

**ASSESSMENT OF THE IMPACT OF COVID-19 ON THE SUPPLY  
CHAIN OF ESSENTIAL HEALTH COMMODITIES IN TANZANIA**

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**Assessment of the Impact of Covid-19 on the Supply Chain of Essential Health  
Commodities in Tanzania.**

**By**

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**A Dissertation Submitted in (partial) Fulfillment of the Requirements for the Degree of  
Master of Science in Pharmaceutical Management of Muhimbili University of Health  
and Allied Sciences**

**October, 2021**

**CERTIFICATION**

The undersigned certifies that she has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled, “**Assessment of the Impact of Covid-19 on the supply of essential health commodities in Tanzania**” in (partial) Fulfillment of the Requirements for the Degree of Master of Science in Pharmaceutical Management of Muhimbili University of Health and Allied Sciences.

.....

**Prof. Godeliver Kagashe**

**Supervisor**

.....

**Date**

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## **DEDICATION**

This dissertation is dedicated to my lovely wife Mariam Mbelwa, our child Jaden P. Ipagala, and my parents, for being a source of inspiration and strength to never give up.

Lastly, to the Lord Almighty, who made it possible for his guidance, strength, and protection.

## **ABSTRACT**

**Background:** Essential medicines are those drugs that satisfy the priority healthcare needs of the population. In Tanzania the supply chain of essential health commodities largely

depends on imported finished products and Raw materials. As a result of the surge in the COVID-19 pandemic, which led to the inevitable lockdown of the economy across affected countries, there has been a noticeable decrease in production and exportation of raw materials as well as finished health products across different countries. So far it is not known how the pandemic has affected the supply chain of essential health commodities in Tanzania.

**Objective:** To assess the impact of Covid-19 on the supply chain of essential health commodities in Tanzania.

**Methodology:** This retrospective register-based study was conducted at TMDA, to assess price changes before and during COVID-19. Cross sectional study was conducted at selected retail pharmacies to assess for the availability, price changes and customer's purchasing pattern of essential health commodities.

Qualitative interview of key informants from pharmaceutical industries and private importers of health commodities was done using open ended questions.

The longitudinal data and quantitative interview data analysis were performed for T- Test using SPSS version 20 and Microsoft Excel®, Microsoft Corporation 2019 respectively.

The recorded interviews were analyzed for themes (thematic analysis) of the impacts of COVID 19 on the supply chain of essential commodities in Tanzania.

**Results:** Quantitative interview consisted of two hundred forty-two participants, among those 89.3% agreed that COVID-19 reduced the availability of health commodities. Different ways through which the pandemic reduced the availability included increase in demand, increase in price as well as reduced production of health commodities. Fifty one percent (51%) of participants disagreed that COVID-19 reduced pharmacy business while 61% said that customers' ability to purchase health commodities during the pandemic was not affected (not reduced). Products that were in high demand included medicines like Azithromycin, Vitamin C, Multivitamin, Dexamethasone, Ivermectin, Aspirin and Heparin.

Qualitative results from pharmaceutical importers showed reduced production of health commodities and increased demand of some health commodities reduced their availability.

Transportation factors, port clearance issues and withholding stocks of health commodities also were found to increase the price of imported health commodities. While shortage of workforce in manufacturing plants, customs factors and scarcity of raw materials increased the lead time of imported health commodities and pharmaceutical raw materials.

**Conclusion:** Findings of this study show that COVID-19 impacted the supply of essential health commodities by reducing availability, increasing price and lead time of imported health commodities and pharmaceutical raw materials, further the study found changes in purchasing pattern of essential health commodities where for some commodities demand was increased dramatically while their supply decreased.

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## **ABBREVIATIONS**

API- Active Pharmaceutical Ingredients

COVID-19 -Corona Virus Disease 2019

DLDM-Duka la Dawa Muhimu

HAI-Health Action International

MSD-Medical Stores Department

PHEIC- Public Health Emergency of International Concern

PI-Principal Investigator

SARS-Severe Acute Respiratory Syndrome

SCM-Supply Chain Management

TMDA-Tanzania Medicines and Medical Devices Authority

UNDP-United Nations Development Program

USD- United State Dollars

WHO-World Health Organization

## **DEFINITIONS**

Supply chain -encompasses all the activities, functions and facilities involved in producing and delivering a product and/or service, from suppliers (and their suppliers) to the customers

Essential health commodities –Includes health products, health and medical supplies and other items that are needed in provision of health services including vaccines, medical supplies such as contraceptives dressings, needles and laboratory/diagnostic consumables.

Essential medicines-Are medicines which satisfy the priority healthcare needs of the population

Lockdown –is an emergency measure or condition in which people are temporarily prevented from entering or leaving a restricted area during a threat of danger.

## CHAPTER ONE

### 1. INTRODUCTION

#### 1.1 BACKGROUND

Essential health commodities are those that satisfy priority healthcare needs of the population(1). Supply chain of essential health commodities encompasses all the activities, functions and facilities involved in producing and delivering a product and/or service, from suppliers (and their suppliers) to the customers(2). Supply chain management is a dynamic process that integrates manufacturing resources and vendors, and delivery of goods and services to providers (3).

Health supply chain management involves manufacturers of medical devices, surgical supplies and pharmaceuticals, Vendors (suppliers of goods/services), purchasers, storage (stocking places and sourcing points), Distributors (transport, logistics, communication) and providers (hospitals, Pharmacies) (2,3).

Supply chains have risks which can be categorized into operational and disruption risks, Operational risks are risks concerned with day to day disturbances in the supply chain operations such as lead time and demand fluctuations while disruption risks belong to low-frequency-high-impact events, Examples of disruption risks are natural disasters such as earthquakes and tsunamis (e.g., tsunami in Japan in 2011 and its huge impact on the Supply Chain worldwide)(3,4).

Supply chain risks are characterized by a very strong and immediate impact on the supply chain network design structure since some industries, suppliers, distribution centers and transportation links become temporarily unavailable/reduced resulting to material shortage and delayed delivery causing the ripple effect and performance degradation in terms of revenue, service level and productivity (5).

Epidemic outbreaks can cause supply chain disruption and they represent a special case of supply chain risks which is characterized by three components which include the following; long-term disruption and its unpredictable scaling, simultaneous disruption propagation in the supply chain and simultaneous disruptions in supply, demand, and logistics infrastructure (5). Unlike other disruptions, epidemic outbreaks start small but

scale fast and cover many geographic regions and recent examples include Ebola, Swine flu and the most recent coronavirus (COVID-19/SARS-CoV-2) (6).

On January 30, 2020 WHO declared COVID-19 as Public Health Emergency of International Concern (PHEIC) (7). On March 11, 2020, the World Health Organization (WHO) declared the coronavirus (COVID-19) outbreak a pandemic (8). The disease has resulted in over 4.3million confirmed cases and over 290,000 deaths globally by March 2020 (7). In response to the coronavirus disease 2019 (COVID-19) pandemic, many countries in the WHO South-East Asia region began implementing lockdowns and other measures in March 2020 (9).

To slow down the spread of this infectious disease and avoid overburdening the healthcare systems, several social-distancing measures were implemented, including the closing of schools and workplaces, self-isolation, quarantine, restricting the movement of people and the cancellation of mass gatherings and such measures were early implemented in China which is the epicenter of the disease in its province Hubei (10,11).

Supply chain have faced demand–supply disruptions due to both global and local economies being severely affected by the COVID-19 outbreak leading to reduced supply availability (12). COVID- 19 has had a broad- based negative impact on trade and foreign direct investment, with considerable declines in global exports and imports in a range of industries. Health supply chain has also suffered from COVID-19 prevention policies (13,14). From the first precaution of dumping international air traffic to and from The Chinese city of Wuhan to country lockdown, closure of Schools, colleges, restaurants, Hotels, Cafés, disruption of work in Government and private institutions all these have impacts on supply, demand and Logistics of essential health commodities(15).

Tanzania's health supply chain depends largely on imported finished pharmaceutical products (16,17). In addition Tanzania's local pharmaceutical production is low and its raw materials are 100% imported (18). Countries like China and India which are greatest source of pharmaceutical raw materials and finished pharmaceutical products being under lockdown has implications on the supply chain of health commodities in Tanzania (16).

To date there is no study conducted to assess the impacts of COVID-19 on the availability, and community's purchasing power of essential health commodities in Tanzania.

Therefore, this study assessed the impacts of the pandemic in the country's health supply chain.

## **1.2 PROBLEM STATEMENT**

Health supply chain in Tanzania is administered by the private distributors and public distributor/agency (MSD) which is an autonomous body under the ministry of Health, Community Development, Gender, Elderly and Children. The private sector involves pharmaceutical importers, distributors, wholesalers, and retailers. It plays a great role in health commodities supply chain to the extent of supplying the Public health facilities through a prime vendor system when MSD capacity to supply the commodities is inefficient (19).

In 2014, local pharmaceutical production which is mainly concerned with generic medicines was reported to account only 12% of total demand leading to raised importation (16).

Studies have shown that the majority of pharmaceutical imports in the public and private sector supply chain in Tanzania are dominated by imports of finished products from India and pharmaceutical raw materials from China (20).

Implementation of preventive measures against COVID -19 such as country Lock down in China and India have impacts on the supply chain specifically on the importing countries of both finished pharmaceuticals and raw materials which also impacts on the local production of essential health commodities. Reduced transportation activities due to lockdown have impacts on the supply capacity and changes in production costs which in turn led to health commodities price changes and delayed delivery (21).

In Tanzania, since local pharmaceutical production is still low, most pharmaceuticals and other health commodities are being imported. Local production is 100% dependent on imported raw materials, therefore implementing restriction measures in exporting countries have impacts on the availability and affordability of essential health commodities due to low production in importing countries and increased production and transportation costs (18).



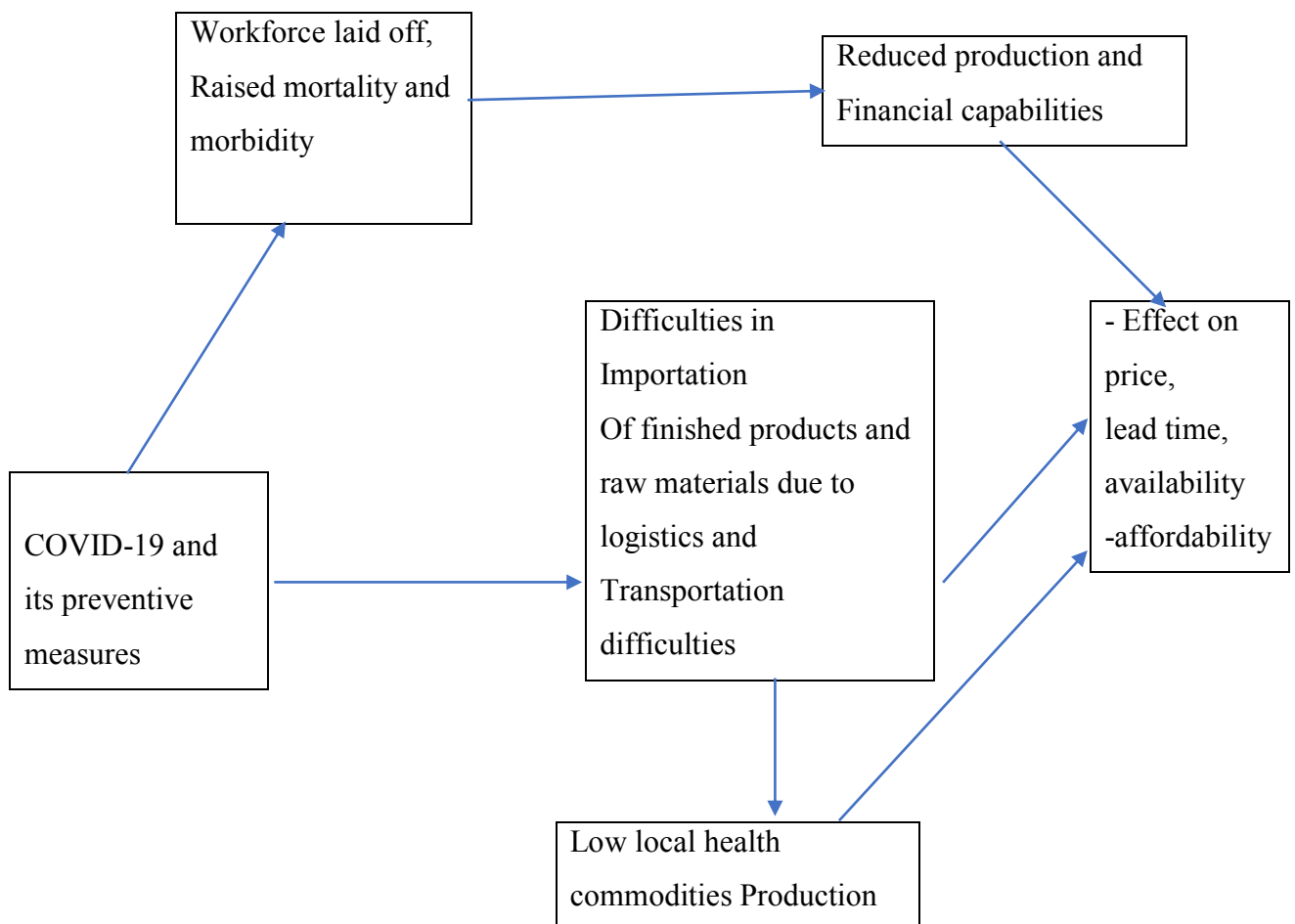
COVID-19 has also reduced production activities in different sectors leading reduction in workforce which has impact on the purchasing pattern of people (7). To date no study has been conducted to assess the impact of COVID-19 on the supply chain of essential health commodities in Tanzania.

This study therefore has assessed the impact of COVID-19 on the availability, changes in price, lead time and purchasing pattern of essential health commodities in Dar es Salaam city.

### 1.3 CONCEPTUAL FRAMEWORK

Tanzania largely depends on importation of health commodities due to its low local health commodities production which also depend on importation of pharmaceutical raw materials. Lockdown due to COVID-19 in exporting countries disrupt production, transportation and logistics activities which can affect availability, price, lead time and affordability.

COVID-19 and its preventive measures have led to workforce being laid off and increased mortalities and morbidities which have impact on production and financial capabilities of which have effects on the availability, price and affordability of health commodities.



**Figure 1: Conceptual framework**

#### **1.4 RATIONALE OF THE STUDY**

The utility of this study is to help decision makers and other health supply chain stakeholders to capture the magnitude of supply chain disruptions caused by COVID-19 in the country, and to give opinions that if followed can minimize the impact of the pandemic and other similar outbreaks or supply chain disruptors that might happen in the future.

#### **1.5 RESEARCH QUESTIONS**

- i. What are the effects of COVID-19 on the Availability of Essential health commodities in Tanzania?
- ii. How has COVID-19 affected the lead time of imported raw materials for local pharmaceutical manufacturing?
- iii. How has COVID-19 Affected the lead time of imported pharmaceuticals in Tanzania?
- iv. What are the impacts of COVID-19 on the prices of essential health commodities in Tanzania?
- v. What are the effects of COVID-19 on the people's purchasing pattern of essential health commodities in Tanzania?

#### **1.6 OBJECTIVES OF THE STUDY**

##### **1.6.1 Broad objectives**

The study aimed at assessing the impact of Covid-19 on the supply of essential health commodities in Tanzania.

##### **1.6.2 Specific objectives**

- i. To assess the effect of COVID-19 on the availability of selected essential health commodities in public health facilities.
- ii. To determine price changes of selected essential health commodities during the Covid-19 crisis.
- iii. To explore changes in lead time for imported essential health commodities
- iv. To explore changes in lead time for imported pharmaceutical raw materials
- v. To identify changes in customers' purchasing pattern of health commodities during COVID-19 Pandemic.

## CHAPTER TWO

### 1.7 LITERATURE REVIEW

Supply chain (SC) is a network of organizations and processes wherein a number of various enterprises (suppliers, manufacturers, distributors and retailers) collaborate (cooperate and coordinate) along the entire value chain to acquire raw materials, to convert those raw materials into specified final products and to deliver these final products to customers (22). Healthcare supply chains (HSCs) have often been considered different from the usual supply chains (SCs) due to their high level of complexity, the presence of high valuable medical materials and, finally, the fact that they deal with human lives (23).

Studies have shown that pandemics and other natural disasters cause demand-supply disruption depending on their nature and scope. COVID-19 pandemic has impacted global health product supply chains, affecting production of key materials and ingredients, finished health products, logistics and shipping (5). Measures implemented to cut down progression of the pandemic has impact on productivity hence affecting availability, price, lead time and customer's purchasing pattern of health commodities (24).

#### 1.7.1 Effect of COVID-19 on the availability of essential health commodities

Globally the pandemic has directly affected pharmaceutical production in key countries and a major impact on the pharmaceutical companies that depend highly on China for raw materials and finished products, as factories in China were not able to work at full capacity. India which is the supplier of essential pharmaceuticals in most low- and middle-income countries reduced production due to lockdown prompting concerns about availability of essential medicines in these countries (9).

About 70% of medicines used in Africa are imported from China and India (25,26). lockdown in these countries have impacts on the availability of essential medicines in African countries (6). Studies in Nigeria, have shown that lockdown which was accompanied with the closure of borders and travel ban led to a significant drop in the quantity of essential medicines in the health facilities, making it difficult for consumers to get the medicines they needed (24).

By 2010 Tanzania imported about 70 % of health commodities requirements and local production accounted only about 30% using imported active pharmaceutical ingredients (API) and other materials from China and India but recently local pharmaceutical production has gone down to about 12% of the country's requirements (16,18). Imported medicines in Tanzania are procured and distributed by local private wholesalers and public medical stores department (MSD). Wholesalers deliver products to the public through retail pharmacies, DLDMs, and the public health facilities as prime vendors where MSD Capacity seem inefficient (19).

Most of the local pharmaceutical production concentrates on less sophisticated medicines such as simple antibiotics, cough and cold preparations, analgesics and antipyretics, sedatives, nutraceuticals, anthelmintic and antimalarials. More technologically sophisticated pharmaceutical products like IV fluids, injectables, and more advanced antibiotics like cephalosporins are not produced by local industries which further necessitates their importation (16,19). Disruptions in the importation of both raw materials and finished health commodities is more likely to affect their availability in the country.

Currently there is no study conducted to determine the effect of COVID-19 on the availability of essential health commodities in health facilities in Tanzania, therefore this study will assess the effect of the pandemic on the availability of essential health commodities.

### **1.7.2 Price changes of health commodities**

Most supply chain disruptions impact supply (27), with COVID-19 pandemic initial global supply chain disruptions started on the supply side with factory closures in China aimed at slowing the spread of the pandemic (28), and disruptions caused by COVID-19 pandemic adversely affected production and financial flows for firms leading to disruptions in the production network (17,21). Barriers to supply chain and economic disruptions indicate fluctuations in the availability of essential medicines which is more likely to impact their prices (21). Several Cost drivers affect manufacturers of health commodities and the fear that manufacturers may favor larger buyers with higher margins and better prospects over smaller buyers (17). Diversion of production capacity for COVID-19-related medical products may also place additional constraints on the supply of other essential medicines, leading to a possible increase in their costs (9).

Stringent measures imposed by governments on pharmaceutical industries to cut down transmission of the pandemic and product contamination such as reduction in number of staff, safe distancing have impacts on cost of production of pharmaceuticals and other raw materials (13,21,29). African countries and developing countries are faced with inefficient health care system and insufficient supply chain management (22,25,30). Implementing lockdown and border closures in exporting countries have led to reduced logistics activities which are more likely to impact prices of health commodities (12,14). Studies in other countries have shown changes in demand and supply and regulation revisions which have impact on the prices of health commodities (5,22).

In Tanzania there is no study which have shown changes in price of essential health commodities as an impact of COVID-19 in the country, therefore this study will assess the impact of the pandemic in price of essential medicines.

### **1.7.3 Changes in lead time for imported essential health commodities and Pharmaceutical raw materials**

Supply chain disruptions interrupt materials/goods flows in a supply chain, sometimes resulting in abrupt cessation of movement of goods due to transportation disruptions which can be caused by natural disasters and other catastrophes (2). Pandemics as other natural disasters can affect logistics, shipping and other modes of transportation due to measures taken to prevent their spread (3,14,15).

Globally COVID-19 pandemic have caused delay in arrival/delivery of pharmaceuticals and raw materials in some countries (9,21). Lockdown have caused even more difficulties in logistics (15). Several countries have put in place measures to prevent importation of the virus by closing airports and closing borders which turn cause delays in pharmaceuticals and raw materials which is more prominent in African countries which largely depend on importation (23,25).

Tanzania as other low and middle income countries imports most of the pharmaceuticals from India and China which were severely affected by the pandemic (17,20). Measures taken to prevent the spread of the pandemic such as lockdown have paused logistics and boarder difficulties have implications in the lead time of the imported pharmaceuticals and raw materials.

In Tanzania there is no study which has assessed if there is changes in lead time of imported pharmaceuticals and raw materials, therefore this study will determine the change of lead time caused by the pandemic on imported pharmaceuticals and raw materials.

#### **1.7.4 Changes in Customer's purchasing pattern of essential health commodities**

The emergency of COVID-19 has disrupted the economy of the world by destructing the production in key countries which are sources of pharmaceuticals, raw materials, leading to financial impacts on firms and individuals (28,31). Measures implemented by the world to fight the disease have impacts on financial status of people (7,8). Due to closure of borders, lockdown, the rate of unemployment has exacerbated and severely affected those in the informal sector to even shrink further their economy (13,28).

In Tanzania, hospitality, hotels and other places which involve mass gathering were closed, closure of such places led to workforces being laid off , leading to impacts in the people's purchasing pattern in the country(32). Currently there is no study in Tanzania which has assessed the impacts of COVID-19 on the purchasing pattern of the people amid the pandemic.

## CHAPTER THREE

### 2. METHODOLOGY

#### 2.1 Study design

Mixed method study design.

##### 2.1.1 Quantitative methods

A retrospective register-based review of prices of selected products was done in the Regulatory Information Management system version 2.0 (RIMS 2.0) at TMDA Import/export section to capture for the change in price.

Cross sectional study was conducted to assess changes in availability and customer's purchasing pattern by involving retail pharmacy staff.

##### 2.1.2 Qualitative method

Guided interview was done to key staff dealing with importation at local pharmaceutical manufacturers and private importers to capture their views on the changes in availability, price and lead time of imported essential health commodities and pharmaceutical raw materials before and during the pandemic.

#### 2.2 Study setting

The study was conducted in Dar Es salaam, Tanzania where most of the pharmaceutical manufacturers, retailers, and importers of pharmaceuticals are situated.

#### 2.3 Study population

Study subjects were informants from pharmaceutical retailers, wholesalers, Manufacturers and importers.

#### 2.4 Sample size and sampling method

Two hundred and forty-two retail pharmacy staff each from one of the selected pharmacies 242 pharmacies were interviewed to assess the effects of COVID-19 on the supply chain of essential health commodities in the country.

A total of fifteen (15) participants from pharmaceutical industries (3) and health commodities importers (12 were obtained by purposive sampling method which enable us



to get experienced and knowledgeable pharmaceutical supply chain stakeholders from private health commodities importers and local pharmaceutical industries.

## **2.5 selection criteria**

### **2.5.1 Inclusion criteria**

#### **The study included;**

- i. Pharmaceutical dispensers with an experience of more than one year at the visited pharmacies.
- ii. Directors/managers of pharmacies who are also dispensers.

### **2.5.2 Exclusion criteria**

- i. Directors or managers of pharmacies who were not dispensers
- ii. Dispensers with an experience of less than one year

## **2.5 Variables**

In determining impact of COVID-19 on the change in price of essential health commodities, the Variable was the price which was determined by retrospective review of the RIMS Version 2.0 by comparing prices of selected essential health commodities before and during the pandemic.

In assessing impact of COVID-19 on the availability of Essential Health commodities, the Variable is the availability of selected commodities which was assessed by asking the retail pharmacy staff on the presence of health commodities before and during COVID-19.

In assessing impact of COVID-19 on lead time, the lead time was the Variable which was assessed by questioning the importers on the time taken to deliver the imported health commodities before and during the pandemic.

## **2.6 Data collection and Management**

### **2.6.1 Data collection tool**

Checklists and interview guides.

### **2.6.2 Data collection**

A researcher interviewed two hundred forty-two (242) staff in retail pharmacy using a checklist to capture how COVID-19 have affected the availability, price and customer's purchasing pattern of health commodities and the obtained participants' information and responses were fed into the MS Excel spreadsheet (Microsoft Excel®, Microsoft Corporation) which include their identification number, education level, working experience, and responses.

A total of fifteen (15) participants from pharmaceutical industries (3) and health commodities importers (12) were interviewed at their offices and at their convenient time using guided interviews with open ended questions, recorded using audio recorders, the records were transcribed and printed out, and Codes were developed during data analysis from each interview.

A retrospective longitudinal survey was done at the import/export desk at TMDA to track changes in prices of selected essential health commodities in the RIMS version 2.0 system, the Microsoft excel spreadsheets of all tracer commodities were extracted from the system and prices were recorded from March 2019 to February, 2020 and from March 2020 to February, 2021

### **2.6.3 Data management**

Data obtained by interviewing retail pharmacy staff were fed into Microsoft Excel spreadsheet and were double-checked to ensure quality of data. Ten entries were picked by simple random sampling from the collected data and cross-checked with the data sources to ensure correct data was entered in the excel sheet. All errors, double entries, and missing data were cleaned accordingly. Data was kept in a password secured computer to ensure confidentiality, and a copy was sent to the researcher's email.

## **2.7 Data Analysis**

The longitudinal data analysis was done by T-Test while quantitative interviews were analyzed for responses which were entered in the Microsoft excel.

The recorded qualitative interviews were transcribed and then translated into English languages, preliminary code book was developed which consisted of objectives, pre-determined codes and definitions, then Code book was developed which consists of Codes, Subthemes and themes (Thematic analysis).

## **2.8 Ethical considerations**

Ethical approval with reference no. MUHAS-REC-05-2021-605 was granted by the Directorate of Research and Publication ethical review committee at MUHAS. A letter of permission and ethical clearance was sent to Pharmacy Council, TMDA and to Private importers

## CHAPTER FOUR

### 4. RESULTS

The study involved qualitative interviews, quantitative interviews and documents review and the table below shows the social demographic information of participants.

**Table 1: Demographic information of participants.**

Categories of participants	Frequency (n=242)	Percentage
<b>Gender</b>		
<b>Male</b>	73	30.2
<b>Female</b>	169	69.8
<b>Working experience</b>		
<b>1- 2 years</b>	15	6.2
<b>2-5 years</b>	131	54.1
<b>&gt; 5 years</b>	96	39.7
<b>Education level</b>		
<b>Certificate</b>	129	53.3
<b>Diploma</b>	97	40.1
<b>Degree</b>	14	5.8
<b>Masters or More</b>	2	0.08
<b>Designation/working post</b>		
<b>Dispenser</b>	228	94.2
<b>Manager</b>	12	5
<b>Director</b>	2	0.8

During data analysis the following findings were obtained and are presented as per the objective of the study;

#### **4.1 Effects of COVID-19 on the availability of essential health commodities**

Under this objective, qualitative interviews of pharmaceutical importers generated a theme related to the effects of COVID-19 on the availability of essential health commodities which shows that there was low availability of commodities during the pandemic, three sub-themes emerged with respect to theme which included reduced production of health commodities, transportation disruptions and increased demand of health commodities, these sub-themes are presented below;

##### **4.1.1 Increased demand of some health commodities**

Most of the interviewees mentioned scarcity of health commodities during COVID-19 as compared to times before the pandemic, this was attributed to increased demand of some health commodities which were mostly needed during the outbreak. This led to availability challenges of such commodities.

*“YES, we based on those products especially products used in management of Pneumonia, Upper respiratory infection and Paracetamol for fever, the demand for those products was high and there were troubles in getting them”* (Participant 6)

An official from one of the pharmaceutical importation companies described that before COVID-19 they estimated few amounts of some commodities, but with the emerge of the pandemic their demand rose dramatically to the extent of running out of stock, this was attributed to their use in managing the pandemic and other related conditions.

*“...another thing is changes in demand, you find the amount you projected before COVID-19 is 300 units and then someone comes with a demand of 5000 units so you find running out of stock”* (Participant 3)

##### **4.1.2 Reduced production of health commodities**

Interviewees mentioned the reduction in number of staff in Pharmaceutical industries with the aim of maintaining social distance and decongesting pharmaceutical plants as a measure to prevent infection reduced the production of health commodities as industries couldn't work in their full capacity, this impacted the availability.

*“.....Manufacturing was also taking long because of working shifts to maintain social distance, imagine the plant which was taking 200 to 300 workers now using few people to reduce congestion, must use long period of time to manufacture the required amount of health commodities hence reducing availability in the market”* (Participant 6)

Participants further mentioned that some companies especially in highly infected countries stopped production of health commodities and importation of such products ceased due to lockdown and other restrictions imposed to control the pandemic, the control measures affected pharmaceutical production and their exports, this had impact on the availability in importing countries.

*“.... There certain times the importation process was ceased and especially from countries which were highly infected by COVID-19, some companies in countries where we import commodities from stopped production due to lockdown”* (participant 2)

*“.... Availability of some medicines We import decreased as their manufacturers reduced operations especially during the first phase of COVID-19”* (Participant 8)

#### **4.1.3 Delayed delivery of essential health commodities**

Interviewees highlighted that COVID-19 disrupted transportation due to lockdown and other restrictions imposed to contain the virus, as with the first wave most of the exporting countries closed their borders and suspended airways, these actions had impact on both delivery time of imported health commodities and availability in the market.

*“.....transportation faced some challenges because countries closed their borders and ceased airways, shipping processes decreased leading to reduced availability of commodities”* (Participant 10)

In a cross-section study of retail pharmacy staff, (216) 89 % of participants agreed that COVID-19 reduced availability of health commodities in the market.

Participants also mentioned various factors by which COVID-19 reduced availability of health commodities as shown in table 2 below;

**Table 2: Factors that led to reduced availability of commodities during the pandemic**

<b>Factors</b>	<b>Frequency (n=242)</b>	<b>Percentage (%)</b>
Increased price	60	25
Increased demand	57	24
Scarcity/unavailability from source	41	17
Panic buying	4	2
Switching to Covid-19 related products	3	1

Participants further mentioned a number of health commodities whose availability was reduced by COVID-19 in the market as listed in table 3 below.

**Table 3: Health commodities whose availability was reduced by COVID-19.**

<b>Health commodities</b>	<b>Frequencies (n=242)</b>	<b>Percentage</b>
<b>Vitamin C</b>	141	58
<b>Multivitamins</b>	111	46
<b>Dexamethasone</b>	104	43
<b>Azithromycin</b>	43	18
<b>Aspirin</b>	40	17
<b>Ivermectin</b>	30	12
<b>Colchicine</b>	27	11
<b>Paracetamol</b>	26	11
<b>Zinc</b>	23	10
<b>Repace H</b>	20	8
<b>Examination/surgical gloves</b>	18	7
<b>Prednisolone</b>	18	7
<b>Exam/surgical gloves</b>	10	4
<b>Prednisolone</b>	6	2
<b>Calcium supplements</b>	6	2
<b>Chloroquine tabs</b>	3	1
<b>Amoxicillin +clavulanic acid tablet</b>	3	1

Health commodities which were less available during COVID-19 outbreak were then classified into groups and the proportion of participants who mentioned the group are as shown in the table below.

**Table 4: Groups of health commodities frequently found to be less available during the outbreak.**

Health commodity group	Frequency (n=242)	Percent
Vitamins	178	74
Steroids	105	43
Antibiotics	51	21
Anticoagulants	52	21
Minerals	29	12
Analgesics	23	10
Gloves	18	7
Sanitizers	6	2
Masks	3	1

#### **4.2 Change in price of health commodities during COVID-19 crisis.**

Under this objective qualitative interview of pharmaceutical importers generated a theme of increase in price of essential health commodities with three sub-themes which include the rise in transportation costs, decrease in port clearance services and withholding stocks of health commodities as elaborated below,

##### **4.2.1 Increase in transportation costs**

Most participants mentioned that the raise in transportation costs had serious implication to selling prices of commodities, participants responded that sea shipment declined and sometimes they opted to cargo only aircraft due to lockdown and boarder closures in exporting countries this made them review their selling price to cater for the added costs.

*“On the other side transportation of consignments was very difficult and there are times sea shipment was very slow due to restrictions imposed in exporting countries and you find in such moments when we needed a certain consignment, then we opted to cargo only aircraft, this is expensive and has serious implications on our selling prices”* (Participant



#### **4.2.2 Decrease in port operations**

Participants mentioned that there was some delay caused by agents working inefficiently in clearing the goods due to either working from home or closing of their offices due to lockdown and other preventive measures.

There was slow clearance of consignments as workers in ports were reduced and some ports stopped operations this added some port charges which had impact on the price of health commodities.

*“because there times when agents offices were closed and we use agencies to clear and forward our consignments , so some closed their activities which necessitated us to switch to others who were working, these were charging a lot compared to before and had a lot of works to do , costs of clearance delays also increased importation costs”* (Participant 6)

*“It has affected greatly, and there times clearing agents closed their offices and sometimes were working from home and those who tried to open their office felt to be risking their lives which made them demand high charges all this delayed deliveries of commodities together with reduction of workers at ports of entry to decongest the places as a means to minimize the chances of infection, this imposed difficulties in clearing the consignments”* (Participant 8).

#### **4.2.3 Withholding stocks of health commodities**

Participants mentioned that some of the suppliers viewed COVID-19 as an opportunity to make a profitable business as they could withhold the stocks of the most demanded products, this led to less availability of certain commodities and consequently their prices raised.

*“Sometimes suppliers of certain products couldn't release the product or delayed to deliver the consignment purposely to make their products less available and specifically those products which were in one way or another involved in the management of COVID-19 with the intent to raise the price”* (Participant 14).

#### **Retrospective register-based method**

Quantitatively the retrospective register-based review of prices of selected products was done in the Regulatory Information Management system version 2.0 (RIMS 2.0) at TMDA Import/export section which found that the mean unit prices of selected essential health

commodities before and during COVID-19 pandemic changed. There was an increase in price for health commodities like Azithromycin tabs (0.001), Paracetamol tabs (0.000) and Multivitamin (0.003), the increase was statistically significant. While the prices for products like Examination gloves, Amoxicillin+ clavulanic acid tablets, Dexamethasone injection, Heparin injection, Vitamin C and Zinc tablets were increased but the increase was not statistically significant.

**Table 5: Mean unit prices of selected essential health commodities before and during COVID-19 outbreak.**

Tracer health commodities	Mean unit price before Covid-19 (USD) (March, 2019 to February, 2020) (n=9)	Mean unit price after Covid-19 (USD) (March 2020 to February,2021)	P-value
<b>Azithromycin (Zaha-500)</b>	5.4±0.2	6.129±0.5	0.001
<b>Paracetamol tablets, 500mg (Cetamolol)</b>	0.34±0.11	0.58±0.1	0.000
<b>Acetylsalicylic Acid tablets, 75 mg (Ascard 75)</b>	1.22	1.22	
<b>Clopidogrel tablets, 75 mg (Clavix 75)</b>	1.6	1.6	
<b>Ascorbic acid tablets</b>	1.1±0.15	3.8±0.14	0.57
<b>Multivitamin tablets (Carofit)</b>	2.28±0.06	2.9±0.12	0.003
<b>Heparin injection</b>	2.4±0.08	5.6±0.13	0.237
<b>Prednisolone tablets (Predilone)</b>	0.66	0.66	
<b>Dexamethasone injection (Deexa pack)</b>	5.3±0.19	9.5±0.12	0.05
<b>Zinc tablets (PedZinc)</b>	1.5±0.12	1.8±0.15	0.75
<b>Amoxicillin + clavulanic acid tabs (Neo-Clav)</b>	2.85±0.09	4.1±0.08	0.668
<b>Cetirizen 10 mg tablets (Oncet)</b>	0.5±0.16	0.56±0.1	0.077
<b>Ivermectin tablets (kelamectin 1%)</b>	1.96	1.96	
<b>Cotton wool (Velvex 500g)</b>	23.2	23.2	
<b>Absorbent Gauze</b>	8.57±0.15	8.9±0.17	0.778
<b>Examination gloves</b>	2.18±0.24	6.53±0.13	0.079

### **4.3 Changes in lead time of imported essential health commodities during COVID-19**

Interview of health commodity importers came out with theme of increased lead time of imported essential health commodities with the following sub-themes; decrease in shipments and decrease of customs activities as described below;

#### **4.3.1 Decrease in shipment**

Participants mentioned that COVID-19 posed difficulties in shipments due to boarder closure and airway suspension, therefore shipping and airways were not operating at their full capacity and this led to late delivery of imported health commodities.

*“You know, there were boarder closures and airway dumping, especially in countries we import from in such periods and you have an order it was difficult to be attended, then you must have delays and our own experience is that ships were delivering late as up to two times the period before COVID-19”.* (Participant 9)

*“Lead time increased as I said before, during the first wave of COVID-19 cargos reduced to the extent that ships couldn’t make it as it was supposed to be, sometimes ships could travel from one place to another to consolidate cargos, this had impact on delivery time”* (Participant 10)

One participant highlighted that before COVID-19 ships took one month to arrive and after imposing restrictions aiming to prevent the pandemic especially in exporting countries, ships could take to two months, which caused some delays and availability challenges.

*“There is a difference, there times the consignment that was to arrive within one month, took up to two months and that’s two times before COVID-19”* (Participants 8)

#### **4.3.2 Decrease of customs activities**

Participants mentioned that customs performance was affected by COVID-19 as restrictions imposed to fight the virus had impact on the number of staff in custom departments leading to underperformance.

*“Yes, some countries where we import medicines closed their boarders, there were no plane entering or leaving those countries, transportation in such countries was difficult, leading to delays , the consignment which could arrive in 20 days, the it was taking almost a month and that is even before clearance at our ports and You know during the first wave*

*(2020), we faced a challenge of delayed delivery, suppliers were complaining of delays at the customs as they were not working at their full capacity due to lockdown and other restrictions imposed by countries to fight the pandemic” (Participant 12)*

#### **4.4 Changes in lead time of imported pharmaceutical raw materials during COVID-19**

Under this objective interviewee from pharmaceutical industries emerged with one theme on the increased lead time of imported pharmaceutical raw materials with two sub-themes which include; decrease in number of consignments in exporting countries and Scarcity of pharmaceutical raw materials as elaborated below;

##### **4.4.1 Scarcity of pharmaceutical raw materials**

Participants mentioned that there was a reduced availability of pharmaceutical raw materials from the sources/suppliers, that the manufacturing was taking so long due to reduced number of staff in raw materials industries, this changed the delivery time as most orders couldn't be attended as soon as they used to be attended before COVID-19.

*“There has been a reduced availability of pharmaceutical raw materials, due to reduced production in raw materials industries and this is associated with lockdown in exporting countries, this has led to delayed delivery of orders of our customers, you find the order which were formerly attended for one month now are taking up to three months”* (Participant 13)

##### **4.4.2 Reduction of work force in manufacturing industries**

Participants mentioned that during lockdown, most industries reduced workers to decongest the plants aiming at fighting the spread of the infection, this had implication on production of raw materials leading to increased waiting times for the ordered amount. Therefore, industries required more time to manufacture the needed amount of consignments leading to delayed delivery.

*“.... another thing is reduction of workforces due to lockdown in the exporting countries leading to reduced /ceased pharmaceutical raw materials production leading to less availability and requiring more time to be delivered”* (participant 5)

Participants further said that, workforce in ports, clearing and forwarding agents and other key players in movements of consignments was either reduced or working inefficiently as others were working from home, this posed some delays of consignments leading to increased lead time of imported pharmaceutical raw materials.

*“There are many reasons as I have said before on the availability, also during lockdown industries reduced workers, clearing agents were also working inefficiently causing some delays in getting the ordered consignments”* (participant 13)

#### **4.5 Changes in customers’ purchasing pattern of health commodities during COVID-19 pandemic.**

Under this objective participant from retail pharmacy mentioned that there were some changes in purchasing patterns for different health commodities which were highly demanded during COVID-19 outbreak as shown in table 6 below;

**Table 6: Health commodities which were highly demanded during COVID-19**

Health commodities	Frequency (n=242)	Percentage
<b>Azithromycin</b>	222	92
<b>Vitamin C</b>	204	84
<b>Multivitamin</b>	91	38
<b>Prednisolone</b>	74	34
<b>Dexamethasone inj/tab</b>	62	26
<b>Paracetamol</b>	62	26
<b>Zinc</b>	61	25
<b>Asprin junior</b>	58	24
<b>Amox +clavulanic tabs</b>	54	22
<b>Covidol</b>	38	15
<b>Nimricalf</b>	27	12
<b>Heparin inj.</b>	16	7
<b>Cetirizen</b>	15	6
<b>Masks</b>	8	3
<b>Sanitizers</b>	7	3
<b>Calcium Supp</b>	5	2
<b>Celestamine</b>	3	1
<b>Ampicillin+cloxacillin caps</b>	3	1

Health commodities which were mentioned by participants to be more demanded during COVID-19 outbreak were then classified into groups as shown in the table below

**Table 7: Group of health commodities which were highly needed during COVID-19 outbreak.**

<b>Group of Health commodities</b>	<b>Frequency (n=242)</b>	<b>Percentage</b>
<b>Vitamins</b>	222	92
<b>Antibiotics</b>	208	86
<b>Steroids</b>	74	31
<b>Others</b>	65	27
<b>Herbal medicines</b>	59	24
<b>Minerals</b>	58	24
<b>Anticoagulants</b>	52	21
<b>Analgesics</b>	41	17
<b>Antihistamines</b>	15	6
<b>Masks</b>	5	2
<b>Sanitizers</b>	5	2
<b>Cough syrups</b>	6	2

Vitamins and antibiotics were the most demanded items

Participants were asked if COVID-19 has reduced the pharmacy business and their customers' ability to buy health commodities and 51% and 61% of participants disagreed with the fact that COVID-19 reduced pharmacy business and customers' purchasing pattern of health commodities respectively.

#### **Mitigation of challenges imposed by the pandemic**

Qualitative interviews came out with a theme on mitigation of challenges imposed by COVID-19 and two sub-themes were generated which included stockpiling and review of forecasting as describe below;

### **Stockpiling**

Findings suggest that importers were accumulating stock of health commodities for reserve in time of shortage as a means to mitigate the challenges of delays, they were stocking the mostly demanded commodities

*"We were overstocking, when we get a manufacturer who may be was supposed to supply us with 200 vials, we could even take 400 vials, so as to cover the gaps of delays"*  
(Participant 6)

### **Review of forecasting**

Respondents described that they reviewed their forecasting processes so as to meet the rising demands of commodities, there was an increase in quantities of commodities with high demands in the market.

*".....We tried our best to review our forecasting by looking at the commodities which were highly needed and adjusting the quantities so as to cover the predicted delays"*  
(Participant 11)

Quantitative interviews of retail pharmacy staff, participants mentioned different ways they adapted to sustain and make more business during the pandemic; the mentioned solutions are as shown in table 5 below;

**Table 8: Ways adapted by pharmacies to sustain their business during the pandemic.**

Ways	Frequency (n=242)	Percentage
<b>Stocking of highly demanded products</b>	153	63
<b>Production of Sanitizers</b>	15	6
<b>Regular review of products' prices</b>	49	20
<b>Direct delivery to clients</b>	2	1
<b>Multiple sourcing</b>	17	7

**Table 9: Thematic Analysis Coding Illustration**

Main Themes	Sub-themes	Quotes
Effect of COVID-19 on the availability of health commodities	Reduced production of health commodities	<p><i>“Manufacturing was also taking long because of working shifts to maintain social distance, imagine the plant which was taking 200 to 300 workers now using few people to reduce congestion, must take long period of time to manufacture the required amount of health commodities” (Participant 6)</i></p> <p><i>“..... availability of some medicines We import decreased as their manufacturers reduced their operations especially during the first phase of COVID-19” (Participant 8)</i></p>
	Increased demand of some health commodities	<i>“..... YES we based on those products especially products used in management of Pneumonia, Upper respiratory infection and Paracetamol for fever, the demand for those products was high and there were troubles in getting them” (Participant 6)</i>
	Delayed delivery of health commodities	<i>“...posed transportation challenges because countries closed their borders and ceased airways, shipping processes decreased” (Participant 10)</i>
price change of essential health commodities during COVID-19	Withholding stocks of health commodities	<i>“Sometimes suppliers of certain products couldn't release the product or delayed to deliver the consignment purposely to make their products less available and specifically those products which were in one way or another involved in the management of COVID-19 with the intent to raise the price” (Participant 14)</i>



	Decreased operations Port	<p><i>“because there times when agents offices were closed and we use agencies to clear and forward our consignments , so some closed their activities which necessitated us to switch to others who were working, these were charging a lot compared to before and had a lot of works to do , costs of clearance delays also increased importation costs” (Participant 6)</i></p> <p><i>"It has affected greatly, and there times clearing agents closed their offices and sometimes were working from home and those who tried to open their office felt to be risking their lives which made them demand high charges all this delayed deliveries of commodities together with reduction of workers at ports of entry to decongest the places as a means to minimize the chances of infection, this imposed difficulties in clearing the consignments” (Participant 8)</i></p>
	Increase in transportation costs	<p><b><i>"On the other side transportation of consignments was very difficult and there times sea shipment was very slow due to restrictions imposed in exporting countries and you find in such moments we hardly need a certain consignment, then we opted to cargo only aircraft, this is expensive and has serious implications on our selling prices” (Participant 15)</i></b></p>
Changes in lead time for imported essential health commodities during COVID-19	Decline in Shipment	<p><i>You know, there were boarder closures and airway dumping, especially in countries we import from in such periods and you have an order it was difficult to be attended, then you must have delays and our own experience is that ships were delivering late as up to two times the period before COVID-19”. (Participant 9)</i></p> <p><i>"Lead time increased as I said before, during the first wave of COVID-19 cargos reduced to the extent that ships couldn't</i></p>

		<i>make it as it was supposed to be, sometimes ships could travel from one place to another to consolidate cargos, this had impact on delivery time” (Participant 10)</i>
	Decreased customs activities	<i>Yes, some countries where we import medicines closed their borders, there were plane entering or leaving those countries, transportation in such countries was difficult, leading to delays , the consignment which could arrive in 20 days, the it was taking almost a month and that is even before clearance at our ports and You know during the first wave (2020), we faced a challenge of delayed delivery, suppliers were complaining of delays at the customs as they were not working at their full capacity due to lockdown and other restrictions imposed by countries to fight the pandemic” (Participant 12)</i>
Changes in lead time of imported pharmaceutical raw materials during COVID-19	Decrease in freight movements	<i>Secondly, before Covid-19 the shipping line was very busy compared to this era of COVID -19 where the shipping line is not busy due to few consignments, so ships tend to consolidate cargos leading to delayed delivery” (Participant 5)</i>
	<i>Scarcity of pharmaceutical raw materials</i>	<i>“There has been a reduced availability of pharmaceutical raw materials, due to reduced production of raw material industries and this is associated with lockdown in exporting countries, this has led to delayed delivery of orders, you find the order which were formerly attended for one month now are taking up to three months”.(Participant 13)</i>
Mitigations of challenges imposed by COVID-19 on	Stockpiling	<i>"We were overstocking, when we get a manufacturer who may be was supposed to supply us with 200 vials, we could even take 400 vials, so as to cover the gaps of</i>

importation		<i>delays" (Participant 6)</i>
	Review of forecasting	".....We tried our best to review our forecasting by looking at the commodities which were highly needed and adjusting the quantities so as to cover the predicted delays" (Participant 11)

## CHAPTER FIVE

### 5. DISCUSSION

This chapter discusses findings of the impact of COVID-19 on the availability, price, lead time for both imported health commodities and pharmaceutical raw materials and changes in purchasing pattern of essential health commodities.

#### **5.1 Effect of COVID-19 on the availability of essential health commodities.**

##### **5.1.1 High demand of some health commodities**

Results in this study show that there was an increased demand of some health commodities especially those which were mostly needed during the outbreak. This led to availability challenges of such commodities as they were overused. Products such as Ascorbic acid, Multivitamins, Dexamethasone, Azithromycin, Acetylsalicylic acid, Ivermectin, Colchicine and Zinc were mentioned to be more demanded and at the same time to be less available. This is in consistency with studies which have shown that supply chains are vulnerable to risks such as supplier disruptions, transportation disruptions or delays and customer demands fluctuations. Natural and anthropogenic risks such as floods, earthquakes, power shortages, labor strikes and pandemics can disrupt the supply chain at the very source (31,33). Studies in Rwanda have shown that during COVID-19 the country faced an increase in demand of drugs and health commodities with importation difficulties which led to low availability (29). The European Medicines Agency (EMA) also reported that some commodities which were highly demanded during COVID-19 such as anesthetics, antibiotics, Resuscitation machines and muscle relaxants posed some challenges in their availability and their supply chains were highly monitored (33). Also a study done in Asian countries has found that during COVID-19 utilization of some commodities such as Vitamins, Antibiotics and personal protective equipment increased and their prices greatly increased compared to times before COVID (39).

##### **5.1.2 Reduced production of health commodities**

Findings from this study reveal that during COVID-19, there was low production of health commodities in local pharmaceutical industries because of lockdown and other restrictions which were imposed to contain the disease in countries where raw materials are sourced. This led to delayed delivery of pharmaceutical raw materials to the extent of stopping

production of some commodities. This aligns with reports which have shown that control measures implemented to control the pandemic have imposed barriers on the manufacturing sectors by disrupting the supply chain in manufacturing industries (34). Reports further reveal that some industries in China which is the exporter of active pharmaceutical ingredients stopped production of active pharmaceutical ingredients and other pharmaceuticals during the first wave of COVID-19 (11,17). All these had impact on the availability of health commodities.

#### **5.1.4 Delayed delivery of health commodities**

Findings in this study show that COVID-19 disrupted transportation due to lockdown and other restrictions imposed to control the virus. With the first wave most of the exporting countries closed their borders and suspended airways, these actions delayed delivery of imported health commodities consequently low availability in the market. Studies have shown that transportation disruption is a source of risk that can quickly cripple the entire supply chain (2).

Findings of this study on the availability of health commodities are in agreement with the quantitative interview findings which further suggest that COVID-19 reduced availability of essential health commodities. About 89.3% of participants from retail pharmacy agreed that the pandemic reduced the availability of health commodities and they further mentioned factors that led to reduced availability of health commodities during the pandemic such as delivery delays, increase in demand of some commodities, increase in price, panic buying, and switching to COVID-19 related products by pharmaceutical industries. This is comparable to the study conducted in Nigeria, which showed that lockdown which was accompanied with the closure of borders and travel ban led to a significant drop in the quantity of essential medicines in the health facilities making it difficult for consumers to get the medicines they needed (24). Findings also align with report of the United Nations Conference on Trade and Development (UNCTAD) which had predicted that disruptions in the maritime transport which underpins the global supply chain would have impacts on the availability and cost of merchandise in developing countries which depend on importation and shipping as well (35,36).

## **5.2 Change in price of essential health commodities during COVID-19.**

Findings in this study suggest that during the pandemic there was changes in price of some health commodities. Results obtained by review of the Regulatory Information Management System version 2.0 at TMDA to track for changes in price of selected essential health commodities has shown a significant increase in unit prices of some selected essential health commodities as can be appreciated in the table 5 of the results.

Participants from pharmaceutical importing companies revealed that during COVID-19 there was an increase in price of some health commodities and they attributed this to increase in transportation costs, decrease in port operations and withholding of stocks of some health commodities as elaborated below;

### **5.2.1 Increase in transportation costs**

Findings in this study suggest that there was an increase in transportation costs during COVID-19. Sea shipment declined due to reduced transportation activities and production in exporting countries as a result of lockdown and other measures implemented to stop the spread of the infection. Most participants viewed that the rise in transportation costs had serious implication to selling prices of commodities. Since sea shipment declined and sometimes, they opted to cargo only aircraft due to lockdown and boarder closures in exporting count. This is in consistency with the UNICTAD report on maritime transport which have shown an increase in transportation costs (35,37).

### **5.2.2 Decrease in port operations**

Results in this study revealed that during COVID-19 there was a reduction in port operations. Participants stressed that During the pandemic there was difficulties in importing health commodities due to reduced port operations. Consignments could stay at ports for some times leading to added charges. This impacted the price of essential health commodities. This findings aligns with the other studies have shown that COVID-19 decreased port operations which imposed difficulties in importation of health commodities, this has had impact on the price of imported commodities (32,37,38).

### **5.2.3 Withholding stocks of health commodities**

Findings of this study have shown that some suppliers of health commodities were withholding their stocks of health commodities. This led to reduced supply and specifically of commodities which were highly demanded during COVID-19 with the aim of selling them at higher price in the future. This led to increase in price of some health commodities. Specifically, those which were in high demand during the pandemic. This is similar to the study done in Rwanda which has shown an increase the price of medicines and other health commodities during COVID-19 due to difficulties in getting them from their suppliers. This reduced supply led to increased price of those health commodities(29).

## **5.3 Changes in lead time of imported health commodities during COVID-19**

### **5.3.1 Decline in shipment**

Findings suggest that during COVID-19 the lead time of imported health commodities increased. This was attributed to transportation disruptions caused by the pandemic. There were delayed deliveries as exporters had few cargos and ships had to consolidate the cargos from different suppliers. This could take sometimes hence delaying the delivery of commodities. The delayed delivery may be due to decline in shipments as indicated by participants from importing companies. Participants revealed that due to lockdown and other measures implemented to stop the spread of the pandemic in exporting countries industrial production decreased. This led to reduction in consignments to be transported which consequently reduced shipments. This is in agreement with the United Nations Development Program (UNDP) report on socio-economic impact of COVID-19 in Tanzania April, 2020 which highlighted that between February and April, 2020 there was a declining trend in the number of freight ships and it further predicted that Tanzania would face a decline in cargo volumes and subsequent stagnation of domestic logistic services (10,32). The 2020 port report on the impact of COVID-19 on shipping trade, trans-shipment, throughput of container ports in Latin America and the Caribbean, has shown that there was reduction in shipments and cargo volumes which increased lead times of imported commodities (38). The World Bank report on the impact of COVID-19 on logistics have shown that the impact of COVID-19 was first felt in China due to its role in global manufacturing, disruptions of manufacturing in China rippled through global supply chains. Cargo were backlogged at China's major container ports, travel restrictions led to a

shortage of truck drivers to pick up containers, and ocean carriers canceled (or blanked) sailings, this led to increased lead times of freights movement (40).

### **5.3.2 Decrease in customs activities**

Findings in this study show that during COVID-19 there was underperformance in customs due to restrictions imposed to fight the pandemic. The underperformance led to delays in clearance of consignments leading to increased lead time of imported health commodities as the imported commodities could stay at the customs for several days before being cleared.

Studies have shown that Customs Administrations and cross-border agencies provide essential services to guarantee and secure the cross-border movement of goods, especially essential products such as medicines. During COVID-19 sometimes borders were closed so as to contain the virus and some remained open to maintain supply chain of essential commodities but with reduced activities which increased lead time of imported health commodities (36).

## **5.4 Changes in lead time of imported pharmaceutical raw materials during COVID-19.**

### **5.4.1 Scarcity of pharmaceutical raw materials**

This study found that delayed delivery of pharmaceutical raw materials was linked with less availability of materials from the sources. That sources had to consolidate the required amount from different manufacturers. This aligns with the study which have shown that, With COVID-19, initial disruptions started on the supply side of pharmaceutical raw materials with factory closures in China which were instituted to slow the spread of virus. This led to shortages of raw materials worldwide as China is the major source of active pharmaceutical ingredients. Reports show that India decided to stop exporting 26 active pharmaceutical ingredients amid fear of shortages within the country. This could have worldwide impacts especially on supplies of Paracetamol, Antibiotics and Vitamin B12. Beyond disruption on the supply side there have been direct demand raise in other commodities specifically those which were involved in management of the disease(6,9).



This study further found that active pharmaceutical ingredients (API) and other key starting materials for local manufacturing are sourced mainly from India and China. Respondents from local pharmaceutical manufacturers said that when the two countries implemented lockdown and other restrictions, availability of raw materials decreased to the extent stopping production of some products. They mentioned Paracetamol as one of the active pharmaceutical ingredients whose supply has been regularly disrupted and its price has dramatically increased. The findings are similar to studies done in India where disruption of international shipping led to delays, increased lead times and rising costs of raw materials (17,23,36).

#### **4.4.2 Reduction of workforce in manufacturing plants**

Findings in this study show that during COVID-19 specifically in exporting countries there was reduction of man power in raw materials industries with the aim of preventing the spread of the infection. This reduction in workforce impacted production and availability of raw materials leading to delays as importers were required to wait for the consignments to be manufactured and it was taking long due to few workforces. This aligns with report on industrial production in China during COVID-19 outbreak which have shown a reduction in number of workers and introduction of shifts with the aim of preventing the infection (11).

#### **5.5 Changes in customers' purchasing pattern of essential health commodities during COVID-19**

Results of this study have shown that during the COVID-19 there was a public panic, clients could purchase commodities as long as they are assured that it could be useful in managing the pandemic. Although the economy wasn't good but clients with and without any signs and symptoms of the disease could go to pharmacies and buy medicines for immediate use and sometimes for future use, 51% and 61% of retail pharmacy staff disagreed with the fact that COVID-19 reduced pharmacy business and customers' purchasing pattern of health commodities respectively. Further conveyed that there was business during COVID -19 as long as you have in stock the demanded health commodities. This aligns with the study on challenges and opportunities of COVID-19

which have highlighted some commodities such as ventilator machines, oxygen concentrator as products which seemed to be opportunities during the pandemic (8,41).

Results further show that during COVID-19 some health commodities such as Azithromycin tablets, Vitamin C/ Ascorbic acid, Multivitamins, Paracetamol and Dexamethasone, masks and sanitizers were highly demanded and could be bought at a higher price more than the price before the pandemic. This aligns with the study in Asian countries (Pakistan, Bangladesh, Malaysia, South Korea and India) which have shown the increase in demand for antimicrobials, multivitamins and other drugs which were used in managing COVID-19 (10,42).

### **Mitigations of Challenges imposed by the pandemic.**

This study found that during COVID-19, companies/ pharmacies were stockpiling especially the highly demanded products compared to the period before the pandemic. Participants in retail pharmacies, pharmaceutical importers and local manufacturers said that they were stocking as much as possible so as not to run out of stock (buffer stock). Studies have shown that before COVID-19 most companies worldwide were implementing lean supply chain management with the focus to minimize cost and just in time delivery. This caused the supply chain of most companies to be prone to the COVID-19 outbreak as they were left with no buffers in terms of provisions forcing them to build inventories which may act as buffer to combat the disruptions in the supply chain (21). Studies have also shown that result of events such as the 2002–2003 SARS epidemic, the March 2010 Iceland's volcano eruption, Japan's earthquake and tsunami in March 2011, and the flood in Thailand in August 2011, companies increased the amount of inventory they kept on hand (5).

Results in this study have shown that most of pharmaceutical retailers, pharmaceutical importers and local pharmaceutical manufacturers switched to multiple suppliers (multi-sourcing) rather than single sources for their needs due to challenges of out of stocks. Respondents stressed that multiple sources were saving in cases if the suppliers were running out of stocks. This aligns with the 2020 Global Fund recommendations on the COVID-19 impact on global health product supply which advised the implementing partners to look for alternative sources of pharmaceuticals as the pandemic surges (22).

## CHAPTER SIX

### 6. CONCLUSION AND RECOMMENDATIONS

#### 6.1 Conclusion

Findings of this study show that COVID-19 has impacted the supply of essential health commodities by reducing availability, increasing price for some products and lead time of imported health commodities and pharmaceutical raw materials, further the study found changes in purchasing pattern of health commodities where for some commodities demand was increased dramatically while their supply decreased.

#### 6.2 Study limitations

- i. The study was conducted in one region among many regions found in the country
- ii. The study was conducted in private pharmaceutical companies only
- iii. Failure to get permission for data collection at some institutions

#### 6.3 Recommendations

- i. Health commodities importers should have multiple sources of their products to ensure constant availability of products even when supply from other suppliers/countries is disrupted.
- ii. A further research should be done on the impact of COVID-19 on the supply of essential health commodities in other regions in Tanzania and by adding more tracer commodities

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## APPENDICES

### Appendix 1- Interview guide for retail pharmacy staff Demographic information

1. Sex M/F.....
2. Working post
  - a. Dispenser
  - b. Pharmacy Manager
  - c. Pharmacy director
3. Level of Education
  - a. Certificate
  - b. Diploma
  - c. Undergraduate
  - d. Postgraduate
4. Length in practice
  - a. 2 years or less
  - b. 2-5 years
  - c. More than five years
  - a. Do you think COVID-19 Outbreak reduced the availability of essential medicines ?
 

NO

YES
  - b. In which ways was Availability of health commodities reduced by COVID-19?
  - c. Which health commodities do you think their availability was reduced by COVID-19 Pandemic?
  - d. Which health commodities were in high demand during the COVID-19 Pandemic?
  - e. Do you think COVID-19 outbreak reduced pharmacy business?
 

NO

YES
  - f. Do you think clients' ability to purchase medicines affected by the COVID-19 outbreak?
 

YES

NO



## **Appendix 2-Interview guide for health commodities importers**

### Demographic information

1. Sex M/F.....
2. Working post
  - a. Procurement officer
  - b. Manager
  - c. Director
3. Level of Education
  - a. Certificate
  - b. Diploma
  - c. Undergraduate
  - d. Postgraduate
4. Length in practice
  - a. 2 years or less
  - b. 2-5 years
  - c. More than five years

### QUESTIONS;

1. What processes are involved in the importation of medicines ?
2. How has COVID-19 affected the importation of medicines?  
Probe for the following if not covered by the interviewee;
  - a. What changes in length of the time taken from placing to receiving of orders of imported medicines have you experienced during the COVID-19 Outbreak?
  - b. How do you compare the price of medicine before and during the COVID-19 Outbreak?
  - c. How do you compare the availability of medicines before and during the COVID-19 Outbreak?
  - d. Please mention any new medicine/health commodity available in the pharmacy/market post COVID-19?
3. What solutions so far have you taken to mitigate the challenges imposed by the pandemic?

## Appendix 3-Interview guide for local pharmaceutical manufacturers

### Demographic information

1. Sex M/F.....
2. Working post
  - a. Procurement officer
  - b. Manager
  - c. Director
3. Level of Education
  - a. Certificate
  - b. Diploma
  - c. Undergraduate
  - d. Postgraduate
4. Length in practice
  - a. 2 years or less
  - b. 2-5 years
  - c. More than five years

1. What processes are involved in importation of pharmaceutical raw materials ?
2. How has COVID-19 affected the supply chain of pharmaceutical raw materials in your industry?

Probe for the following if not covered by interviewee

- a. How do you compare the availability of Pharmaceutical raw materials before and during the COVID-19 Pandemic?
  - b. What changes in price of pharmaceutical raw materials are you experiencing since the eruption of COVID-19?
  - c. What changes in length of the time taken from placing to receiving of orders of imported pharmaceutical raw materials have you experienced during the COVID-19 Outbreak?
3. What mechanisms are you employing to rectify the challenges encountered

#### Appendix-4 Swahili version (dodoso)

Kwa wauzaji wa rejareja wa dawa

Taarifa za Mshiriki

1. Jinsia Me/Ke.....
2. Cheo
  - a. Mtoa dawa
  - b. Meneja
  - c. Mkurugenzi
3. Kiwango cha Elimu
  - a. Cheti
  - b. Diploma
  - c. Shahada ya kwanza
  - d. Shahada ya pili/Zaidi
4. Muda aliotumikia
  - a. Chini ya miaka miwili
  - b. Kati ya miaka 2-5
  - c. Zaidi ya Miaka 5
  - a. Unafikiri mlipuko wa Ugonjwa wa Virusi Korona ulipunguza upatikanaji wa dawa ?

NDIYO

HAPANA

- b. Unafikiri ni kwa njia zipi COVID-19 ilipunguza upatikanaji wa upatikanaji wa dawa ?
- c. Ni dawa zipi unafikiri upatikanaji wake ulipunguzwa na mlipuko wa COVID-19 ?
- d. Je ni dawa zipi zilihita jika sana kipindi cha mlipuko wa ugonjwa wa COVID-19?
- e. Unadhani UVIKO-19 ulipunguza biashara ya Dawa ?
- f. Unadhani uwezo wa wateja wa kufanya manunuzi ya dawa ulipunguzwa na mlipuko wa COVID-19?
  - g. Njia zipi mlitumia kuhakikisha biashara yenu inaendelea kufanya vizuri wakati wa mlipuko wa COVID -19 ?

## Waagizaji wa Dawa nje ya Nchi

### Taarifa za Mshiriki

1. Jinsia Me/Ke.....
  2. Cheo
    - a. Mtoa dawa
    - b. Meneja
    - c. Mkurugenzi
  3. Kiwango cha Elimu
    - a. Cheti
    - b. Diploma
    - c. Shahada ya kwanza
    - d. Shahada ya Uzamili na Kuendelea
  4. Muda aliotumikia
    - a. Chini ya miaka miwili
    - b. Kati ya miaka 2-5
    - c. Zaidi ya Miaka 5
1. Je ni taratibu zipi zinafuatwa kuagiza dawa na bidhaa zingine za afya nje ya nchi ?
  2. Ni namna gani COVID-19 imeathiri uagizaji wa dawa nje ya nchi ?  
 Uliza vitu vifuatavyo kama havijaelezwa kwenye maswali hapo juu;
    - a. Baada ya mlipuko wa ugonjwa wa virusi vya Corona unahisi kuna mabadiliko gani kwenye muda unaotumika kupata shehena ya dawa zilizoagizwa kutoka nje ya nchi ?
    - b. Unalinganishaje bei ya kuagiza dawa kabla na baada ya mlipuko wa ugonjwa wa virusi vya Corona
    - c. Baada ya mlipuko wa ugonjwa wa virusi vya Korona, unafikiri kuna tofauti kwenye upatikanaji wa dawa unazoagiza?
    - d. Tafadhari unaweza taja dawa zilizogunduliwa kwa ajili ya kutibu Ugonjwa wa Virusi vya Korona ?
  3. Ni njia gani mmetumia kupambana na changamoto zilizosababishwa na mlipuko kwenye mfumo wa uagizaji wa dawa ?

## **Viwanda vya dawa vya ndani**

### Taarifa za Mshiriki

1. Jinsia Me/Ke.....
2. Cheo
  - a. Mtaalamu wa Manunuzi
  - b. Meneja
  - c. Mkurugenzi
4. Kiwango cha Elimu
  - a. Cheti
  - b. Diploma
  - c. Shahada ya kwanza
  - d. Shahada ya pili
5. Muda aliotumikia nafasi yako
  - a. Chini ya miaka miwili
  - b. Kati ya miaka 2-5
  - c. Zaidi ya Miaka 5
1. Ni hatua zipi munapitia kuagiza malighafi za kutengenezea dawa nje ya nchi?
2. Ugonjwa wa Virusi vya korona umeathiri vipi mnyororo wa ugavi wa malighafi ya kutengenezea dawa kwenye kiwanda chenu.  
 Uliza vifuatavyo kama havijaongelewa na mzungumzaji
  - a. Unalinganishaje upatikanaji wa malighafi ya kutengeneza dawa kabla na baada ya mlipuko wa ugonjwa wa mlipuko wa virusi vya Corona?
  - b. Tangu kutokea kwa mlipuko wa ugonjwa wa virusi vya Korona kuna mabadiliko gani ya bei ya malighafi za kutengenezea dawa uliyoyaona ?
  - c. Baada ya mlipuko wa ugonjwa wa virusi vya Corona unahisi kuna mabadiliko gani kwenye muda unaotumika kupata shehena ya dawa zilizoagizwa kutoka nje ya nchi ?
3. Mbinu gani mnatumia kuzikabili changamoto kwenye mnyororo wa ugavi zitokanazo na mlipuko wa ugonjwa wa virusi vya Korona ?

**Appendix 5-Checklist for tracking change in price of selected health commodities**

CHECKLIST FOR TRACKING CHANGES IN PRICE		
Tracer medicines	Average unit price before Covid-19 (USD) (March, 2019 to February, 2020	Average unit price after Covid-19 (USD) ( March,2020 to February, 2021)
Azithromycine (Zaha-500)		
Paracetamol tablets, 500mg (Cetamol)		
Acetylsalicylic Acid tablets, 75 mg		
Clopidogrel tablets, 75 mg (Clavix 75)		
Ascorbic acid tablets		
Multivitamin tablets (Carofit)		
Heparin injection		
Prednisolone tablets (Predilone)		
Dexamethasone injection (Deexa pack)		
Zinc tablets (PedZinc)		
Amoxicillin + clavulanic acid tabs (Neo-Clav)		
Cetirizen 10 mg tablets (Oncet )		
Ivermectin tablets (kelamectin)		
Cotton wool (Velvex 500g)		
Absorbent Gauze		
Examination gloves		

**Appendix 6- Informed consent form****MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES****DIRECTOR OF RESEARCH AND PUBLICATION**

Consent to participate in the study: ENTITLED: **Assessment of impact of COVID-19 on the supply chain of essential health commodities in Tanzania.**

My name is Pius Ipagala, a postgraduate student in Department of Pharmaceutics and Pharmacy Practice at Muhimbili University of Health and Allied Sciences(MUHAS). I am conducting a research study on assessment of the impact of COVID-19 on the supply chain of essential health commodities in Tanzania. I hereby request you for participation.

**Purpose of the study:** The purpose of this study is to assess the impact of COVID-19 on the supply chain of essential health commodities in Tanzania.

**What participation involves:** If you agree to join the study, you will meet the researcher for assessment at the facility store of health commodities. Data will be collected and filled in data collection tools through guided interview and document review

**Confidentiality:** The information from the study will be kept confidential and kept in a safe place with access to authorized personnel and will be used for research purposes only. No names will be used instead designation will be used to maintain anonymity of participants.

**Duration:** Participation will take about 30 minutes

**Risks:** For this study, we don't expect any risk prior because no any invasive procedure will be employed only information will be provided regarding impact of COVID-19 on supply chain of essential health commodities.

**Rights to withdrawal:** Taking part in this study is completely your choice. You are free to choose either to participate in this study or not. You can decide to stop participating in this study at any time you wish even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

**Benefits:** If you agree to take part in this study, there are no direct benefits that you will get but information obtained from this study will be used by policy makers and other decision makers of the Government realize the impact of the pandemic on the supply chain of essential health commodities and measures taken to handle the challenges currently and in the future.

**Compensation:** There will be no compensation/or payment of any kind for participating in this study.

**Whom to contact:** In case of any questions from this study, don't hesitate to contact the principal investigator Pius Ipagala, P. O. Box 65001, Muhimbili University of Health and Allied Sciences, Department of Pharmaceutics and pharmacy practice, Phone +255 712898944, [ipapiu2006@gmail.com](mailto:ipapiu2006@gmail.com)

Or

The Chairperson of Research and Publication Committee, P.O. Box 65001, Muhimbili University of Health and Allied Sciences (MUHAS), Telephone 022-2152489

**Consent:** I am willing to participate in the study to assess the impact of COVID-19 on the supply chain of essential health commodities in Tanzania. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason, all of which have been explained to me by Pius Ipagala.

Signature of participant .....

Signature of Principal Investigator .....



The Date signed consent .....

Fomu ya Ridhaa

**CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI MUHIMBILI**



**KURUGENZI YA TAFITI NA UCHAPISHAJI**

Fomu ya ridhaa ya kushiriki katika utafiti wenye kichwa kinachosema: **Tathmini ya madhara ya ugonjwa wa virusi vya Korona kwenye mnyororo wa ugavi wa bidhaa muhimu za afya nchini Tanzania.**

Jina langu ni Pius Ipagala mwanafunzi wa shahada ya uzamili katika shule ya dawa katika Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Ninafanya utafiti wa Tathmini ya madhara ya ugonjwa wa virusi vya Korona kwenye mnyororo wa ugavi wa bidhaa muhimu za afya . Nakuomba ushiriki.

**Umuhimu wa utafiti huu:** Lengo kuu la utafiti huu ni kutathmini madhara ya ugonjwa wa virusi vya Korona kwenye mnyororo wa ugavi wa bidhaa muhimu za afya.

**Jinsi ya kushiriki:** Ukikubali kushiriki katika utafiti huu, utakutana na mtafiti ili kutathmini madhara ya ugonjwa wa virusi vya Korona kwenye mnyororo wa ugavi wa bidhaa za afya. Takwimu zitakusanywa na kujazwa katika fomu za kukusanyia taarifa kwa kuangalia nyaraka pamoja na mahojiano.

**Usiri:** Taarifa zote zitakazopatikana kwenye utafiti huu zitahifadhiwa sehemu maalumu ambapo wahusika tu ndio wataruhusiwa kuzipata taarifa hizo na zitatumika kwa ajili ya utafiti tu. Pia majina hayatumika badala yake tutatumia vyeo tuu kudumisha kutokujulikana kwa washiriki.

**Muda:** Muda wa kushiriki katika utafiti ni wastani wa dakika 30

**Madhara:** Hatutegemei madhara yoyote kukutokea ukiwa /ama baada ya kushiriki katika utafiti huu kwa sababu hakuna utaratibu wowote vamizi (kuingia mwilini kwa kukata au kutoboa ngozi au kwa kuingiza vyombo) utakaotumika isipokuwa taarifa zitatolewa

kuhusu madhara ya ugonjwa kwenye mnyororo wa ugavi na hati za utunzaji na ununuzi wa dawa.

**Haki ya kushiriki au kusitisha kushiriki:** Kushiriki katika utafiti huu ni chaguo lako, na una uhuru wa kukubali au kukataa kushiriki katika utafiti huu. Pia unaweza kusitisha ushiriki wako katika utafiti huu muda wowote utakapojisikia hivyo hata kama umeshakubali kushiriki. Kukataa kushiriki au kusitisha kushiriki katika utafiti huu hakutakufanya upoteze haki zako za msingi au kupata adhabu yoyote.

**Faida:** Ukikubali kushiriki katika utafiti huu hakuna faida ya moja kwa moja utakayoipata lakini tunaamini taarifa utakazotoa zitasaidia watunga sera na watoa maamuzi wengine wa serikali kutambua ikiwa kuna madhara yoyote yametokea kwenye mfumo wa ugavi wa bidhaa za afya na namna zinavyotatuliwa kwa ajili ya kutengeneza sera zitakazosaidia kukabiliana na hili janga pamoja na majanga mengine mbeleni.

**Fidia:** Hakutakuwa na fidia yoyote au malipo yatakayotolewa katika utafiti

**Mawasiliano:** Kama utakuwa na swali lolote kuhusu utafiti huu usisite kuwasiliana na mtafiti mkuu Pius Ipagala S. L. P 65001, Chuo Kikuu cha Afya na Sayansi Shirikishi(MUHAS), Idara ya Dawa, Simu +255 753 781 999, barua pepe [ipapiu2006@gmail.com](mailto:ipapiu2006@gmail.com)

Au kama kuna shida yoyote imejitokeza na huwezi kujadiliana na mtafiti, tafadhari wasiliana na Mwenyekiti wa kamati ya utafiti na uchapishaji, S.L. P 65001, Chuo Kikuu cha Afya na Sayansi Shirikishi(MUHAS), Dar es Salaam Simu +255 022-2152489, barua pepe [drp@muhsa.ac.tz](mailto:drp@muhsa.ac.tz)

**Ridhaa:** Nipo tayari kushiriki katika utafiti huu wa kutathmini madhara ya Ugonjwa wa virusi vya Korona kwenye mnyororo wa ugavi wa bidhaa muhimu za afya. Nimeelewa kwamba ushiriki wangu ni wa hiari hivyo niko huru kujitoa wakati wowote bila kutoa sababu kama ambavyo nimefafanuliwa na Pius Ipagala.

Saini ya mshiriki .....

Saini ya mtafiti mkuu .....

Tarehe .....