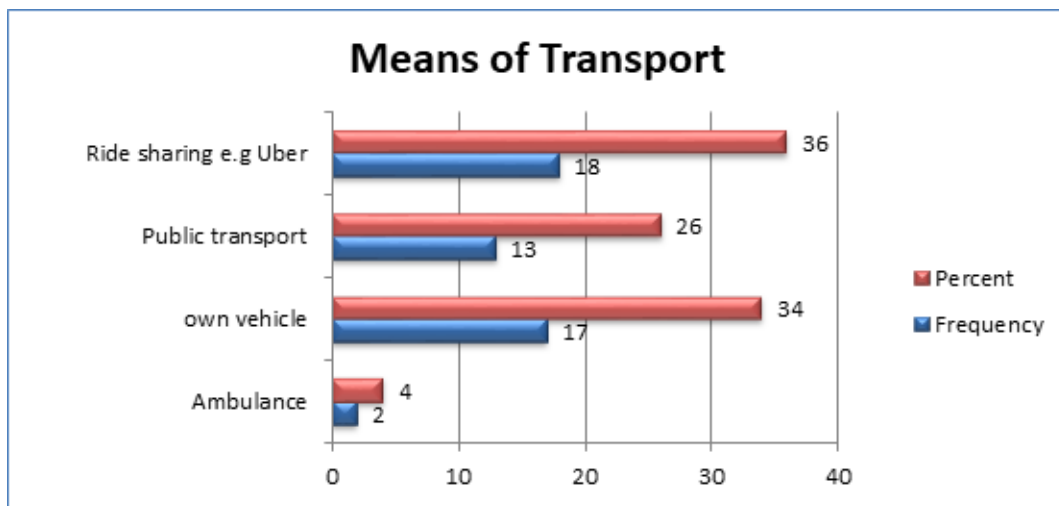
Means of Transport

Figure 4.4: Means of Transportation

Source: Field Survey, 2021
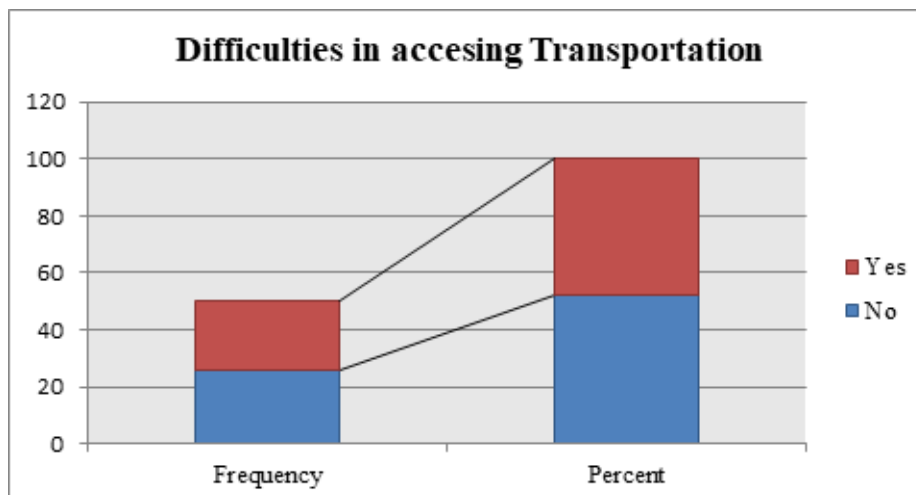
Difficulties in accesing Transportation

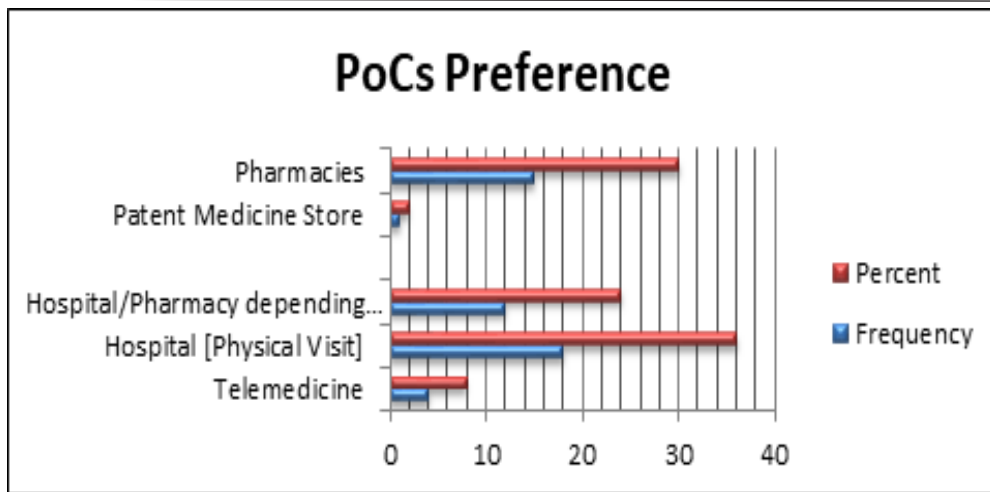**Figure 4.5: Difficulties in accessing transportation**

Source: Field Survey, 2021

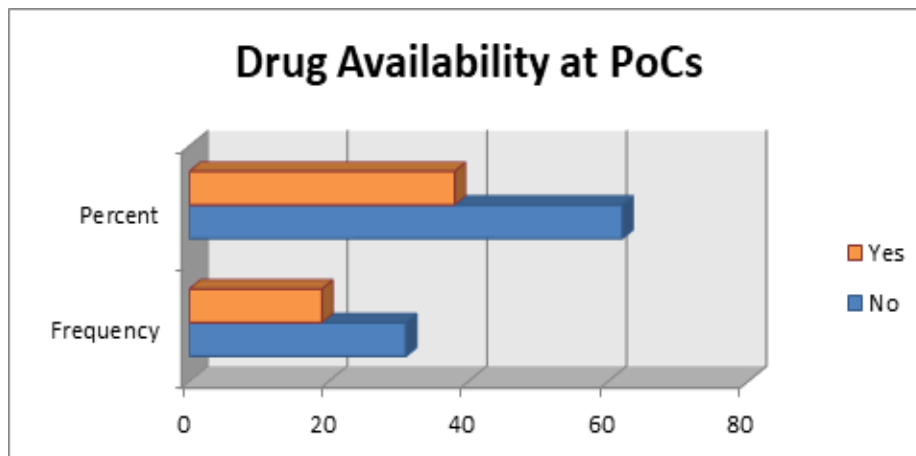**Figure 4.6: PoCs Preferences**

Source: Field Survey, 2021

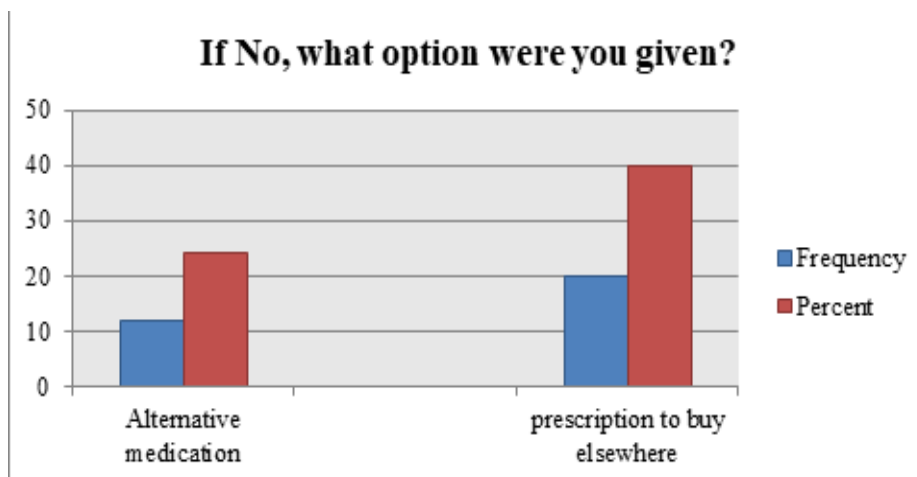
Figure 4.7: Drug availability at PoCs

Source: Field Survey, 2021

Figure 4.8: Respondents alternative prescription options
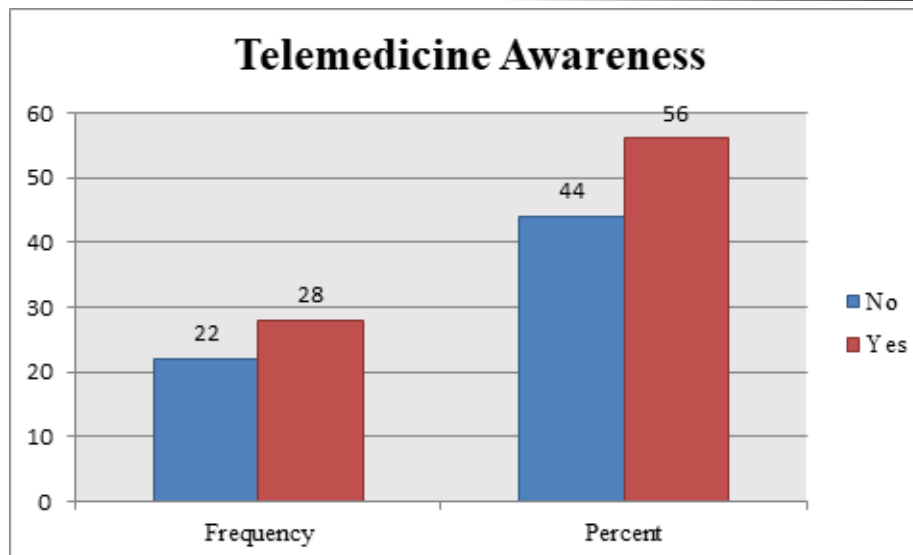
Source: Field Survey, 2021

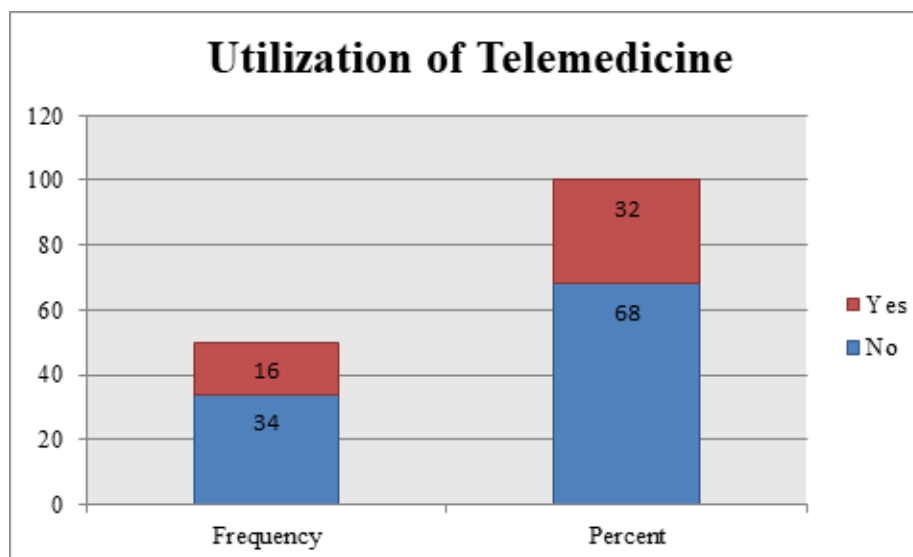**Figure 4.9: Telemedicine Awareness**
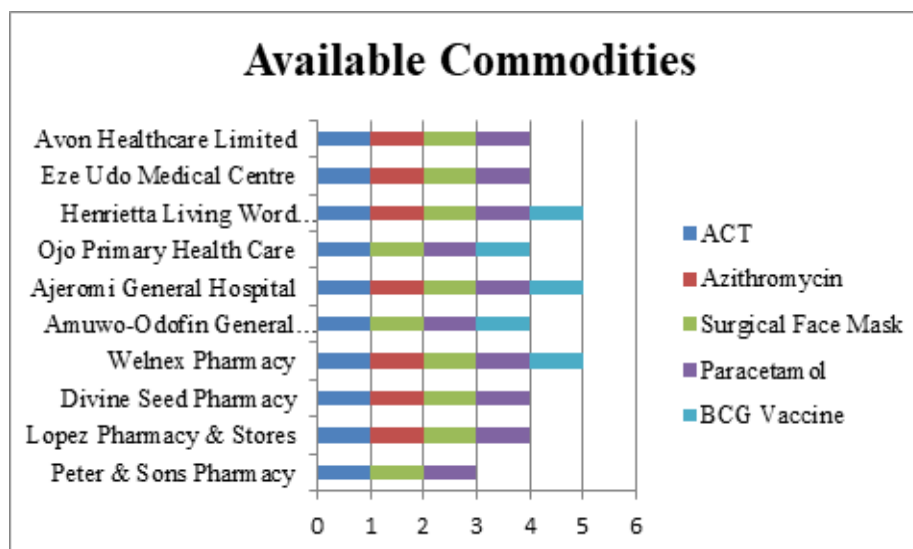
Source: Field Survey, 2021

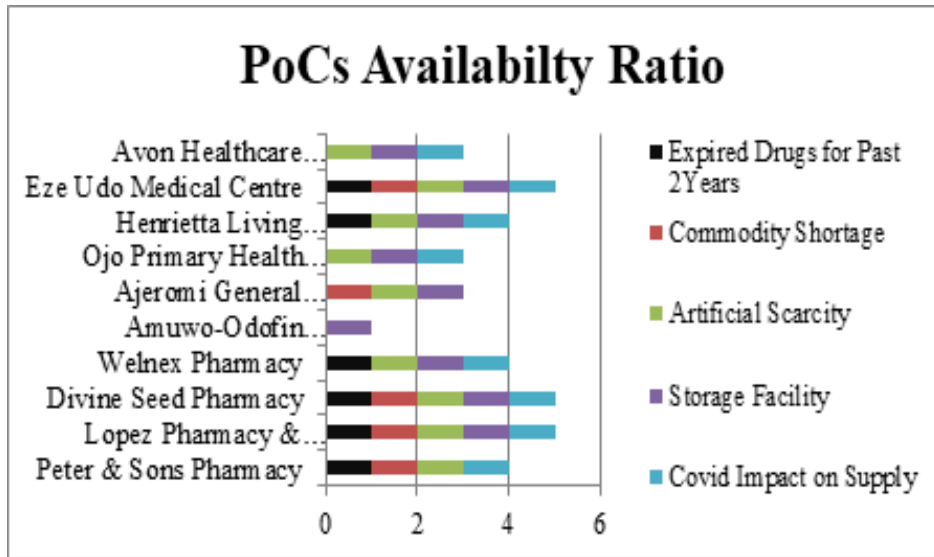**Figure 4.10: Utilization of Telemedicine**

Source: Field Survey, 2021

Figure 4.12: PoCs Availability Ratios
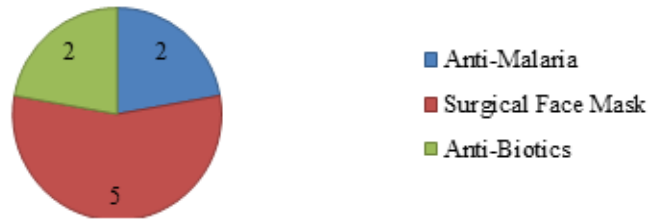
Figure 4.13: PoCs Essential Commodities Shortage
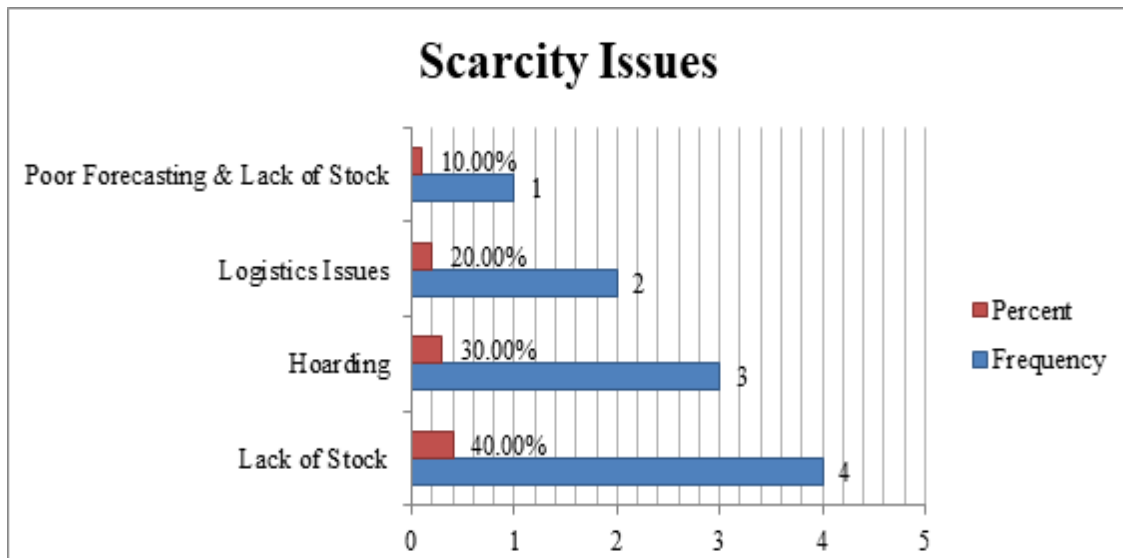
Figure 4.14: PoCs Scarcity Issues

Eleyon Publishers

Reason for Price Spike
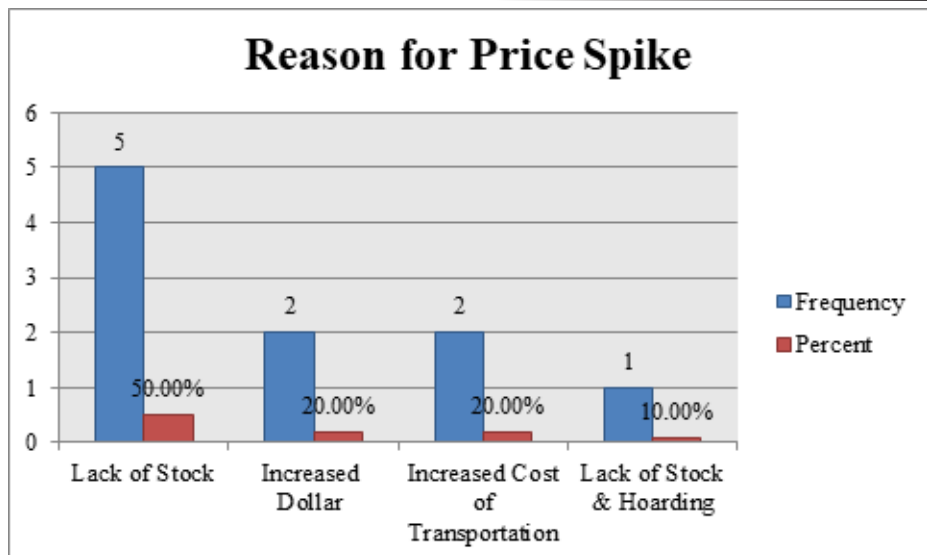
Figure 4.15: PoCs reasons for price spike

Source: Field Survey, 2021

Means of Transporting Essential Commodities
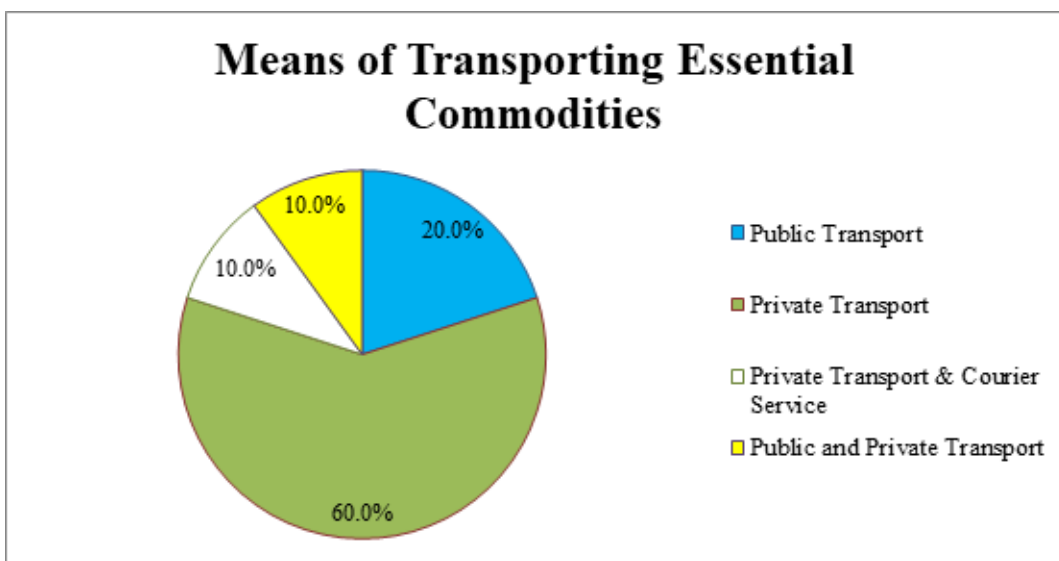
Figure 4.16: PoCs Transportation means

Source: Field Survey, 2021

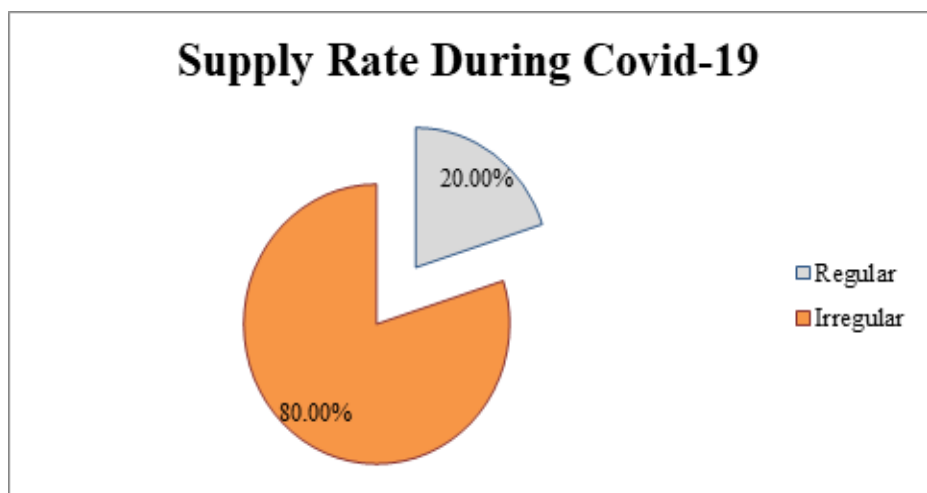## Supply Rate During Covid-19

Figure 4.17: PoCs Supply Rate

Source: Field Survey, 2021

Figure 4.2.2: Closing Stock Antibiotics

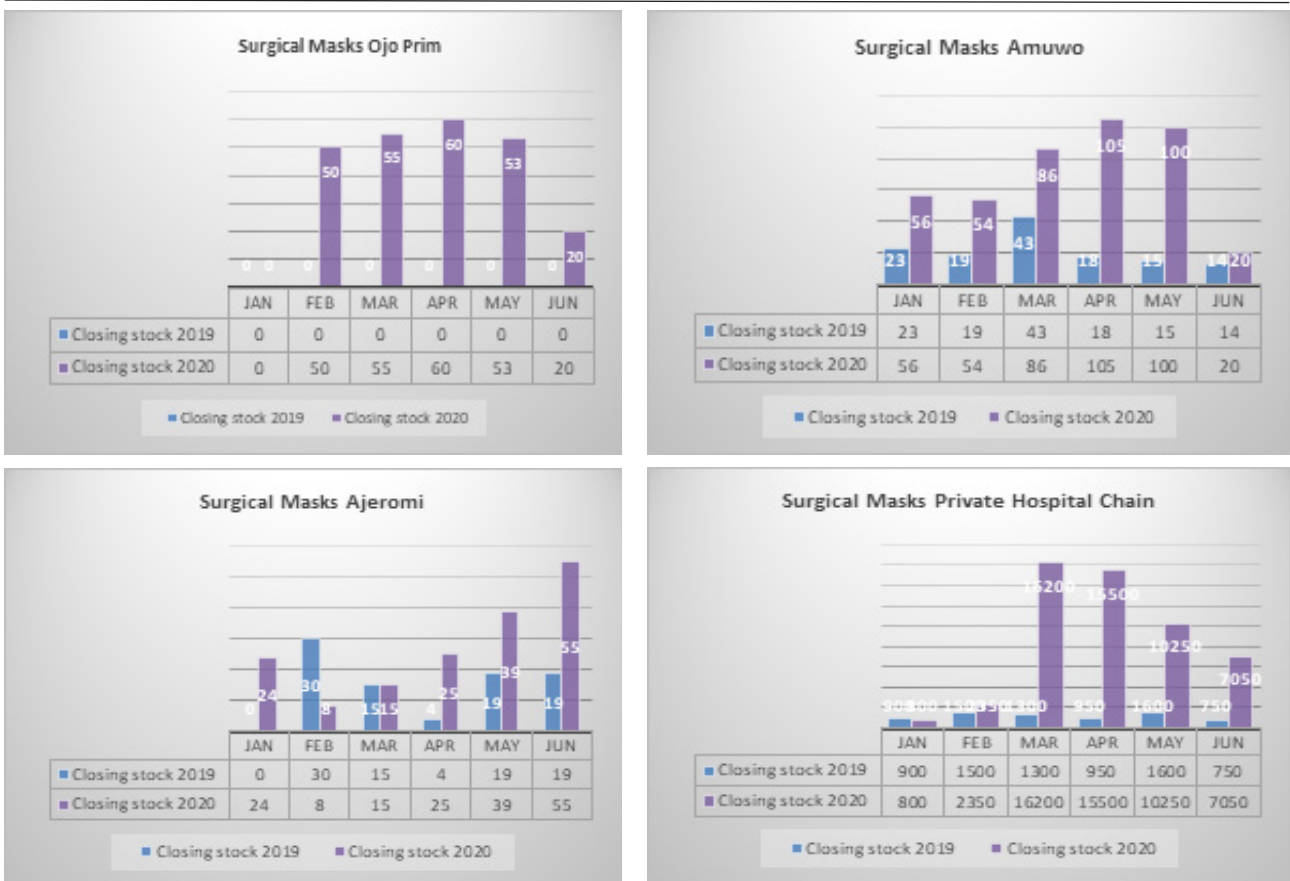**Figure 4.2.3: Closing stock surgical masks**
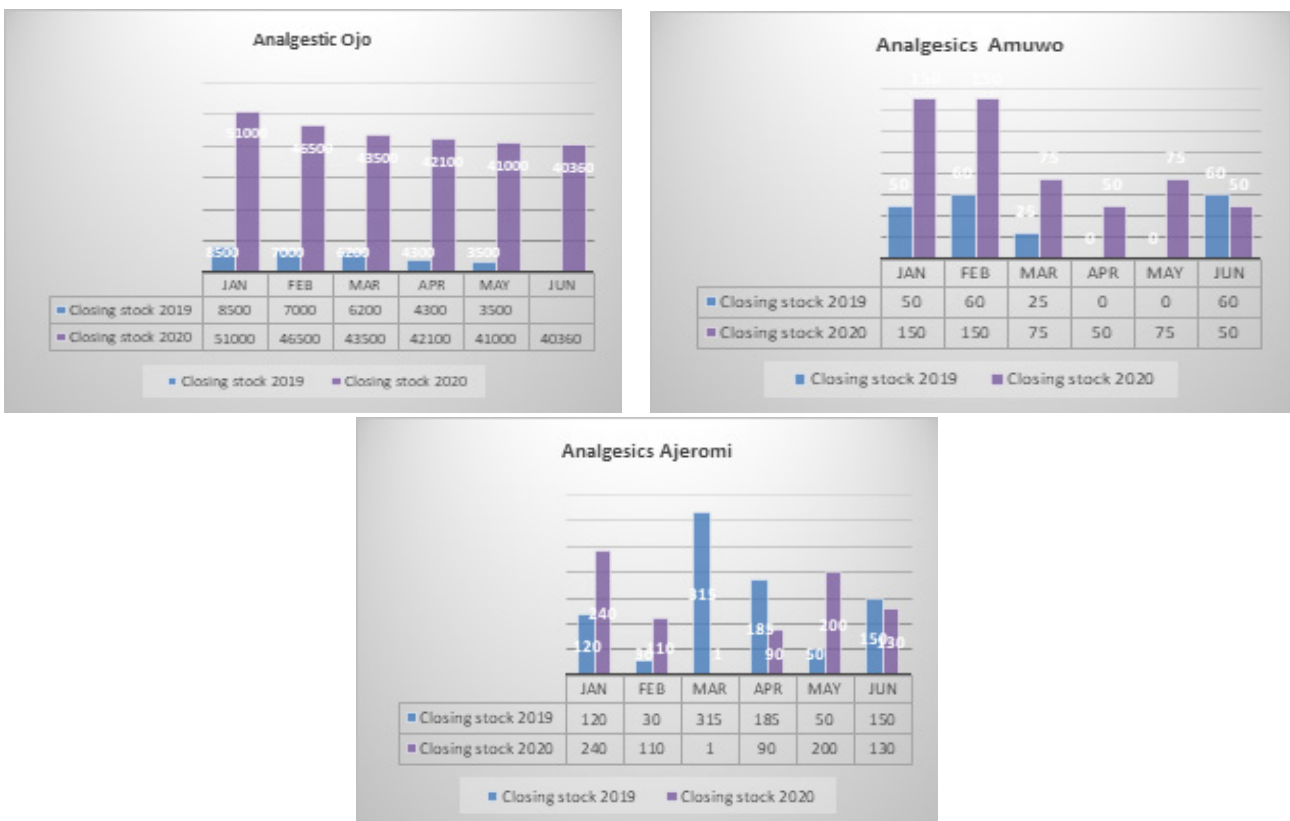
Figure 4.2.4 Closing stock Analgesic
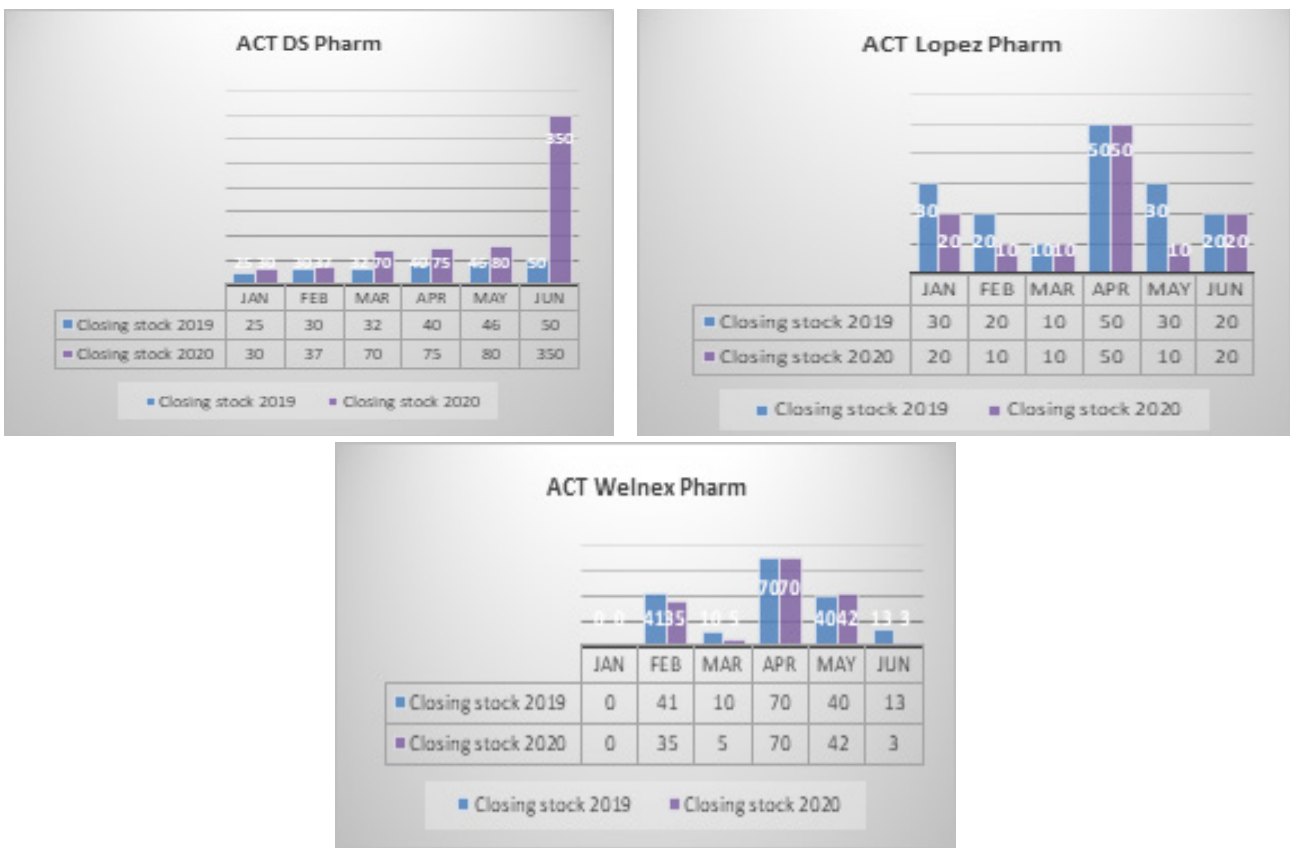

Figure 4.2.5 Closing stock ACTs Pharmacies

ACT DS Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	25	30	32	40	46	50
Closing stock 2020	30	37	70	75	80	350

ACT Lopez Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	30	20	10	50	30	20
Closing stock 2020	20	10	10	50	10	20

ACT Welnex Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	0	41	10	70	40	13
Closing stock 2020	0	35	5	70	42	3

Figure 4.2.6 Closing stock Antibiotics Pharmacies

Antibiotics DS Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	30	92	23	40	30	50
Closing stock 2020	20	50	200	100	120	90

Antibiotics Lopez Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	10	10	10	20	30	20
Closing stock 2020	10	10	10	10	10	10

Figure 4.2.7 Closing stock Surgical Masks Pharmacies

SM DS Pharm

	JAN	FEB	MAR	APR	MAY
Closing stock 2019	20	23	12	15	10
Closing stock 2020	24	30	102	210	200

SM Lopez Pharm

	JAN	FEB	MAR	APR	MAY	JUN
Closing stock 2019	3	2	2	1	3	3
Closing stock 2020	3	2	3	2	1	2
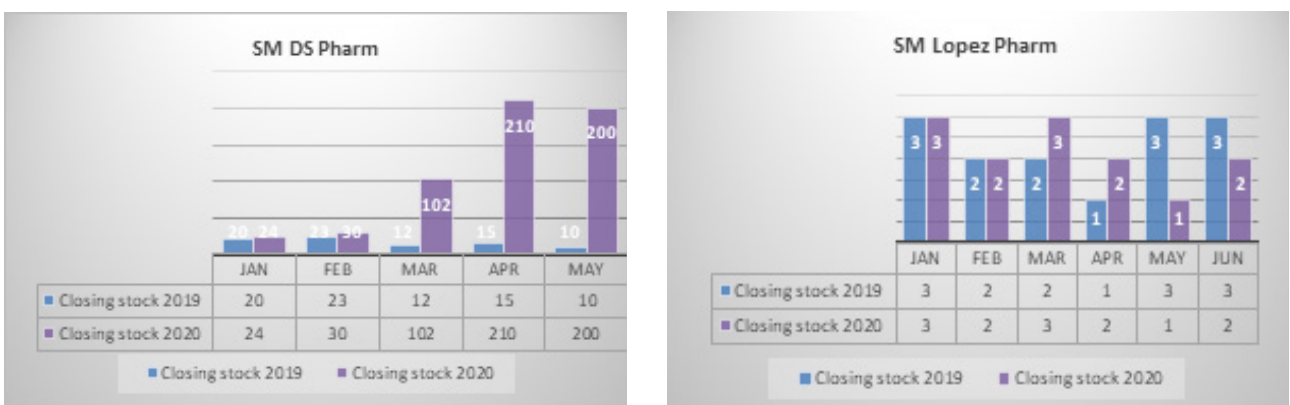
Figure 4.2.8: Closing stock Analgesics Pharmacies

to other states in Nigeria due to the ban of inter-state travel. Delivery pharmaceutical companies need to at least have different hubs were they can store their commodities to serve the populace of that region in case of eventualities such as interstate/country ban.

5.1.3 Government

1. The creation of Drug Bank: The hospitals and pharmacists under study were able to source the commodities through alternative channels though at higher prices, this indicates that there may be a natural buffer of drugs available in the country. Therefore there is need to understand these alternative channels with a view of establishing drug banks. Drugbank would be useful in Nigeria because it would be a hub for drug storage and it should have a comprehensive online database in which it would be freely accessible and information's regarding drugs and their shortages would be posted in the website. It would be designed in a way where pharma-companies would be sending in information on drugs that they are about going in short supply, as this would help inform the government on the pro-active steps to take before the drugs are not available in the country anymore. Study the installed capability of key commodities. (e.g. face masks in Nigeria with a view to unlocking easy alternatives during emergency situations)

2. Study telemarketing success and issues to see how to expand that to become main-stream as it seems to have extended healthcare delivery during this period.

3. Massive training to improve forecasting capability as the data shows that there has have been fluctuations even without the emergency situation.

5.1.4 Last Mile

1. Transportation Issues: In cases of lockdown (where vehicles are banned) and the patients who do not have private vehicles cannot have access to public transport, there is need for the government to either leave the public transport for operation or operate on a door to door healthcare services.

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