Anti-TB Medicines Supply Chain Management Practices and Related Challenges in Gurage Zone Public Health Facilities, Southern Ethiopia

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This is to certify that the thesis prepared by Sifrash Gezahagn, entitled: *Anti-TB Medicines Supply Chain Management Practices and Related Challenges in Gurage Zone Public Health Facilities, Southern Ethiopia* and submitted in partial fulfilment of the requirements for the Degree of Master of Science (Health Supply Chain Management) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abbreviations and Acronyms

CDC	Centers for Disease Control and Prevention
DOT	Directly Observed Treatment
EPSA	Ethiopian Pharmaceutical Supply Agency
FMHACA	Food, Medicine and Health Care Administration and Control Authority
EMOH	Ethiopian Ministry Of Health
HEART	Health & Education Advice & Resource Team
HFs	Health Facilities
HIV	Human Immune Virus
INH	Isoniazid
IPLS	Integrated Pharmaceutical Logistics System
LMIS	Logistics Management Information System
MSH	Management Science for Health
MDR TB	Multi Drug Resistant Tuberculosis
NGOs	Non-Government Organizations
NTPs	National Tuberculosis Programs
PFSA	Pharmaceutical Fund and Supply Agency
PZA	Pyrazinamide
RHBs	Regional Health Offices
SCM	Supply Chain Management
SDP	Service Delivery Points
STGs	Standard Treatment Guidelines
TB	Tuberculosis
TLCP	TB and Leprosy Prevention and Control program
TLCT	TB and Leprosy Prevention and Control Team
WHO	World Health Organization
XDR	Extensively Drug-Resistant

ABSTRACT

Anti-TB Medicines Supply Chain Management Practices and Related Challenges in Gurage Zone Public Health Facilities, Southern Ethiopia

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Introduction: Gaps in managing the supply chain of anti-tuberculosis (TB) medicines result in supply interruptions posing significant health-related and economic consequences.

Objective: To assess anti-TB medicines supply chain management practices and related challenges in Gurage Zone public health facilities.

Methods: A concurrent/parallel explanatory mixed methods design was followed in this study. Institutional based cross-sectional study was conducted from August to September, 2020. Simple random and purposive sampling was used to select study participants. A structured questionnaire and observational check list was used to collect quantitative data and analyzed using Microsoft Excel 2013 and SPSS version 25. For the qualitative part, an interview guide was used to collect data from fifteen key informants and analyzed thematically.

Results: Twenty public health facilities (HFs) in Gurage Zone providing TB management and care were included in the study. Majority of the HFs (18, 90%) were using only stock recording cards to control the inventory of anti-TB medicines. The average physical stock count corresponding to inventory recorded count for a set of anti-TB medicines was 76.6%. For a set of anti-TB medicines the average availability was 82.6% and the average stock out duration was 11.23 ± 1.38 days per a year (Min=0, Max=115). The average wastage rate for a set of first-line anti-TB medicines was 4.78%. Qualitative interviews showed the absence of computerized drug management system to manage anti-TB drugs supply chain and the lack of health facilities' involvement in drug quantification as major barriers for the effective management of anti-TB medicines supply.

Conclusions: The most current version of the national TB treatment guidelines and job aids were not available in the majority of public health facilities and it was also noted that quantification of anti-TB drugs was a major problem. In majority of the health facilities storage condition needs early interventions and inventory control system was totally manual.

Key words: Gurage zone, medicines, practice, supply chain management, tuberculosis.

1. Introduction

Tuberculosis (TB) is an infectious disease caused by a bacteria called *Mycobacterium Tuberculosis* (WHO, 2013). Despite being a treatable and curable disease, reports show that TB kills more people than HIV/AIDS worldwide. In 2019 alone, 1.4 million people died of TB globally (WHO, 2020a). A total of 7.1 million new cases of TB were reported in the same year. The most number of TB cases in 2019 came from South-East Asia (44%) followed by the WHO Africa region (25%). What further complicates the control of TB is the emergence of drug resistance to once effective medicines Of those people who were confirmed of contracting TB in 2019, 61% tested for rifampicin resistance TB (WHO, 2020b). Similar to the rest of Africa, Ethiopia is one of the high burden countries for TB, including drug resistance. Treatment coverage of new cases with drug sensitive TB was 88% and in 2019 a total of 1,400 MDR/RR (Multi-Drug Resistant/Rifampicin Resistant) new TB cases were also registered (WHO, 2020a).

Quality management of anti-TB medicines is critical to ensure an uninterrupted supply of both first and second line anti-TB medicines. This is one of the main components of Stop TB Strategy for an optimal patient outcome (WHO, 2014b). A strengthened supply chain management (SCM) system will improve availability of anti-TB medicines at facility level (Barbara et al., 2009). Managing pharmaceutical supply at the facility level, in turn, affects the quality of health care. Every health facility needs to store and effectively manage its medicine stock. The system that is used to manage these medicines stock must have among others: a secure storage facility with a correct environmental condition, accurate record keeping, effective reordering and stock rotation, expiry monitoring, effective fire and theft prevention (Iqbal et al., 2017).

Anti-TB medicines are effective when the quality-assured drugs are taken in the correct doses and for the full duration of the prescribed treatment. In order to achieve anti-TB medicines effectiveness, global initiatives and national TB programs should apply strong pharmaceutical supply chain management practices. However, there is a significant gap exist in the application of the SCM practices even though countries are able to quantify their anti-TB supply needs, long lead times in the global supply of drugs, barrier at the country level, or poor storage management can prevent patients from accessing effective medicines (WHO, 2017).

A study conducted in Ethiopia showed that the quality of anti-TB medicines SCM was defective due to poor resource management, impaired SC systems and lack of supply chain leadership (Tola et al., 2020).

1.1 Statement of the problem

Despite the presence of highly efficacious treatments, TB is still a major global public health problem (WHO, 2018). One of the main reasons for the failure of many health systems to control the disease is related to weaknesses in managing the SC of TB medicines. Apart from their health-related consequences, interruptions in the supply of such medicines pose serious economic consequences (Scott et al., 2015 & Owunna et al., 2011). In the Ethiopian context, studies indicate that the performance of the SCM system is sub-optimal. This leads to the low availability of essential anti-TB medicines even in the relatively developed urban parts of the country (Mekonen, 2017). Despite the paucity of information on the economic impacts of the sub-optimal supply performance, studies suggest that patients suffer clinical consequences such as decreased adherence due to the erratic supply of TB medicines (Megene et al., 2018).

According to a sub-national prevalence survey of TB in rural communities of the southern parts of Ethiopia, Gurage Zone had the highest estimated prevalence of notified cases. In this zone, it was estimated that for every person with smear positive pulmonary TB detected, there were seven undetected people with TB in the community. This indicates the poor detection and high transmission rate in the area (Datiko et al., 2019). There are also reports that suggest the number of cases in the zone have increased from 70.4 per 100,000 population in 2007 to 155.3 cases per 100,000 population in 2016 (Tadesse et al., 2018). Although it will not be the only reason, challenges related with inefficient and non-sustainable anti-TB medicines supply chain system may be a significant contributing factor for the increasing prevalence of the disease (RPMPlus, 2008). Despite its significance in controlling the disease, there is little known about the performance of the anti-TB medicines supply chain management system in Gurage zone and in many other parts of Ethiopia (Desale et al., 2013; Sinishaw et al., 2015 & Mekonen, 2017). There is also little study about the barriers that affect the practice and the challenges of the anti-TB medicines supply chain management system. Therefore, the aim of this study was to assess the supply chain practices and related challenges of anti -TB medicines in public HFs of Gurage Zone, Southern Ethiopia.

1.2 Significance of the study

The findings and recommendations of this study will be useful for policy makers and system designers to improve the pharmaceuticals supply chain management system of the country.. The study result will be helpful for MOH, EPSA, health facilities, woreda and regional health offices, health policy makers, healthcare providers, donors and other stakeholders involved in anti-TB medicines supply chain system to effectively plan and manage the supply system and practices in Ethiopia. The research will also bring directions for further investigators.

2 Literature Review

2.1 Theoretical literature review

2.1.1 Supply chain management practice

Supply Chain Management practice is a set of activities undertaken in an organization to promote effective management of its supply chain. It encompasses activities involved in sourcing, procurement, distribution, and logistics management, with the aim of satisfying the end users as efficiently as possible (Balal and Adam, 2016). In addition, these activities are applied in managing integration and coordination of supply, demand and relationships in order to satisfy consumers in effective and profitable manners. These practices include supplier partnership, outsourcing cycle time compression, continuous process flow and information sharing (Frederico, 2015).

In order to sustain and improve the performance of supply chain, organizations should work more on SCM practices. Performance of the supply chain is influenced by managing and integrating key element of information into their supply chain. To achieve effective supply chain integration, firms need to implement information technology which will also help them in achieving competitive advantage through supply chain dimensions such as quality, cost, flexibility, delivery and profit (Mwale, 2014). As part of SCM, pharmaceuticals SCM is the planning and management of the integration of all activities involved in medicines selection, quantification, procurement, warehousing, distribution and use (Lemay et al., 2012).It is a network of individuals and firms, and the sequence of processes involved in the production, handling and distribution of medicines. Pharmaceuticals logistics involves major activities in the logistics cycle including selection, quantification, procurement, warehousing and storage, distribution and serving customer (USAID/Deliver, 2011).

As the major part of the SCM, logistics plays a key role. Its activities located throughout the chain, from sourcing, providing raw material, to the end, delivery of products to the final customer. Thus, the final goal of every logistics system is to satisfy the customer. Whether a customer receives the right product, at the right place, in the right condition, for the right cost, at the right time is affected by the practice of each component of the logistics system. The term availability ‘right place at the right time’ is recently considered important when it comes to customer service. (Kaveh and Samani, 2009).

2.1.2 Challenges of supply chain management

To increase access to life-saving commodities for patients, challenges related with public pharmaceutical SCM must be identified. The pharmaceutical industry is the one that will always be in demand from people across the world but, it has challenges to face (SIAPS, 2013). The barriers and challenges identified include: lack of resources to implement standards, conflicting goals across supply chain activities, data inaccuracy, duplication of core activities, lack of information technology, shortage of training for supply chain professionals, absence of trust and partnerships, and high variation in customer and client preferences and demand (Elmuti et al., 2013). A major problem with the healthcare supply chain is that, each stage of the supply chain operates independently, leading to misaligned incentives and conflicting goals that prevent the supply chain from operating as a system. In comparison to other challenges, these conflicting goals have hindered more the development and implementation of SCM practices (Mathew et al., 2013).

Because of the current economic condition, many pharmaceutical industries now have to overcome financial barriers in order to improve efficiency and generate money. This is important to response recurrent changes in the pharmaceutical market, where technology is constantly being developed to find new ways of treating diseases, managing medicines and operating to maximum efficiency (LogiPharma, 2012).

2.1.3 Anti-TB Medicines Supply Chain Management

To provide a quality health service, assuring availability of safe, effective, affordable and quality drugs in adequate quantity at every supply chain practices with appropriate dose and dosage forms is crucial. However, managing drug supply is a very complex process that needs a strong organizational structure, and coordinated supply chain practices. It involves a number of interrelated logistics functions accompanied by appropriate support functions in a supply chain and governed by stringent policy and legal framework (Tiye and Gudeta, 2018).

National tuberculosis programs (NTPs) considered different factors to select anti-TB medicines. The major factors include: standard treatment guidelines (STGs), cost, resistance to TB medicines, access to quality medicines, and management and distribution capabilities. Careful selection of anti-TB medicines is one of the most cost-effective ways of promoting uninterrupted supply of TB medicines. In the case of resource scarcity, WHO recommends selecting four essential first-line medicines: isoniazid (H), rifampicin (R), ethambutol (E) and pyrazinamide (Z) (WHO, 2020b). Selection of second-line medicines for a country is allowed and recommended only after an outbreak of drug resistant TB has occurred and been documented in that country (RPMPlus, 2008).

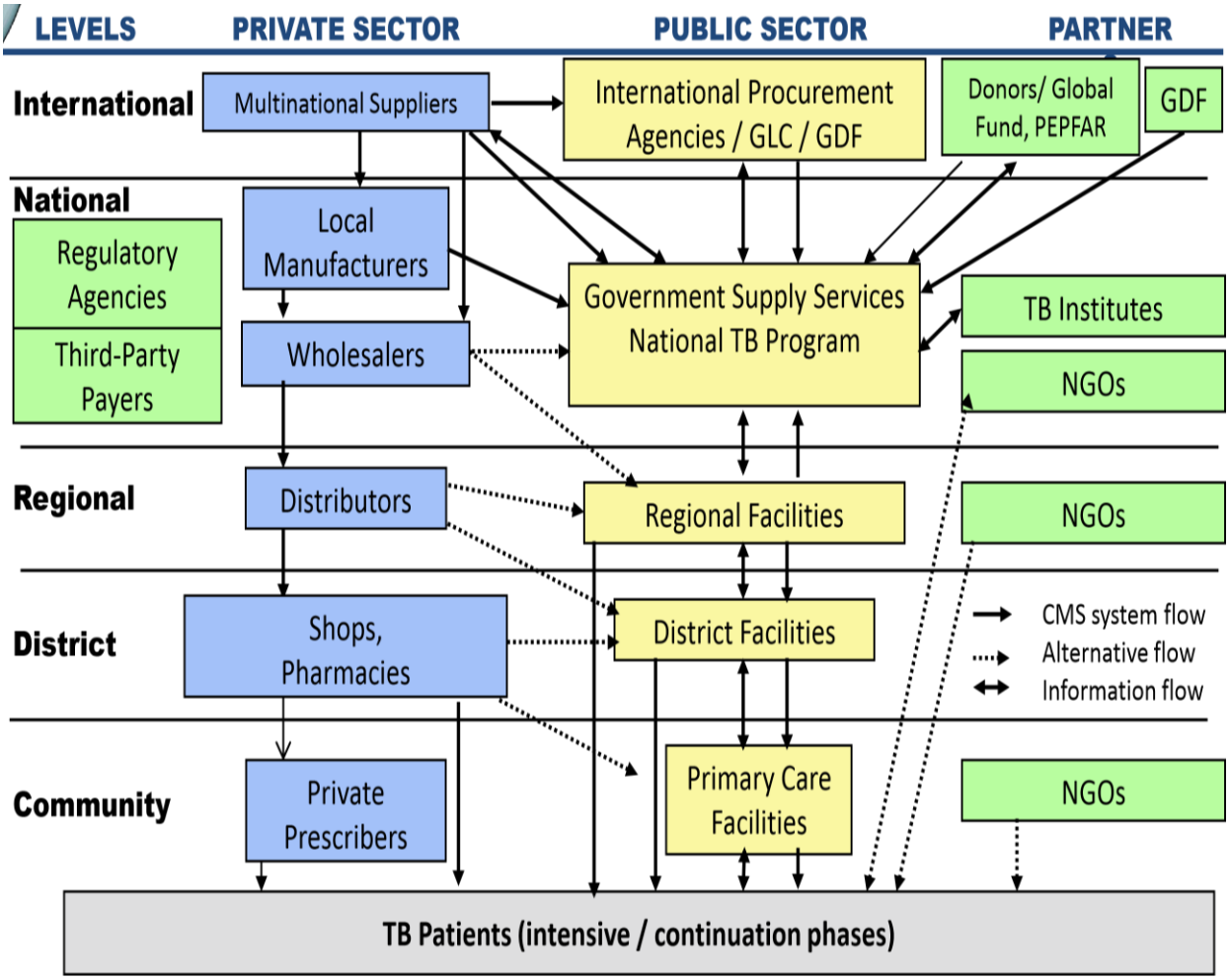


Figure 1 National TB supply chain system with multiple players and levels, Source: (SIAPS, 2013).

2.2 Empirical literature review

2.2.1 The situation of anti-TB medicines SCM

Reliable anti-TB supply systems are identified by the WHO for improving access to medicines. Several reviews done by the Global Fund over the past decade have consistently identified anti-TB medicines procurement and SCM not only as a critical success factor but also as one of the key impediments to funded program (WHO, 2020c). Anti-TB products are central to TB disease interventions, and critical to all TB control programs' mission to end this epidemic. When TB products are getting to intended beneficiaries, significant challenges remain in delivering products on time, to the right place, in the right condition and quantities, and at the best value cost (Global Fund, 2017).

Internationally the supply chain of anti-TB medicines became less successful due to the reasons including: quality assured anti-TB drugs not always found in local markets, dependence on donors for procurement, distribution system often parallel and isolated from the general distribution system and insufficient budgets and funding for SCM (SIAPS, 2013). In other condition, several in-country supply chain systems remain sub-optimal. This is because most anti-TB SCM systems were designed over 40 years ago, but the systems have not been updated to take into account recent levels of anti-TB medicines demand and volumes and also advances in technology (Global Fund, 2017).

A study done in Low-Income Countries showed that in the last years financing for health was increasing and with much of this new funding earmarked for combating priority diseases such as TB. Thus, less for health system strengthening and limited additional resources for investments in the supply chain improvements. Moreover, the lack of a well-functioning supply chain for TB medicines is often the cause of this poor availability (Vledder et al., 2019).Stock outs associated with poor availability drugs result in treatment alteration and discontinuation and finally worse health outcomes. In particular, anti-TB medicine shortages affect developing countries as a study done in South Africa indicated. (Koomen et al., 2019).As Health and Education Advice and Resource Team survey (HEART) stated, most African countries such as (Kenya, Zambia, Uganda, Mozambique, Sierra Leone, Tanzania and Ethiopia) had problems on the national pharmaceuticals procurement and supply. As a result, program pharmaceuticals such as (Kenya, Zambia, Uganda,

Mozambique, Sierra Leone, Tanzania and Ethiopia) had problems on the national pharmaceuticals procurement and supply. As a result, program pharmaceuticals such as anti-TB products were the ones which faced problems like longer tier system, weak information flows along the tiers, weak measurement of SC performances, transportation inaccessibility and weak supply chain leadership (HEART, 2016).

2.2.2 Factors that influence anti-TB medicines SCM performance

In recent years, the pressure on already fragile TB medicines supply chain systems has increased significantly as a result of programs scale up and new initiatives are rolled out by partners. These increased volumes have not always been accompanied by commensurate systems strengthening, which has resulted in supply chain challenges (Global Fund, 2017). Failing to strengthening systems that can run with the programs scale up and initiatives, resulted in factors causing for inadequate treatment of TB disease. The major factors include: unavailability of certain anti-TB medicines, delivery disruptions, poor storage conditions, and poor quality and regulation of medicines. Thus, inadequate TB treatment is the main cause that can contribute to the development of MDR-TB strains and rise the mortality rate (Tola et al., 2020).

Mostly Sub-Saharan African countries faced challenges of anti-TB medicines supply chain. Poor selection and quantification of demand, a lack of transparent procurement procedures, inadequate storage facilities and capacity, lack of guidelines for good storage procedures, lack of appropriate planning, monitoring and evaluation and inadequate budget allocation were some of the challenges (Schöpperle, 2013).In addition to this, a study conducted in Ethiopia on supply chain enablers and barriers showed that scarcity and lack of expertise in SCM, lack of commitment and motivation, gap in leadership, inadequate knowledge and skill, weak integration between stakeholders, and poor transport facilities were barriers for good anti-TB medicines supply chain management performance (Sporrong et al., 2016).

2.2.3 Impacts of weak of anti-TB medicines SCM performance

The under-performance of anti-TB medicines supply chain presents a significant impediment to disease control in developing countries (WHO, 2019a). Unavailability of essential TB medicines are one of the results of poor supply chain performance that lead to treatment interruption which

can force changes in patient drug regimens, drive drug resistance and increase mortality among TB patients (Koomen et al., 2019).Furthermore, the economic impact of tuberculosis come from the size of the problem and from the fact that in developing countries the majority of those affected are in the economically active segment of the population. In addition to the economic costs, TB causes psychological and social costs and as the result, TB patients may be rejected by family and friends or lose their jobs (Menzies et al., 2020).

A study conducted in South Africa showed that the frequent occurrence of anti-TB medicine stock outs represented a significant obstacle to tuberculosis control in the country (Koomen et al., 2019). A study conducted in Ethiopia also revealed that, due lack of access to treatment to anti-TB drugs stock out, about 70% of clients with sputum smear-positive and 20% of people with culture-positive but smear- negative pulmonary TB died within 10 years of being diagnosed (Tola et al., 2020).

2.2.4 Research on anti-TB medicines SCM in Ethiopia

In Ethiopia, selection, quantification, and procurement of commodities required for the management of TB are done centrally by EPSA in collaboration with the National TB Program/ MOH. The Agency plays leadership role in organizing taskforces, discussion, and data for the procurement exercise; and follow up the quantification process (Shewarega et al., 2015). EPSA applied Integrated Pharmaceutical Logistics System (IPLS), in which pharmaceuticals flow from international or local suppliers to health families through the Agency, on the other hand information is expected to be exchanged to bottom-up and vice versa (USAID/Deliver, 2011).

Distribution is a key function that adds value across the supply chain of anti-TB commodities and plays an important role. Every other month, anti-TB medicines are delivered directly to all public hospitals and some health centers by EPSA and the rest health centers and private hospitals are supplied through Woreda health offices and RHBs. The distribution of program items is based on target of the programs by using push system well mixed with pull system when necessary (EMOH,

2015).

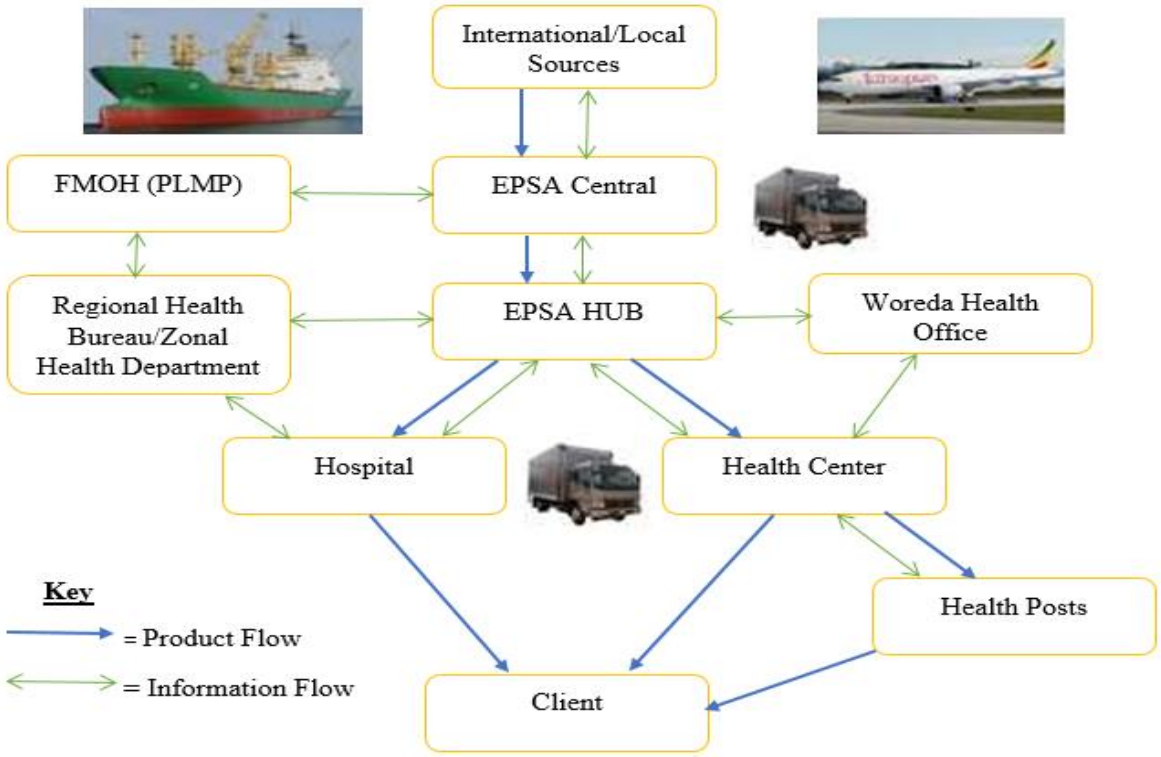


Figure 2 Flow of Pharmaceuticals and information in the supply chain system. Source: (USAID/Deliver, 2011)

A survey done in Ethiopia by EPSA identified problems associated with the SCM of anti-TB medicines such as stock outs, absence and non-updated bin cards for the drugs, discrepancies on bin cards, unsatisfactory inventory management practice and poor storage practice. In addition to this, health facilities request their needed quantities through RRF, but they didn't get the actual quantities ordered from the Agency (EPSA, 2019). In the case of health facilities, poor inventory management of anti-TB medicines was identified which leads to waste of financial resources, shortage of some medicines or over stock of others resulting in expiration and reduce in the quality of patient care. It also indicated that, wrong decisions about order frequency and quantity, inaccurate stock records and lack of systematic performance monitoring were the results of weak SCM of these commodities in the HFs (Berhanu, 2018).

3 Conceptual framework

The conceptual framework was prepared based on the concept of the literature review part of this study.

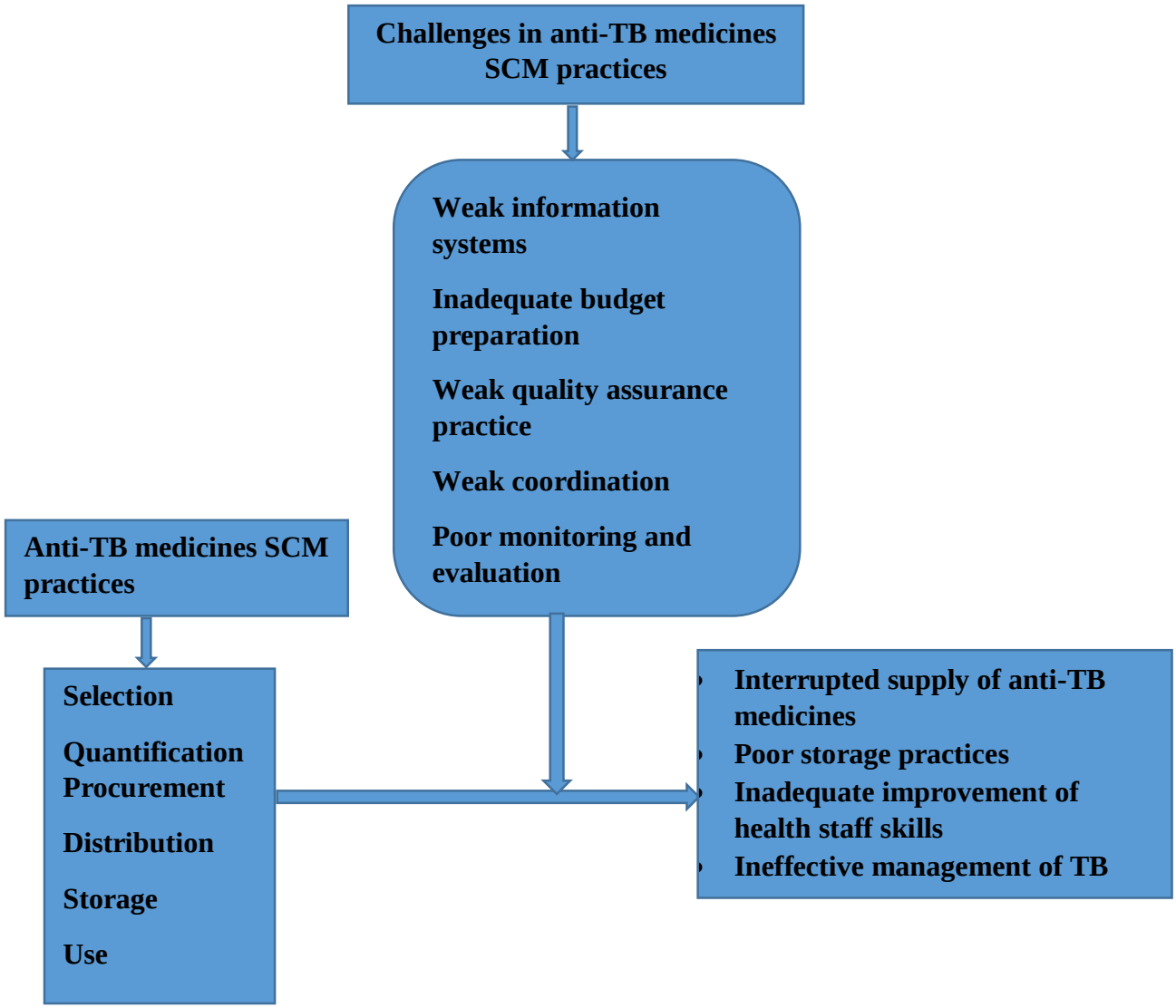


Figure 3 Conceptual framework of the study.

4 Objectives of the study

4.1 General objective of the study

To assess the practices of and related challenges for anti-TB medicines SCM in public health facilities of Gurage zone, southern Ethiopia.

4.2 Specific Objectives of the study

- To assess anti-TB medicines SCM practices (selection, inventory management, quantification, procurement, storage management and distribution) in public HFs of Gurage zone.
- To identify facilitators and barriers to effective anti-TB medicines SCM in public HFs of Gurage zone.

5 Methodology

5.1 Study design and period

A concurrent/parallel explanatory mixed methods design was followed in this study. The quantitative data collection employed institutional-based cross-sectional study of selected public HFs of Gurage Zone, Southern Ethiopia. The study used MSH's tool (Pharmaceutical management of TB indicator-based assessment tool) in assessing anti-TB medicines SCM practices. The qualitative data were collected concurrently to identify the factors that influence anti-TB medicines SCM from the perspectives of managers at various levels of the SC. The data collection took place from August 20 to September 25, 2020.

5.2 Study area

The study was conducted in Gurage Zone, Southern Ethiopia, which is located between 7˚ 76' and 8˚45' N latitude and 37˚46' and 38˚71' E longitude. It has 16 districts and 5 town administrations, from which Welkite town is the capital of the zone. It is found 153 km southwest to Addis Ababa, the capital of Ethiopia. The zone has projected average population of about 5.000,000. About 84% of the populations live in the rural areas. 79% of all eligible children are enrolled in primary school, and 12% in secondary schools. 18% of the zone is exposed to malaria, and 38% to Tsetse fly (Solomon et al., 2020). The zone has a total of 8 hospitals, 75 health centers, 412 health posts and 92 private clinics that are involved in the prevention and treatment of TB. Public HFs (6 hospitals and 66 health centers) that were involved in the SCM of anti-TB medicines were source of information for the study (Tadesse et al., 2018 & FDREPCC, 2008).

5.3 Source population

All public health institutions and departments that are involving in the SCM and practice of anti-TB medicines in the federal and South Regional Health Bureau and in Gurage Zone Health Departments, as well as all Gurage Zone public health facilities were considered as a source population.

5.4 Study population

Records on anti-TB medicines in medical stores of Gurage Zone public health facilities were considered as a study population for the quantitative survey; anti-TB medicines SC managers from EPSA, MOH, stakeholder NGOs (organizations which are supporting the End TB Strategy in Ethiopia), South Regional Health Bureau and Gurage Zone Health Department and pharmacy heads of the study health facilities were respondents for the key informant interview/qualitative study.

5.5 Eligibility criteria

5.5.1 Inclusion criteria

Public health facilities with anti-TB medicines SCM system in Gurage Zone were included in the quantitative part of the study. And for the qualitative part, working as anti-TB medicines supply chain manager at MOH, stakeholder NGOs, South Regional Health Bureau, Gurage Zone Health Department and at the study health facilities was an inclusion criterion.

5.5.2 Exclusion criteria

Public health facilities with less than one year service experience and those facilities converted as COVID-19 treatment center were excluded in the study.

5.6 Sample size determination

According to the logistics indicator assessment tool (LIAT) in resource constrained situations, a minimum number of health facilities to be studied is 15% of the facilities in the study areas, thus 20 public HFs were included in the study which is more than 15% of the public health facilities available in the Gurage Zone (USAID, 2011).

5.7 Sampling techniques

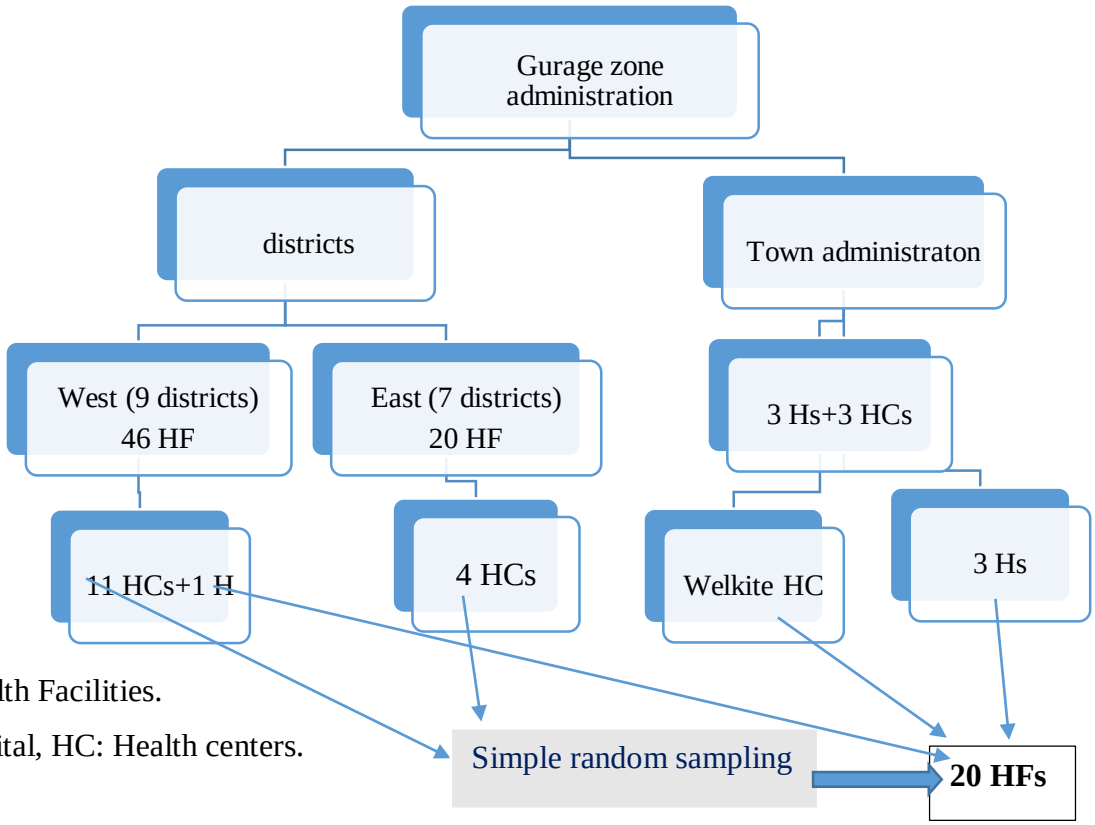
5.7.1 Sampling for the quantitative part

The study was carried out at 20 public health facilities s of Gurage Zone. All eligible four hospitals and Welkite heath center were directly included in the study purposively due to their high anti-TB medicines supply chain activities. The other 15 health centers were selected by simple random sampling from the health facilities available in the districts and town administration of the Zone.

Before selecting randomly, the number of health centers from each district and town was obtained proportionally.

5.7.2 Sampling for the qualitative part

Purposive sampling was used to select the study participants considering their current position and experience in the organization that they are working. Interviewees were selected from Gurage Zone Health Department and health facilities, South Regional Health Bureau, EPSA, MOH and stakeholder NGOs. The issue of theoretical saturation about when further data collection was unnecessary was decided by the principal investigator's sense of what was hearing within interviews.



HF: Health Facilities.

H: Hospital, HC: Health centers.

Figure 4 Schematic representation of sampling technique.

5.8 Data collection tools

For the quantitative part of this study, a structured questionnaire was used to collect data on the supply chain practices of anti-TB medicines in the health facilities. The questionnaire was customized from the pharmaceutical management of TB indicator-based assessment tool which is

developed by Management Science for Health (MSH, 2005). In order to assess anti-TB medicines SCM practices, stock out data, inventory data, and inventory control systems in the health facilities were checked. The self-administered questions filled by twenty four supply chain managers used to collect information including availability and use of guidelines, data type used for quantification, reporting schedule and stock level maintained (Annex- I).

For the qualitative part, in-depth interview guide was prepared for the anti-TB medicines supply chain managers and it included questions on anti-TB medicines procurement, quantification, distribution, inventory management, storage, monitoring and evaluation and capacity building. Socio-demographic data of the respondents including gender, qualifications, practice sitting, job title and years of experience as supply chain manager were collected prior to the interview. (Annex- I). A digital voice recorder and note taking was used to collect data from the in-depth interviews which was undertaken in selected rooms. The average tame taken to interview the key informants was 24 minutes.

5.9 Data quality control

Data was collected by two pharmacists. One-day training was given by principal investigator for data collectors and supervisor on how to collect the necessary data using a structured questioner, ethical principles, and data management. Key informant interviews were conducted by the principal investigator (who was a pharmacist and working as a logistic officer at Zonal health office of Addis Ababa for four years) using a structured key informant interview guide. Expert validity views and suggestions of the advisor was incorporated in the questionnaire and pre-test of data collection tools was carried out on 5% of the respondents before conducting the study to obtain feedback and modification. The pre-test was conducted at one health centre found in Gurage Zone.The principal investigator regularly supervised the data collection focusing on the completeness and consistency of the collected data. Errors, ambiguities and incompleteness were addressed before the end of each data collection day. The quantitative data was collected in the same language with the tool. In addition, data was entered with assigned codes to address any errors occurred easily. The key interview guide was translated from English to Amharic language by supply chain professionals and was back translated to English by language expert to check for consistency and understanding of the tool.

5.10 Data analysis and presentation

The quantitative data collected was coded and the coded variables were entered and analysed using Microsoft Excel 2013 and SPSS version 25. The quantitative data was analysed and frequency and percentages are presented in tables and graphs. In addition, a chi-square test was run to determine the associations between the dependent and independent variables. A critical values $p < 0.05$ were considered as statistically significant.

The qualitative data was analysed using a thematic analysis approach. The recorded interviews were transcribed in Amharic language using the interview guide. Through detailed reviewing, initial phrases for analysing data were drawn from the interview guide and key themes emerged. The findings were grouped according to key themes; and positions that emerged under each key theme were identified. Each of the different positions was summarized and the findings were narrated and presented in English.

5.11 Study Variables

Supply chain management information system practices, stock out rate and wastage of anti-TB medicines were the dependent variables, whereas availability of inventory control systems and anti-TB medicines, budget preparation, quality assurance practices, coordination, and monitoring and evaluation activities were the independent variables, as indicated in Figure 3.

5.12 Indicators

Inventory management practices of ant-TB medicines

- Availability of inventory control systems
- Inventory accuracy rate
- Timelessness of RRF report
- Availability of anti-TB medicines
- Number of stock out duration

Wastage of ant-TB medicines

- Wastage rate

5.13 Operational definitions

Anti-TB medicines: All anti TB drugs and kits used to treat tuberculosis.

Bin card update: had to be updated with in the previous 30 days. Also if the bin card was last updated with a balance of zero and the facility has not received any of those products.

Inventory accuracy rate: the accuracy of stock balance between recorded in bin card and physical count of anti-TB medicines.

Logistics records: includes bin cards and stock record cards and designed to capture critical logistics data at each level of the health system.

Logistics reports: move data up and down through the supply chain system and help in decision making.

RRF completeness: the report should contain all necessary information like beginning balance, quantity received, ordered quantity, stock out duration, and stock on hand of each pharmaceutical.

Stock out of anti-TB medicines: anti-TB medicines not available in stock and a balance of zero on stock recording cards on a day of visit and/or during the last six months.

Supply chain management: it is the integration of key participants from end-users through the original supplier that provide product, service information that adds value for customers and other stakeholders.

Wastage rate: the percentage of the stock products, in value, those are unusable because of expiration and damage.

5.14 Ethical consideration

Ethical clearance for the study was obtained from the Ethical Review Committee (ERC) of the School of Pharmacy, Addis Ababa University (August 14, 2020 & ERB/SOP/174/08/2020). A formal letter of support was obtained from Addis Ababa University, School of Pharmacy and submitted to MOH, EPSA, stakeholder NGOs, South Regional Health Bureau and Gurage Zone Health Department. Gurage Zone Health Department was written a formal letter of support provided by the Gurage Zone Health Department was presented to each study health facility (Annex II). Verbal consent was obtained from each study participant after the study objective was

explained to them in detail by the data collectors. The study participants were informed that they can refuse or discontinue their participation in the study at any time during the interview process. The key informants were also encouraged to ask anything related to the study before, during or after the interview was started. For the purpose of confidentiality, the study participants name and institutional affiliation was kept secret at the time of data collection and assured throughout the study period and analysis. Key informant interviews were tape recorded after obtaining consent from the interviewees.

6 Results

6.1 Findings of the quantitative study

A total of 20 public health facilities including 4 hospitals and 16 health centres under Gurage Zone Health Department and South Regional Health Bureau were included as a source of information for the study. Records and reports on anti-TB drugs available were reviewed and physical observation was also made on the storage conditions of the anti TB drugs in the study health facilities.

6.1.1 Selection and quantification of TB medicines

All the 20 visited health facilities were using WHO recommended essential anti-TB first line medicines (Isoniazid, Rifampicin, Etambutol and Pyrazinamide), FDC and/ or patient kits, two medicine combination (Isoniazid + Rifampicin), three medicine combination (Rifampicin + Isoniazid + Pyrazinamide) tablet, and four medicine combination (Rifampicin + Isoniazid + Pyrazinamide + Ethambutol). With regard to Multi Drug Resistant TB treatment centres, the health facilities were using the newly introduced treatment regimen. Information on the MDR_TB related regimen was announced to the health facilities by Regional Health Bureau and Zonal Health Department in a circular letters and training manuals. All first-line anti-TB medicines were included in the drug list of the health facilities which was developed by drug and therapeutic committee of each health facility.

Only 9 (45%) of the 20 visited health facilities had a copy of the most recent version (2017) of the national TB treatment guidelines. Of these, 8 (88.9%) facilities made the TB treatment guidelines accessible to the health staffs for reference. Among the health facilities visited, 9(45%) had no any job aids and 2 (10 %) had other job aids without TB treatment guidelines like IPLS manual. The availability and accessibility of TB treatment guidelines among health facility type, only 1(25%) hospital had TB treatment guideline and not accessed by health staffs for reference. Among the visited health centres, 8 (50%) of them had TB treatment guideline and accessed by health staffs for reference.

Table 1: Availability and accessibility of TB treatment guidelines and job aids in public HFs of Gurage Zone, Sept. 2020.

Guideline availability and accessibility	**Number of responses (n)**	**YES** **Number (%)**
Facilities with most recent TB STG	20	9(45)
TB STGs accessed by health workers	20	8(88.9)
Facilities with any job aid without TB STG	20	2(10)
Facilities without any guidelines	20	9(45)

Findings further showed that the health facilities quantify their needed anti-TB first-line drugs. Different health facilities were considered different data sources for the quantification. Eight (40%) of the visited health facilities considered total number of medicines consumed in a specific period to determine their anti-TB drugs need. Only 3(15%) of health facilities considered information on both total number of TB cases notified in a specific period and total number of TB medicines consumed in a specific period to forecast their anti-TB drug needs. About 15% of the health facilities reported that they did not considered any data including data on drug consumption or number of TB patient identified to determine their first-line anti-TB drug needs.

Table 2: Data considered when determining TB medicine needs in public HFs of Gurage Zone, Sept. 2020.

Data considered for drug forecasting	**Number of responses (n)**	**YES** **Number (%)**
Total number of TB medicines consumed in a specific period only	20	8(40)
Total quantity of each medicine to order for a specific period only	20	3(15)
Did not quantify	20	3(15)
Total number of TB cases notified in a specific period and total number of TB medicines consumed in a specific period	20	3(15)

Buffer or safety stock only	20	1(5)
Total number of TB cases notified in a specific period only	20	1(5)
All data considered except buffer or safety stock	20	1(5)
Order period only	20	0(0)

According to the responses obtained from higher level anti-TB medicines supply chain managers, nationally there were sufficient financial resources available to procure the needed quantities of TB medicines for the country, but there was no stock and plan to procure and stock limited amounts of separate drugs for use in special regimens for patients with drug toxicity or other special requirements.

6.1.2 Inventory management practices of TB medicines

Findings showed that the assessed health facilities were using two inventory control systems to monitor the stock status of anti-TB medicines. Accordingly the great majority (90 %) of the health facilities were using only stock recording cards to control the inventory of anti-TB medicines. Only one (5%) of the studied health facility was using both computer software system and stock recording cards to manage the stock of anti-TB drugs. It was also noted that 1(5%) of the study health facility was not using any of inventory control systems. All hospitals were using inventory control systems from which 1(25%) was using both computer software system and stock recording cards. Majority 15(93.8%) of the health centres were using stock recording cards only to manage their inventories. One (6.2%) health centre was not using any inventory control systems to manage its anti-TB medicines.

Table 3: Inventory control system usage in public HFs of Gurage Zone, Sept. 2020.

	Health facilities that reported only stock recording cards used (N=20)	Health facilities that reported a computer system and stock recording cards used (N=20)	Health facilities that reported no stock recording cards used (N=20)
Health facilities reported using a specific inventory control system	1(5)	1(5)	18(90)

The discrepancy between inventory records and physical counts of anti-TB medicines were reviewed in all stores of the assessed health facilities. Accordingly, data collected from the 20 study health facility showed that the average physical stock count correspondence to their inventory records for a set of anti-TB medicines was 76.6 % (min. 0%; max. 100%). For three (15%) of the health facilities, the physical count correspondence to recorded count for a set of ant-TB medicines was below 15%. In other case, in majority of the health facilities (85%), the physical count correspondence to recorded count for a set of ant-TB medicines was above 70%.The discrepancy between recorded count and physical count for a set of ant-TB medicines was high in hospitals than health centres. Thus, the average physical count correspondence to recorded count for a set of ant-TB medicines was 73.3% in hospitals and 79.9% in health centres. For first-line anti-TB medicines, the average physical count correspondence to recorded count was relatively high for RHZ (75mg/50mg/150mg), in which no discrepancy was identified in 17 (85%) health facilities (see figure 5). From the second-line anti-TB medicines only Cycloserine 250 mg showed discrepancy between average physical count correspondences to recorded count. This correspondence was 2(66.67%) from the three HFs visited which were MDR-TB sites.

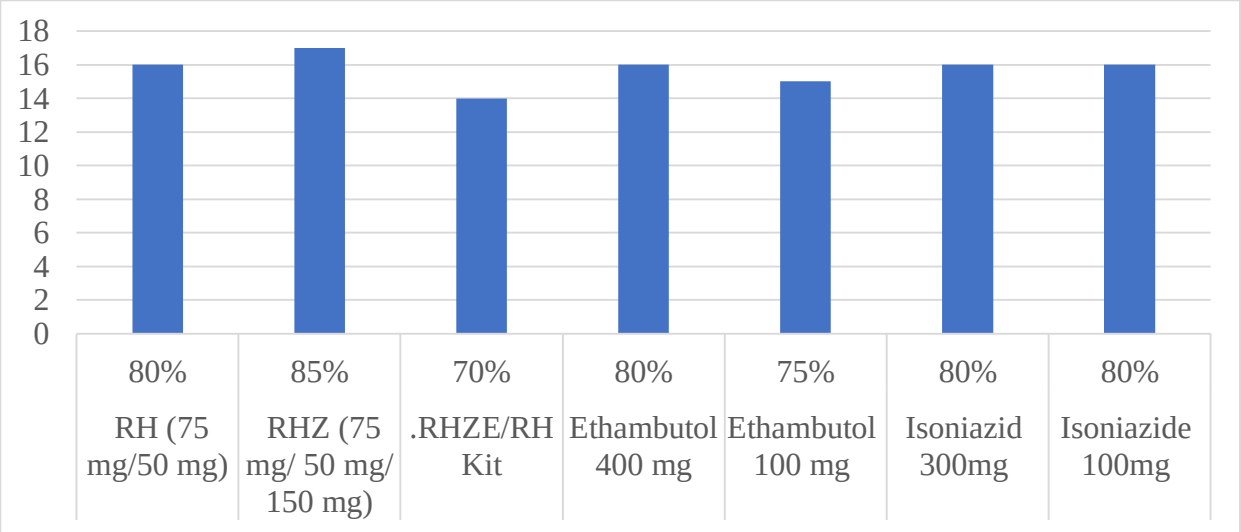


Figure 5: Average percentage correspondence between physical count and recorded count of anti-TB medicines by facility in public HFs of Gurage Zone, Sept. 2020.

The last anti-TB medicines SCM report was reviewed for the timeliness of the report and it was found out that 17 (85%) of health facilities reported on time. Only 1 (5%) of the health facilities reported before the due date of the report and the rest 2 (10%) report was delayed.

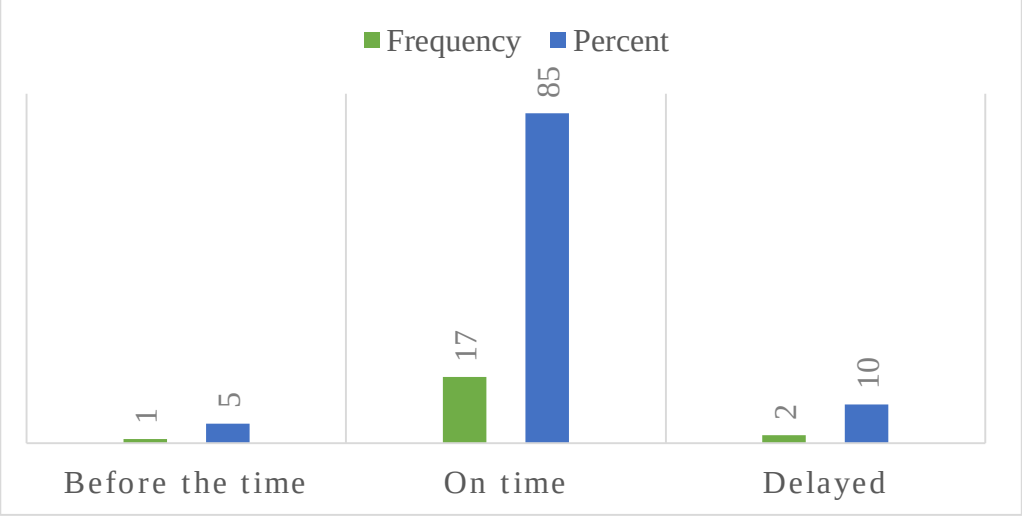


Figure 6: Last anti-TB medicines SC report sent in public HFs of Gurage Zone, Sept. 2020.

Only 50 % of the HFs followed the established maximum and minimum TB medicines stock levels maintained as indicated in the national drug management guideline (for how long time safety stock

and maximum level maintained and when to order). The rest reported different months of stock and order frequency time.

6.1.3 Availability of anti-TB medicines

At the time of data collection, the presence of physical stocks count for anti-TB medicines was reviewed to calculate the drug availability. Thus, for the 20 visited health facilities, on average 82.6 % (min. 43% and max.100%) of a set of first-line anti-TB medicines were found to be available on the day of visit. In 9(45%) of the health facilities, the availability for a set of anti-TB medicines was above 85% whereas for 9 (45%) health facilities, the extent of availability was between 50% and 75%. The remaining 2 (10%) health facilities had 43% availability for each. The extent of drug availability data disaggregated by the type of health facility visited showed that on the day of visit an average of 70.4% and 94.75% of a set of ant-TB medicines were available in the health centres and the hospitals respectively. From first-line ant-TB medicines, RHZE/RH Kit was found availability in the great majority 19 (95%) health facilities while the minimum availability was for Ethambutol 400 mg which was found only in 9 (45%) health facilities (figure 7). Second-line anti-TB medicines were 100% available at all the visited MDR-TB sites. The Pearson Chi-Square test revealed that the availability of anti- TB medicines had a significant association with the correspondence of physical count and recorded count or inventory accuracy rate of anti-TB medicines (P=0.015) and availability of inventory control systems (P=0.024).

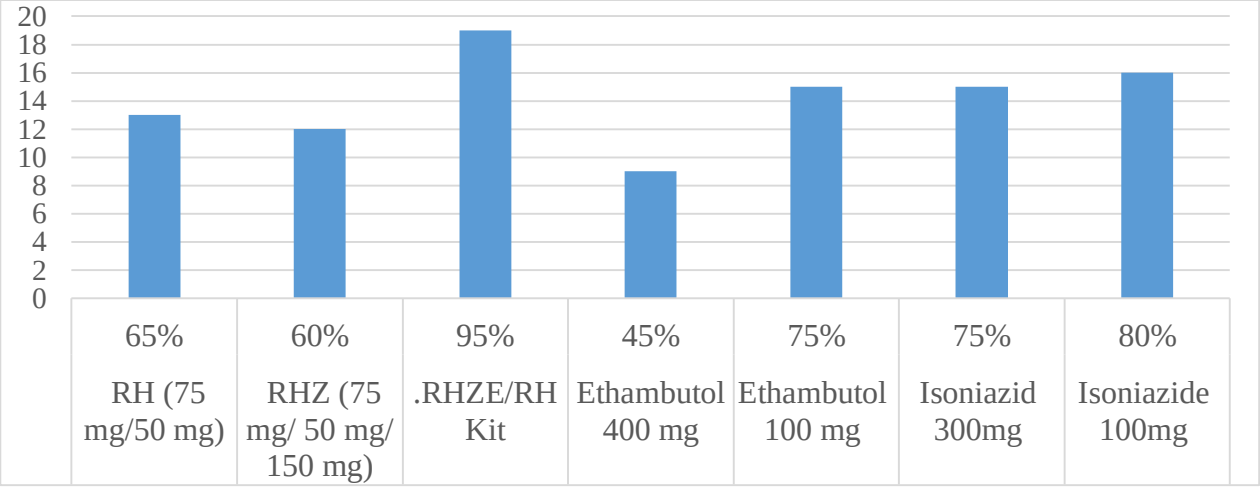


Figure 7: Average percentage of anti-TB medicines availability by facility in public HFs of Gurage Zone, Sept. 2020.

Inventory data for the past 12 months preceding the assessment was reviewed from all the 20 visited health facilities, to find out the total number of days out of stock for the anti-TB drugs. This data was collected from stock recording cards and registration books of anti-TB medicines. From selected fourteen anti-TB medicines only six of them (42.9%) reported frequent stock outs with a mean stock out duration for a set of anti-TB medicines was 11.23 ± 1.38 days (Min=0, Max=115). The highest average stock out duration recorded was on RH (150mg/75mg) which was 19.15 ± 2.69 days per a year (Min=0, Max=115). Whereas the minimum average stock out duration was recorded on Etambutol 400mg which was 3.1 ± 0.7 days per year (Min=0, Max=62) Table 5.

Table 4: Average stock out duration for anti-TB medicines per a year in public HFs of Gurage Zone, Sept. 2020.

	Stock out duration					
	RH (150mg/75 mg)	RHZ(75mg /50mg/150 mg)	RHZE/RH kit	Etambutol 400mg	Etambutol 100mg	Isoniazid 300mg
Number of responses (n)	20	20	20	20	20	20
Mean	19.15	11.95	11.55	3.10	18.00	3.55
Std. Deviation	2.69	1.32	1.11	0.70	1.86	0.62
Minimum	.00	.00	.00	.00	.00	.00
Maximum	115.00	97.00	71.00	62.00	115.00	52.00

6.1.4 Wastage of ant-TB medicines

The inventory data of anti-TB medicines which were wasted and stored with usable stocks at the time of visit were collected with the corresponding usable physical count. In addition, cost of wasted and usable physical stock at the time of visit for anti-TB medicines was collected in study health facilities. The wastage rate was calculated by using the monetary value of wasted TB medicines to the monitory value of the respective physical stocks at the time of visit. For all wasted anti-TB medicines, the average wastage rate was more than 2%. The average wastage rate of a set of expired first-line TB medicines found within the usable stock at the health facilities visited was 4.78 %. Moreover, the highest average wastage rate was for RHZE/RH kit and the lowest was for RH (150mg/75mg) which was 8.33% (min. 0 % and max. 76 %) and 2.02 % (min. 0 % and max. 57.14 %) respectively. The comparison made in wastage rate between hospitals and health centers

showed that the highest wastage rate of anti-TB medicines 6 (42.86%) was reported from hospitals. The wastage rate for RH (150mg/75mg),RHZ (75mg/50mg/150mg), RHZE/RH kit, Ethambutol 100mg and Isoniazid 300mg was 3.24%, 6.5%, 14.7%, 10% and 8.6% in hospitals respectively. While, the wastage rate for these anti-TB medicines was 0.8%, 1.4%, 2%, 1.4% and 2.6% in health centres respectively. From second-line anti-TB medicines, only Cycloserine 250mg capsule was found expired in the usable stock. The average wastage rate for Cycloserine 250mg capsule in MDR_TB sites was 26.2 %. According to the Pearson correlation, wastage rate and stock out duration had significant negative correlation with the availability of anti-TB medicines ($r=0.9$, $p<0.03$ and $r=0.89$, $p< 0.033$) respectively.

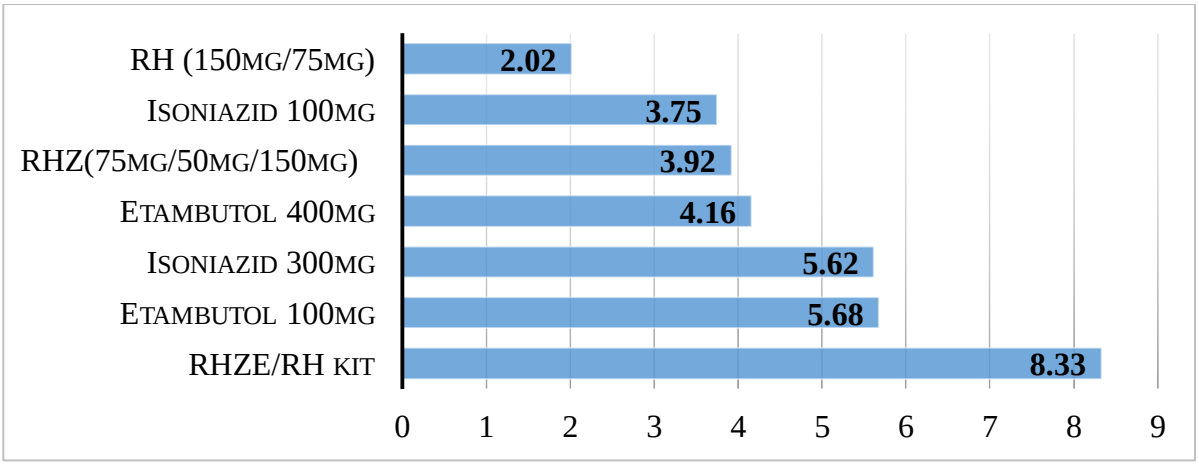


Figure 8: Average wastage rate of anti-TB medicines in public HFs of Gurage Zone, Sept. 2020.

The total average estimated wastage cost for the expired anti-TB medicines was 135,215.84 birr. Nearly half of the wastage cost was for Isoniazid 300mg (table 6).

Table 5: Estimated wastage cost of anti-TB medicines in selected public health facilities of Gurage Zone, Sept. 2020.

Medicines name	Estimated wastage quantity	Estimated wastage cost in birr
Isoniazid 300mg tablet	79754	59017.96
RHZE/RH kit tablet	10624	29747.2
RHZ(75mg/50mg/150mg) tablet	3973	8025.46
Etambutol 100mg tablet	2712	24570.72
RH (150mg/75mg) tablet	2649	3178.8
Cycloserine 250 mg capsule	1100	9673.4
Etambutol 400mg tablet	739	886.8
Isoniazid 100mg tablet	330	115.5
Total	101,881	135,215.84

6.2 Findings of the qualitative study

6.2.1 Participant characteristics

In-depth interviews were held with a total of 15 respondents including eleven anti-TB SC managers (7 pharmacy heads, 1 dispenser, 1 medical director and 2 store managers) working in study health facilities and four TB supply chain managers who were working in EPSA, MOH and Gurage Zone Health Department. Six of the supply chain managers interviewed were pharmacists, six were pharmacy technicians, two were pharmacy professionals with second degree level training and the one was a clinical nurse. Two of the key informants were female and the rest were male.

Table 6: Socio demographic characteristics of the study participants working in selected health organizations and public health facilities of Gurage Zone, Sept. 2020.

Characteristics		**Number**
Sex	Female	2
	Male	13
Age (in Years)	25-30	11
	31-40	4
Highest academic degree completed	Diploma	7
	First Degree	6
	Second Degree and above	2
Profession	Pharmacist	8
	Druggist	6
	Clinical nurse	1
Place of work (Organization)	MOH	1
	EPSA	2
	Zonal health office	1
	Hospital	4
	Health center	7
Role/position in the organization	TB SC focal	3
	Pharmacy head	7
	Store manager	2
	Dispenser	1
	Logistic officer	1
	Medical director	1
Length of service in current role/position (in Years)	1-5	6
	6-10	9

The following themes were identified in the qualitative analysis: acquisition of TB medicines and supplies, storage and distribution of TB medicines and supplies, treatment guideline-related issues and human resources-related issues. The corresponding sub-themes and the most relevant quotes from the participants are presented below.

Acquisition of TB medicines and supplies

Quantification

According to the informant interviewees, consumption data are the main sources of information for forecasting TB medicines and supplies. KIs explained that, lower-level health facilities didn't have the culture of using morbidity data to forecast anti-TB drugs need, and the awareness on the importance of using morbidity data for drug forecasting was also not satisfactory. However, it was noted that at the country level, the morbidity data is used in the quantification. The absence of accurate information on drug use was identified as the major hindrance for proper quantification of TB medicines and supplies. The incompleteness of information from bin cards and stock cards, unreliability of morbidity data collected from health facilities, and lack of timeliness of data were identified as the major issues with the observed problem in drug quantification. In this regard one of the KIs said:

"Data related problems are the major challenge in quantification of medicines and supplies that can be used for the management of TB as well as other diseases. The current anti-TB drug quantification practices of the country is like shooting in the dark… it is always made through assumptions. Even though, quantification is done using the national target, in actual scenario, the fact on the ground is something different [from the assumptions] …. " (Pharmacist working at FMOH with 7 year experience).

Procurement of TB medicines and supplies

Here, the long-time that the national supplier (EPSA) takes to process the procurement of pharmaceuticals was described as a major challenge in ensuring ideal supply chain performance for TB medicines and supplies. Some of the key informants mentioned cases where the procurement process took so long that treatment guidelines were changed before the procured

pharmaceuticals could be received. While explaining his/her experience on the issue one of the KIs said the following:

"… while we were in the process of purchasing medicines for MDR-TB, WHO changed the treatment guideline and as the result we tried to negotiate with the supplier by asking them not to send the ordered products to Ethiopia but rather dispose them in the country of origin. Though we agreed to pay the cost for the drugs and supplies, the supplier refused our proposal for them not to send the drugs to Ethiopia. As the result we were forced to accept the medicines and dispose them in country." (Pharmacist, working at EPSA).

Some participants also mentioned the issue of low budget as an obstacle for ensuring steady supply of TB drugs and supplies. One of the KIs said:

"……for procuring laboratory diagnostic supplies, we have budget shortage….the cost of laboratory reagents and supplies to diagnosis TB is very expensive and mostly it is not funded by NGOs, so we face severe shortage…. for medicines, since our community TB detection rate is poor…..if our performance is good…..we will face a shortage." (Pharmacist working in an NGO with 2 years' experience).

Storage and distribution of TB pharmaceuticals

Storage infrastructure

According to the KIs, the absence of conducive storage facilities greatly impacts the quality of medicines and other supplies. In many cases the rooms used to store drugs and medical supplies are originally designed for other purposes and it is very common to see medical stores with problems such as cracked walls, non-functional fans for ventilation, absence of air conditioner for temperature control. Windows in some stores are sealed. The reasons given by the respondents for the storage infrastructure problem are poor leadership and management. While explaining the problem one of the KIs said:

"… initially the room was built to serve as cafeteria. The wall is short and the rooms are not well ventilated, and the overall setting exposes the products to direct sun light." (Pharmacy technician with 10 year experience working at hospital pharmacy).

Another KI said:

"…. The walls and roof of our medical store is made of corrugated iron sheets and the storage space is not enough. The room temperature increase during hot seasons… it does not meet the required standard for a medical store …" (Head of a pharmacy department at a health centre with 7 years' experience).

Store utilization

Some of the KIs have raised conditions whereby flammable and non-flammable products, expired and non-expired drugs, and medical and non-medical equipment stored in the same room. According to the majority of the respondents, due to the shortage of room and floor pallets, drugs were placed on the floor. In some cases, space available in the medical store was not properly managed. As the respondents revealed, negligence to construct medical stores by considering storage SOPs and poor storage monitoring by responsible supply chain stakeholders was among the reasons for poor storage practice. One KI mentioned:

"… you can see the shelf ….. it looks like a rural cattle silo and not a medicine store… Due to lack of financial capacity, we are using stones as shelves." (Store manager working in a health centre drug store).

Flow of information and TB pharmaceuticals

The KIs described that, depending on their levels, HFs fill the RRF (report and requisition format) bi monthly and send the completed forms to either EPSA or the Woreda Health Office. In this process, KIs agreed that there are several supply chain related leadership problems. At the beginning, all respondents agreed that all health institutions had the problem of updating stock recording cards, even though there were department units that fill IRRF timely. Inaccuracies in calculations were also reported. Here is what one KI said:

"It is very hard to say RRF is actually filled in the right way using bin card and stock cards… meaning, we are not using beginning balance and ending balance…" (Pharmacy head working at a hospital with 2 year experience).

One of the reasons that KIs mentioned for lack of motivation to accurately and adequately report anti TB drug consumptions was the fact that the national supplier, EPSA seems to disregard the

reports while making deliveries of anti-TB drugs. While describing his/her observation on to this issue one KI said:

"There is discrepancy between what EPSA delivers and what we requested for. That is why we are not motivated to fill in [the RRF] accurately…" (Head of pharmacy department working at a health centre with 6 years' experience).

Several respondents said that after health institutions send RRF and when EPSA refilled, the majority of the anti-TB drugs delivered had a short expiry date as well as their amount was over or less than the amount stated in the RRF. Moreover, since most of the time drivers are the ones making delivery of the drugs, it is often difficult to return the anti-TB drugs with a short expiry dates back to EPSA or make them understand the quantity discrepancy between what we requested for and what is sent to us by EPSA. Few respondents have raised that when institutions received drugs that were above or less than their requested for, complaints are made through personal connections or during workshops rather than following the formal grievance handling mechanisms of the national supplier. One KI said:

*"Most of the time facilities make complaints through personal contacts… and as the result it does not reach to the appropriate officials at the national supplier, EPSA]. They could have submitted their complaints through the formal channels but often such complaints are raised during review meetings …" (*Pharmacist with 8 years of work experience at EPSA).

All KIs have reported that there was no computer system that could be used to automate TB drugs SC, and as the result the RRF is filled manually. They further indicated that though in many cases, computerized systems are installed in the facilities to facilitate drug management; most often the computers fail to operate as intended due to technical issues. Respondents have also indicated that Woreda Health Offices often fail to distribute the anti-TB drugs and supplies that they received from EPSA to health facilities. It was also mentioned that the practice of holding of drugs at Woreda Health Offices could be one of the reasons for the TB medicines with close to their expiry dates were distributed to health centres. While explaining his/her observation on the discussed issue, one KI said;

"… we face shortage when TB drugs expire…. the problem is even worse in case of TB medicines used for children. Professionals often get disappointed when anti-TB medicines are in short supply… mothers incur additional costs to get their children treated… for sure… a mother would go to other sources to get the medicine... the erratic supply also will contribute to death of patients due to MDR-TB." (Pharmacist with 10 year experience working at Zonal health office).

Treatment guideline-related issues

Key informants discussed that, there was a frequent change in the TB treatment regimen through WHO especially in MDR-TB depends on the clinician's desire to minimize the risk of failure and, in particular, to limit the risk of prolonging a failing regimen. At the time, nationally announcement of the change was through circular letters and then training of professionals followed. A respondent working at the Zonal Health Department discussed that after phone communication about the regimen change, the formal communication through letters were delayed causing delays on the starting date of the regimen. Sometimes, trainings are given months after we were notified about the regimen change. According to a national level key informant, updating and incorporating the global update on anti-TB treatment regimen, to the national TB treatment guideline faces a lot of bureaucracies, budget, human resources and system challenges. And he further indicated that the above mentioned issues are the reasons why health facilities in Ethiopia are still using the sixth edition (2017) TB treatment guideline. The KI further said:

".....this year, the TB regimen is changed but still there is no plan to announce the change and training to health professionals on the change has not yet carried out."(Pharmacist with 7 year experience working at hospital).

Human resources-related issues

The majority of the KIs have agreed that there was a gap on the supportive supervision and evaluation from the concerned institutions. Sometimes, monitoring and evaluation is conducted by the Zonal Health Department and Woreda Heath Offices. Both at the Zone and Woreda level, competent professionals with training on supply chain management are not engaged in supply chain related activities. To make things worse, pharmacists with trainings in IPLS often resign looking for a better job, which makes knowledge transfer breakdown between the senior and well trained professionals and the new ones. It was also noted that due to the COVID-19 pandemic,

the monitoring and evaluation activities that have been undertaken by the Zonal Health Department and Woreda Health Offices in the past one year have been limited and as the result were not effective. While explaining his/her observation one of the KIs said

"…. there is a gap on supervision …. there was one conducted by EPSA itself …. currently since there is no partner support, supervisors are demotivated …. our work is usually dependant on donors … if there is no donor, there is no government budget …. and as the result the monitoring and evaluation activities' will be not periodic and inconsistent " (Pharmacist working at MOH with 7 years of experience).

7 Discussion

A good pharmaceutical management for TB medicines can help patients to receive good-quality medicines in the right dose for the right period of time in order to achieve cure (RPMPlus, 2008). To achieve this programs' ultimate goal, the anti-TB medicines SC system should be sustainable and uninterrupted. In order to improve the SC system of anti-TB drugs, system based limitations and underlining factors has to be identified. This study has focused on selection, quantification, availability, storage conditions, LMIS and wastage rate of anti-TB medicines.

Findings of this study showed that the most current version of the national TB treatment guidelines (national guidelines for TB, MDR-TB and Leprosy in Ethiopia, 6th edition) were available in less than half of the visited health facilities. Ethiopian Drug Authority Control Agency set standards that all health facilities have a copy of job aids and guide lines. As compared to the minimum standard expected from health facilities, this finding is a small number. The standard emphasis that health workers working on TB SC shall refer TBSTGs in order to access recent treatment information on effective TB control and management and for supporting their day-to-day activities (EFMHACA, 2014) . Actually, to run SC activities STGs, manuals and job aids are crucial for TB SC actors to comply with the national and facility requirements. When newly introduced 2nd line anti-TB medicines were distributed to health facilities, health professionals could get information about these drugs SCM and treatment protocol only by circular latters and training manuals since these drugs were not included in the sixth edited TBSTG. But, the in-depth interview in this study revealed that pharmacists with trainings in IPLS often resign looking for a better job, which makes knowledge transfer breakdown between the senior and well trained professionals and the new ones. When there is a change in regimens, TB control programmes should have to consider whether the health facilities are capable in order to undertake the necessary changes in patient management because this will affect the feasibility of implementing the recommendation in a particular programme (WHO, 2019b).

In this study less than half of the health facilities visited estimated their anti-TB medicines need by considering total number of medicines consumed in a specific period. Moreover, only 3 health facilities considered total number of TB cases notified in a specific period and total number of TB medicines consumed in a specific period jointly. In order to supply appropriate quantities of anti-

TB medicines, TB SC managers need to know how many patients are currently under different treatment regimens as well as how many patients are expected to be enrolled for each treatment regimen for the next procurement plan. In addition to this other key factors and data that should be taken in to account to have correct quantification are the existing stock, lead time for delivery, safety stock needed and the shelf lives of each drug (WHO, 2014a). To estimate anti-TB medicines need WHO recommends considering epidemiological data, and using a systematic method such as morbidity-based or consumption-based quantification. Estimates of TB drug needs should be more accurate and stock-outs attributable to quantification weaknesses will be reduced and thus drugs will available when and where needed by the patient (WHO, 2002). The in-depth interview in this study indicated that there was no complete information from bin card and other stock recording cards and facilities had unsatisfactory awareness and culture of using morbidity data to estimate anti-TB drugs need. Moreover, nationally TB drugs were quantified only using morbidity data due to unreliable consumption data from health facilities even though the quality of morbidity data from monthly HMIS report was questionable. But, TB medicines were supplied to health facilities with their respective quantification which was done by using different methods. Nationally, when TB medicines selected and quantified to procure, WHO recommends to consider 2 % of all TB patients in order to have a separate drug stock for use in special regimens for patients with drug toxicity or special requirements (RPMPlus, 2008).

Regarding inventory control system, this study showed that almost all health facilities were not using automated inventory management software. Instead, majority of the HFs were using manual stock recording cards. In addition, the in depth interview in the present study indicated that stock recording cards have a problem of data quality, completeness and consistency. This finding was in line with the study conducted in Dessie town and Addis Ababa revealed that none of the health institutions have automated stock inventory management software system in their medicine stores (Wodajo, 2018 &Workneh, et al.,2019). A good inventory management system enables health facilities to become more efficient and to keep track on their inventory level as low as possible at minimum cost. A computerized system enables pharmaceutical SC activities to be accomplished more rapidly, accurately, economically, and flexibly. So that automated software system helps SC professionals to analysis drug inventory data in real time; providing real time data on products lot no, expiration of drugs, availability of essential medicine and stock on hand (MSH, 2012 & Kaur

& Hall, 2001). In the in-depth interview in the present study revealed that the absence of computer system that assists to manage TB drugs SC, and the RRF was filled manually, even though, various computer software systems have been loaded in different times, they would corrupt in a short period and would remain without any user.

The current finding showed that the average percentage correspondence of physical stock count to record count for a set of anti-TB medicines was 76.6%.The inventory accuracy rate was high in the assessed health centres than hospitals. The discrepancy (23.4%) in this study is lower than 27.8% and 30%, which were reported by studies done in Adama and Gonder respectively. Both studies were done on essential medicines which included anti-TB drugs (Fentie et al., 2016 & Kefale, 2019). Scheduled monitoring and evaluation of stock levels results in good management of stocks. All records should be kept update and in proper manner in order to use as initial information for new stock ordering thus it saves time and helps to identify misuses or thefts. Inappropriate inventory management will finally lead to wastage and/or stock outs of TB medicines (WHO, 2010b). The in depth interview in the present survey also revealed that inventory management systems such as stock recording cards were not provide complete information that is necessary to avail TB medicines.

This study showed that majority of the health facilities reported their anti-TB medicines SC activities timely even though deviated from the standard which is all HFs have to report on seated schedule for the responsible body (FMHACA, 2014). Complete reporting about the SC of anti-TB medicines enables the assessment of progress and achievements of activities so that reporting shows how effectively and efficiently the program is meeting its objectives. Moreover, it helps as a basis for decision-making and learning at all levels (Uganda MOH, 2008). The in-depth interview in this study showed that health facilities filled reports as a mandatory and not completed based on inventory control systems such as bin cards as well as the reports didn't contain all the necessary information as the reporting format requests. This study finding is in line with a study done in Bangladesh, as supply chain managers did not report anti-TB medicines stock status as required by the supplier and decision makers due to poor supportive supervision activities and inconsistent supplying (Dias and Marmio, 2012).

In this study, 50% of the health facilities were not followed established maximum and minimum stock levels as indicated in the national drug management guideline. The maximum and minimum stock levels should be used at HFs to make orders from TB medicine supplying institutions, additionally patient data have to be used to supplement the estimation of need when necessary (PFSA, 2015). Maintaining an adequate level of inventory is critical since an enormous amount of capital tied up with it. Having excess inventory leads to wastage. On the contrary, insufficient commodity leads to stock out. Program medicines supplying agency EPSA was challenged with emergency orders in the past years due to poor inventory management from health facilities thus the agency has incurred additional costs (Boche et al., 2020).

In this study, inventory data for the past 12 months preceding the assessment were reviewed to find out the total number of days out of stock. Additionally, average percentage availability of a set of anti-TB medicines was assessed at the time of visit. In majority of TB drugs, days out of stock was reported. The study showed that the mean stock out duration for a set of anti-TB medicines was 11.23 days. The mean stock out duration for a set of anti-TB medicines documented in this study is longer than the situation in African countries, such as Namibia (10.6 days) and Malawi (9 days) (Chana, 2011 & Owunna et al., 2011). The deviation might be due to the inconsistent supply of TB medicines from EPSA and poor inventory management from HFs as the KIs discussed. However, the mean stock out duration in this study is shorter than the mean stock out duration (28.2 days) reported by MOH on baseline survey in public hospitals (EMOH, 2020).

In the present survey, the average availability for a set of anti-TB medicines (82.6 %) was lower than program drugs availability (85.4%) which was done in Addis Ababa (Mudzteba, 2014), however higher than the availability documented in the national pharmaceutical sector assessment which was 72.4% (EFMHACA, 2017). This might showed that the SC system for program pharmaceuticals has been improved even though the availability was far from the WHO recommended target of 100% (WHO, 2010a). The finding of this research also showed that pediatrics RHZ and RH were stocked out in 40% and 35 % of HFs, respectively. In support of this finding, an assessment done in public health facilities of Dire Dawa City Administration shows that sock out has occurred for these products (Tola et al., 2020).. The in depth interview in this study also showed that most of the time anti-TB drugs were supplied to HFs with near expiry which face a stock out until the next refill season. Anti-TB medicines should be available at all

times in the SC in order to ensure continuity in supply to the patient without which, patients may go for some days without their medicines (WHO, 2002). The finding of this study also identified the absence of inventory control systems and poor inventory accuracy rate were a contributing factors for low availability of anti-TB medicines. This was also true in the case of studies conducted at health facilities in Dire Dawa City Administration and SNNPRS of Ethiopia which identified poor communication and delays due to lack of good inventory systems reduced the availability of program medicines (Tola et al., 2020 & Damtie et al., 2020).

In this study, the average wastage rate of a set of expired first-line TB medicines found within the usable stock at the HFs visited was 4.78 %. When comparing between individual drugs, RHZE/RH kit was taken the highest rate. There were also many unexpired quantities of TB drugs found at the HFs which they were not using in the past several months were likely to expire on the shelf. This wastage rate is lower than the estimated medicines wastage rate (7.5%) reported by a study in public HFs of south west Shoa zone (Tadesse, 2017). However, the wastage rate in this study (4.78%) was higher than the wastage rate (2%) reported by MOH for program medicines at the baseline survey and the national target of below 2% set on HSDP IV (EMOH, 2020 & EMOH, 2014). The in-depth interview in this study also showed that anti-TB medicines were supplied to HFs with short expiry date especially by woreda health offices and the quantification and data management were poor at health institutions. So that without minimizing wastage of anti-TB medicines, achieving efficient pharmaceutical budget utilization will be difficult. Thus, this high wastage was caused to a loss of 135,215.84 birr only in a set of anti-TB drugs at zonal level without including other SC cost.

8 Limitation of the study

This study did not cover all components of the SC systems such as TB drug use, and quality assurance. In addition, some of the interview guide questions might also introduce recall bias. This study is focused in one zone and as the result generalizing the result to other areas is limited.

9 Conclusion and Recommendations

9.1 Conclusion

According this study finding it can be concluded that the current version of the national TB treatment guidelines and job aids were not available in the majority of health facilities. It was also found out that in all health facilities covered by the study quantification of anti-TB drugs was a major problem. Most professionals working in the visited facilities had inadequate knowledge about quantification and data use. Essential activities for a proper drug management like supportive supervisions, accountability and capacity building were practiced poorly throughout the supply chain system. Inconsistent supply of anti-TB medicines through EPSA affected the anti-TB drugs supply system thus, the supplying system became push system. In addition, time of stock out, over stock, availability and wastage was the issue of most of the study health facilities. In the majority of the health facilities storage condition of drugs and supplies are improper and storage facilities are inadequate. Inventory control system was manual, data management is poor and accuracy of record keeping was found to be low. Collaboration between health facilities, stakeholders and computer software managers was poor.

Finally, even though there is high government commitment in improving the program, much work is expected to tackle TB drugs and supplies SCM related problems identified by this study.

Recommendations

Based on the finding of this study the following recommendations can be drawn

- The National Tuberculosis Program should ensure that the new national TB manual is incorporated in the TB medicines guideline and all health facilities that are providing services in TB treatment and care use the guideline.
- Gurage Zone Health Department and all Woreda Health Offices under it should ensure that supply chain management job aids are available in all health facilities.
- South Regional Bureau in collaboration with partners has to ensure that capacity building training is provided to TB medicines SC managers working in the public health facilities in the region.

- Gurage Zone Health Department and its partners should construct standard drug storage facilities in all public health facilities in the zone.
- MOH in collaboration with stakeholders should work on the automation of inventory control systems.
- Similar studies should be conducted in other parts of the country in order to get full picture of TB medicines SCM.

10 Suggestions for future work

- Studies that aim at assessing the SCM of anti-TB medicines and TB diagnostics laboratory reagents should be done in different parts of the country at all level health institutions.
- Studies that evaluate the quality of TB control should be done in different health care settings of the country.

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Annexes

Annex I

A. Informed consent

Addis Ababa University School of Pharmacy, Department of Pharmaceutics and Social Pharmacy, Health Supply Chain Management Program

Greetings! My name is Sifrash Gezahagn, a final year MSc student at the School of Pharmacy, Addis Ababa University. I am conducting a study on the Supply Chain Management of Anti-TB Medicines in Public Health Facilities of Gurage Zone, Southern Ethiopia as part of the requirements for my MSc degree in Health Supply Chain Management. I would like to extend my deep appreciation to your institution and you for the willingness and cooperation in undertaking this valuable research. Taking part in this study you will help in identifying critical challenges of the anti-TB pharmaceutical supply chain system and contribute towards alleviating the problem.

I request your cooperation to fill and respond truthfully to the questions. Your participation is completely voluntary. You can refuse to answer any question and/or withdraw from the study at any time. All of the information collected is strictly confidential. No one, other than the research team will have access to your responses. Your personal identifiers such as your name and facility will not be used in the final report. The principal investigator will not refer to individual respondents or facilities in the report, but rather describe the overall picture of the facilities in aggregate. If you have any question, you can contact me (Phone: 0910164313 or email: sifrash2112@gmail.com) and/or my research advisor Dr. Eskinder Eshetu Ali (Phone: 0911944218 or email: eskinder.eshetu@aau.edu.et).

Do I have your permission? Yes ☐ No ☐ If Yes, Continue.

I understand the study aims and objectives and have decided to participate in the study.	
Name:	Day/Month/Year
Person Obtaining Consent:	
Name: Signature:	Day/Month/Year

B. Tracking form for interviews and observations

1. Observational check list for health facilities

A. Stock-Out Data Form

Facility code:	Location:
Facility type:	Date:

- For each product, write the normal stock (Y for yes if the product is normally stocked at the facility & N for no if the product is not usually stocked at the facility) and number of days out of stock for each month.

Commodity	Normal stock	Jul 31 19	Aug 31 19	Sep 30 19	Oct 31 19	Nov 30 19	Dec 31 19	Jan 31 20	Feb 28 20	Mar 31 20	Apr 30 20	May 31 20	Jun 30 20	Total days out of stock
1. Rifampicin 75 mg/isoniazid 50 mg (RH) tablet														
2. Rifampicin 75 mg/isoniazid 50 mg/pyrazinamide 150 mg (RHZ) tablet														
3.RHZE/RH(150mg +75mg + 400mg + 275mg) /(150mg + 75mg) tablet														
4. Ethambutol 400 mg (E) tablet														
5. Ethambutol 100 mg (E) tablet														
6. Isoniazid (H) 300mg tablet														

7. Isoniazide 100mg tablet														
8. Bedaquiline 100mg tablet														
9. Cycloserine 250 mg capsule														
10. Clofazimine 100mg capsule														
11. Delamanid 50mg tablet														
12. Levofloxacin 250 mg tablet														
13. Linezolid 600mg tablet														
14.Prothionamide 250mg tablet														
Row 1: Sum total days out of stock for all stocked commodities														
Row 2: Count total number of products checked "Y" in the normal stock column														
Row 3: Average percentage time out of stock = (number in row 1 × 100) ÷ (365 × number in row 2)														

B. Inventory Data Form

Facility code:	Location:
Facility type:	Date:

Existing inventory control systems:

Data collected from: Computer system ☐ Manual ledger ☐

Stock record cards ☐ Tally sheets ☐

- For each product, write the normal stock (Y for yes & N for no) and the other records by observing the existing inventory control system.

Commodity	Counting Unit	Normal Stock	Record Count	Unrecorded Receipts	Unrecorded Issues	Adjusted Total	Physical Count	Expired Stock	Expired Stock cost	Percentage Expired
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col.10	Col. 11
1. Rifampicin 75 mg/isoniazid 50 mg (RH)	Tablet									
2. Rifampicin 75 mg/isoniazid 50 mg/pyrazinamide 150 mg (RHZ)	Tablet									
3.RHZE/RH(150 mg +75mg + 400mg + 275mg) /(150mg + 75mg)	Tablet									
4. Ethambutol 400 mg (E)	Tablet									
5. Ethambutol 100 mg (E)	Tablet									

6. Isoniazid 100 mg (H)	Tablet									
7. Isoniazid 300 mg (H)	Tablet									
8. Bedaquiline 100mg	Tablet									
9. Cycloserine 250 mg	Capsule									
10. Clofazimine 100mg	Capsule									
11. Delamanid 50mg	Tablet									
12. Levofloxacin 250 mg	Tablet									
13. Linezolid 600mg	Tablet									
14.Prothionamide 250mg	Tablet									

Row 1: Total number of commodities for which Col. 7 equals Col. 8	
Row 2: Total number of commodities for which Col. 8 is greater than Col. 9	
Row 3: Total number of commodities checked “Y” in the Normal Stock column	
Row 4: Percentage of records corresponding with physical counts (Number in Row 1 × 100 ÷ number in Row 3)	
Row 5: Percentage of TB commodities available (Number in Row 2 × 100 ÷ number in Row 3)	
Row 6: Average percentage of expired commodities (Sum of Col. 11 ÷ number in Row 3)	
Raw 7: The sum of the average wastage cost of each commodity	

C. Questions for pharmacy heads

Please tick (√) or provide your own answers where applicable.

1. Is the most recent TB standard treatment guideline present at this facility? Yes □ No □
2. Do health workers have access to the TB treatment guidelines? Yes □ No □
3. Are any job aids (such as posters or small pocket books with instructions about TB regimens) present at this facility to facilitate daily tasks? Yes □ No □
4. When the last training has been given to anti-TB supply chain managers? _____

   4.1 How many staff were trained? _____

   4.2. Was the training done by the health facility/MOH/RHB/NGO? (Please underline one)
5. Based on the schedule of reporting, the last anti-TB medicine supply chain report was sent

   Before the time □ On time □

   Delayed □ Other, please specify _____
6. What types of data are considered when determining TB medicine needs?

- Order period ▭
- Buffer or safety stock ▭
- Total number of TB cases notified in a specified period ▭
- Total number of TB medicines consumed in a specified period ▭
- Total quantity of each medicine to order for a specified period ▭
- Other, please specify _____

7. Complete the information that applies to the facility in this table for TB medicines

Stores	Order frequency	Safety stock level maintained	Comments
Hospital			
Health center			

2. Socio-demographic characteristics of anti-TB supply chain managers (for zonal, regional and national level anti-TB supply chain managers and facility pharmacy heads)

Please tick (√) or provide your own answers where applicable.

1. Gender □ Male □ Female
2. How old are you? Age _____ years
3. Highest academic degree □ Certificate in Pharmacy □ Diploma in Pharmacy □ B Pharm (BSc in Pharmacy) □ MSc in pharmacy □ Others, Please Specify_____
4. Current practice setting:
   □ Hospital □ Health center □ Zonal health bureau
   □ Regional health bureau □ MOH □ NGO □ EPSA
   □ Others Please specify _____
5. Years of experience in the organization_____
6. Current Job title _____

3. Interview guide (for facility pharmacy heads)

1. How does the facility get TB medicines from the supplying stakeholders such as EPSA and Zonal health bureau including the transportation process?
2. How do you describe the pharmaceutical supply chain management as a whole and TB supply chain management practice in your facility?
    i. How do you explain the storage condition of anti-TB medicines in your facility?
    ii. What are the reports and other inventory control mechanisms that you use at the facility? What reports are completed and sent regularly to responsible stakeholders about TB medicines supply chain management?
    iii. How do you describe the quality and reporting process of TB medicines supply chain in your facility?
3. How do you quantify TB medicines?
4. How do you describe the supervision and its frequency from supervisors to assess performance and practices of anti-TB medicines supply management in the last 12 months?
5. How do you describe the capacity building activities for TB Medicines supply chain professionals in your facility to improve their performance in the last 12 months?
6. How do you describe the challenges in TB medicine management at your facility (organization) over the past 12 months?
7. Is there anything more you would like to add?

4. For zonal, regional and national level anti-TB medicines supply chain managers

4.1. WHO-recommended criteria

I. Are you using WHO-recommended essential first-line medicines: isoniazid (H), rifampicin (R), ethambutol (E), pyrazinamide (Z), streptomycin (S)? Yes ☐ No ☐

II. Are you using fixed-dose combinations and/or patient kits? Yes ☐ No ☐

III. Are you continuing to procure and stock limited amounts of separate medicines for use in special regimens for patients with drug toxicity or special requirements? (WHO recommends 2 percent of all TB patients). Yes ☐ No ☐

IV. Are sufficient financial resources available to procure the needed quantities of medicines?

Yes ☐ No ☐

b. Please specify whether Ethiopia is using

- The two-medicine H+R combination Yes ☐ No ☐
- The two-medicine H+E combination Yes ☐ No ☐
- The three-medicine combination Yes ☐ No ☐
- The four-medicine combination Yes ☐ No ☐
- A patient kit containing FDCs (Fixed Dose Combinations) Yes ☐ No ☐

1. **Interview guide (for zonal, regional and national level anti-TB medicines supply chain managers)**

    1. How do you describe the pharmaceutical supply chain management as a whole and TB supply chain management practice in the zone/nationally?
        i. How are TB medicines requirements quantified?
        ii. How do you describe the quality and reporting process of TB medicines supply chain from facilities?
    2. How do you describe the procurement process of anti-TB medicines of the zone/country?
    3. How is the distribution of the medicines conducted by your institution (how do the health facilities get anti-TB medicines)?
    4. How do you monitor and evaluate anti-TB medicines supply chain system?
    5. How do you describe the challenges in TB medicine supply management by your organization over the past 12 months?
    6. Is there anything more you would like to add?

C. Amharic version of the consent form and interview guide

አዲስ አበባ ዩንቨርስቲ

ፋርማሲ ትምህርት ቤት

ፋርማሲቱክስና ሶሻል ፋርማሲ ትምህርት ክፍል

ሄልዝ ሰፐላይ ቼይን ማኔጅመንት ፕሮግራም

በኢትዮጵያ በፌደራል ፣በደቡብ ክልል፣በጉራጌ ዞንና በዞኑ ውስጥ በሚገኙ የመንግስት ጤና ተቋማት ውስጥ ለሚሰሩ የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራሮች በጥናቱ ለመሳተፍ ፈቃደኝነታቸውን የሚገልፁበት ቅጽ፣ 2012 ዓ.ም.

ጤና ይስጥልኝ! ስፍራሽ ገዛኸኝ እባላለሁ :: በአዲስ አበባ ዩንቨርስቲ በፋርማሲ ትምህርት ቤት የመጨረሻ ዓመት የሁለተኛ ድግሪ ተማሪ ነኝ :: በሄልዝ ሰፐላይ ቼይን ማኔጅመንት ላይ የምሰራውን የሁለተኛ ድግሪዬን ለማጠናቀቅ በደቡብ ክልል በጉራጌ ዞን በሚገኙ የመንግስት ጤና ተቋማት ውስጥ የፀረ-ቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራር ላይ ያሉ አሰራሮችና ችግሮቻቸውን በተመለከተ የዳሰሳ ጥናት እየሰራሁ እገኛለሁ:: በዚህ ጥናት ላይ ለመሳተፍ ፈቃደኛ ስለሆናችሁና ስለተባበራችሁ ለእርስዎና ለመስሪያቤትዎ ከልብ የመነጨ ምስጋናዬን አቀርባለሁ:: የእርስዎ በዚህ ጥናት ላይ መሳተፍ በፀረ-ቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራር ሲስተም ላይ የሚታዩ ቁልፍ ችግሮችን ለመለየትና ለመፍታት ትልቅ አስተዋፅዖ ይኖረዋል::

ለጥያቄዎቹ ትክክለኛውን ምላሽ ለመስጠት እንዲተባበሩኝ በትህትና እጠይቃለሁ:: በዚህ ጥናት ውስጥ የእርስዎ ተሳታፊነት ሙሉ በሙሉ በእርስዎ ፈቃደኝነት ላይ የተመሰረተ ነው:: በዚህ ጥናት ውስጥ ቃለ መጠይቁን በማንኛውም ሰዓት ማቋረጥ ወይም ጥያቄዎችን አለመመለስ ይችላሉ:: በጥናቱ ውስጥ ለሚነሱ ጥያቄዎች የሚሰጡት ምላሽ ሙሉ በሙሉ በምስጢር የሚጠበቁ ሲሆን ከጥናት ቡድኑ በስተቀር ማንም ሊያገኛቸው አይችልም:: የእርስዎና የተቋምዎ ማንነት የሚገልፁ መረጃዎች በጥናቱ ውስጥ የማይገለፁ ሲሆን ማጠቃልያ የሚሰጠው የሁሉንም ተቋማት ምላሽ በአንድላይ በማጠቃለል ይሆናል:: ማንኛውም አይነት ጥያቄ ካልዎት በስልክ ቁጥር: 0910164313 ወይም በኢ -ሜይል አድራሻዬ sifrash2112@gmail.com እንዲሁም በጥናቱ አማካሪዬ ዶክተር እስክንድር እሸቱ አሊ በስልክ ቁጥር: 0911944218 ወይም በኢ -ሜይል አድራሻው eskinder.eshetu@aau.edu.et ሊያገኙን ይችላሉ::

በጥናቱ ለመሳተፍ ፍቃደኛ ነዎት? አዎ ☐ አይደለም ☐

ፈቃደኛ መሆናቸውን ካረጋገጡ ቃለመጠይቁን ይጀምሩ::

የጥናቱን ዓላማና ግብ ተረድቼ ጥናቱ ላይ ለመሳተፍ ፈቃደኛ ሆኛለሁ ::		
ስም :		ቀን/ወር/ዓ.ም
ቃለ መጠይቅ አቅራቢ:		
ስም :	ፊርማ :	ቀን/ወር/ዓ.ም

በመንግስት ጤና ተቋማት ውስጥ ለሚሰሩ የፋርማሲ ክፍል አስተባባሪዎች የሚቀርብ ቃለ-መጠይቅ

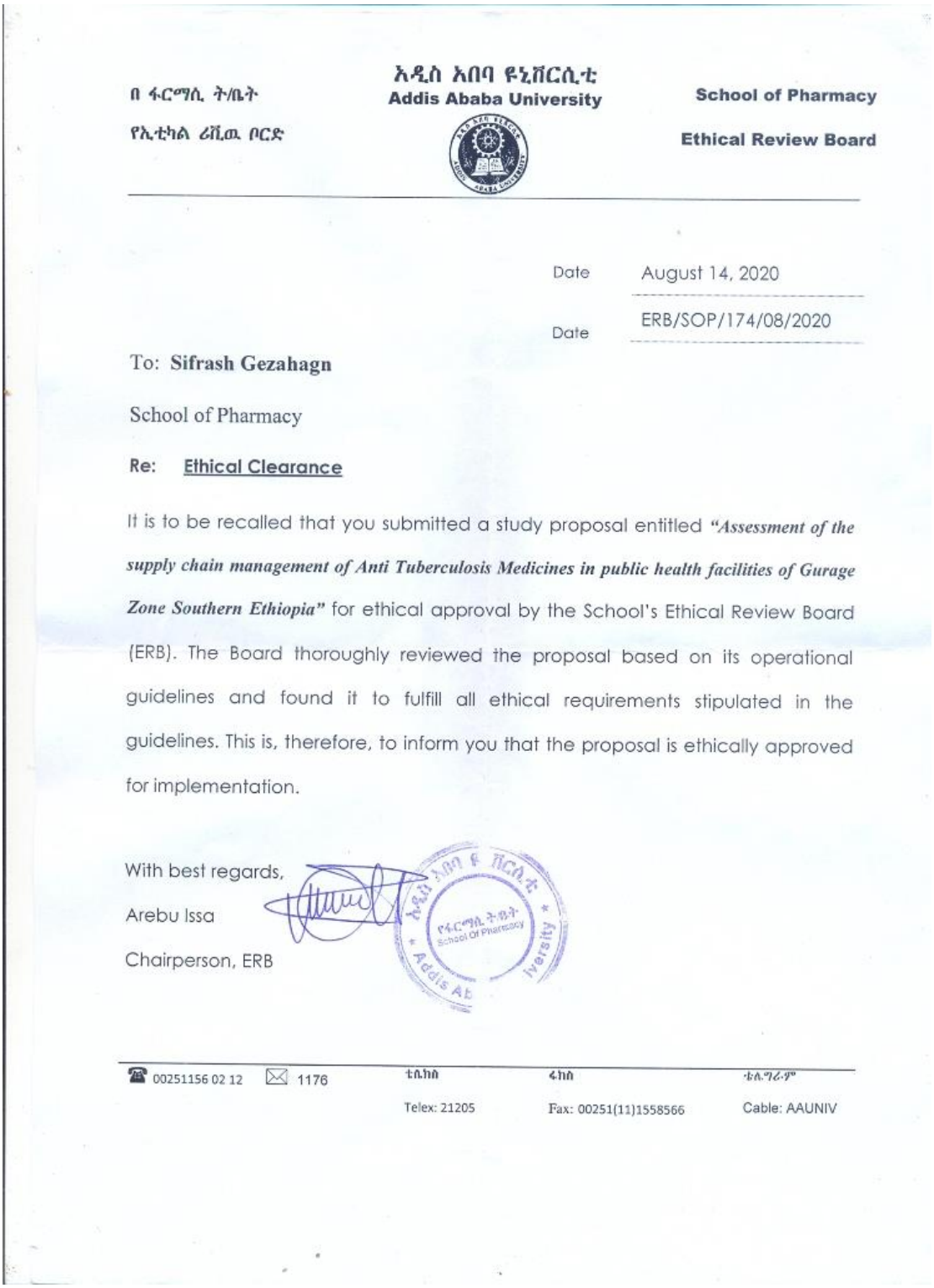
1. የእርስዎ ተቋም የቲቢ መድኃኒቶችን ከአቅራቢ ተቋማት (EPSA፣ ዞን ጤና ቢሮና የመሳሰሉት) በምን መልኩ ነው የሚያገኘው? የትራንስፖርት አቅርቦቱስ ምን ይመስላል?
2. የፋርማሲቱካል አቅርቦት ሰንሰለት እንደአጠቃላይና የቲቢ መድኃኒት አቅርቦት ሰንሰለት ስራዎች በእርስዎ ተቋም እንዴት ይገልፅዋቸዋል?
    - የቲቢ መድኃኒቶች ከምችት ሁኔታዎች እንዴት ይገልፅዋቸዋል?
    - በተቋማችሁ ውስጥ ምን ዓይነት ረፖርቶችንና የከምችት ቁጥጥር ዘዴዎችን ትጠቀማላችሁ? የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራርና አጠቃቀም በተመለከተ ምን ምን ሪፖርቶች ተዘጋጅተውና ተሞልተው ለሚመለከታቸው አካላት በቋሚነት ይላካሉ?
    - የቲቢ መድኃኒቶች የአቅርቦት ሰንሰለት አመራርና አጠቃቀም በተመለከተ የሚዘጋጁ ሪፖርቶች ጥራታቸውና የአላላክ ሁኔታቸው እንዴት ያብራሩታል?
3. ለእርስዎ ተቋም የሚያስፈልጉ የቲቢ መድኃኒቶችን በምን መልኩ ነው የሚሰሉት ወይም የሚተነበዩት?
4. ባለፉት 12 ወራት ውስጥ የቲቢ መድኃኒቶችን አቅርቦት ሰንሰለት አመራር ብቃት በተመለከተ በተቆጣጣሪ አካላት የተደረጉ የቁጥጥር ስራዎችና ሂደቶች እንዴት ይገልፁታል?
5. በእርስዎ ተቋም ባለፉት 12 ወራት ውስጥ በቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራር ላይ የሚሰሩ ባለሙያዎች ብቃት ለማሻሻል የተደረጉ የአቅም ግንባታ ስራዎች እንዴት ይገልፁታል?
6. ባለፉት 12 ወራት ውስጥ የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራር ላይ ያጋጠሙ ችግሮችን እንዴት ይገልፅዋቸዋል?
7. ከዚህ በተጨማሪ ሊነግሩኝ የሚፈልጉት ነገር ካለ እድሉን ለእርሶዎ ልስጥ::

በሀገር አቀፍ ፣ በክልልና በዞን ደረጃ በፀረ-ቲቢ መድኃኒቶች አቅርቦት ሰንሰለት ላይ ለሚሰሩ አመራሮች የሚቀርብ ቃለመጠይቅ

1. በሀገር አቀፍ/በዞን ደረጃ ያለውን የፋርማሲቱካል አቅርቦት ሰንሰለት እንደአጠቃላይና የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት ስራዎች እንዴት ይገልፅዋቸዋል?
    - የሚያስፈልጉ የቲቢ መድኃኒቶችን በምን መልኩ ነው የሚሰሉት ወይም የሚተነበዩት?
    - የቲቢ መድኃኒቶች የአቅርቦት ሰንሰለት አመራርና አጠቃቀም በተመለከተ በጤና ተቋማት የሚዘጋጁ ሪፖርቶች ጥራታቸውና የአላላክ ሁኔታቸው እንዴት ያብራሩታል?
2. በሀገር አቀፍ/በዞን ደረጃ ያለውን የቲቢ መድኃኒቶች የግዥ ሂደት እንዴት ይገልፁታል?
3. የቲቢ መድኃኒቶች ስርጭት በምን መልኩ ነው የሚደረገው (የጤና ተቋማት የቲቢ መድኃኒቶችን እንዴት ነው የሚያገኙት)?
4. የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት ሲስተም ክትትልና ምዘና እንዴት ይደረጋል?
5. ባለፉት 12 ወራት ውስጥ የቲቢ መድኃኒቶች አቅርቦት ሰንሰለት አመራር ላይ ያጋጠሙ ችግሮች ካሉ ይግለፁልን?
6. ከዚህ በተጨማሪ ሊነግሩኝ የሚፈልጉት ነገር ካለ እድሉን ለእርሶዎ ልስጥ::

Annex II

Permission letters



በ ፋርማሲ ትምህርት ቤት
የኢቲካል ሪቪው ቦርድ

አዲስ አበባ ዩኒቨርሲቲ
Addis Ababa University

School of Pharmacy
Ethical Review Board

Date August 14, 2020

Date ERB/SOP/174/08/2020

To: **Sifrash Gezahagn**

School of Pharmacy

Re: **Ethical Clearance**

It is to be recalled that you submitted a study proposal entitled ***"Assessment of the supply chain management of Anti Tuberculosis Medicines in public health facilities of Gurage Zone Southern Ethiopia"*** for ethical approval by the School's Ethical Review Board (ERB). The Board thoroughly reviewed the proposal based on its operational guidelines and found it to fulfill all ethical requirements stipulated in the guidelines. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Arebu Issa

Chairperson, ERB

☎ 00251156 02 12 ✉ 1176 ቴሌክስ Telex: 21205 ፋክስ Fax: 00251(11)1558566 ቴሌግራም Cable: AAUNIV

Addis Ababa University
አዲስ አበባ ዩኒቨርሲቲ

በፋርማሲ ት/ቤት
የፋርማሲዩቲክስና ሶሻል ፋርማሲ
ትምህርት ክፍል

School of Pharmacy
Department of Pharmaceutics
and Social Pharmacy

ቀን
Date: August 17, 2020
ቁጥር
Ref No: Ph/ceutics/784/12/2020

To: Gurage Zone Health Administartion, South regional health bureau, EMoH and EPSA

Re: Letter of support

This is to notify that Sifrash Gezahagn Degefa, a student in the Health Supply Chain Management MSc program, is starting work on her thesis research entitled, ''Assessement of the supply chain management of anti tuberculosis medicinces public health facilities of Gurage Zone ,Southern Ethiopia''. This is therefore, to kindly request you to provide her with the necessary support.

With best regards,

Gebremariam Birhanu (PhD)
Head of Department

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ቁጥር ጉ.ጤ.ጽ 1413/4948
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Date

የደቡብ ብሔር ብሔረሰቦች ህዝቦች ክልላዊ መንግስት
የደቡብ ብሔር ብሔረሰቦች ህዝቦች ክልላዊ መንግስት
የጎፋ ዞን ጤና መምሪያ
South Nation Nationalities and peoples Regional
State Gonga Zone Health Department

ለ---------- ወረዳ/ ሆስፒታል

ባሉበት

ጉዳዩ ፡- ለወ/ሮ ስፍራሽ ገዛኸኝ ትብብር እንዲደረግላቸው ስለመጠየቅ ይሆናል

የመድሀኒት እና የህክምና መገልገያ መሳርያዎች ክምችት፣ አያያዝ፣ ስርጭትና አጠቃቀም በተመለከት ጥናታዊ ጽሁፍ ለመስራት ከአዲስ አበባ ዩንቨርስቲ ከፋርማሲ ት/ት ክፍል የመጡትን ወ/ሮ ስፍራሽ ገዛኸኝ ለሚደርጉት ጥናታዊ ጽሁፍ በተቋማቹህ አስፈላጊው ትብብር እንዲደረግላቸው እንጠይቃለን ፡፡

ወረርሽኝን በጋራ እንከላከል!!!

ኤርምያስ በቀለ ሀ/ጊዮርጊስ
Ermyas Bekele H/Giorgies
የመድ/ህክ/መገ/መሳ/አቅ/ደ/ስራ ሂደት አስተባባሪ

ግልባጭ

- ለመምርያችን ሃላፊ ቢሮ
- ለመድ/ህክ/መገ/መሳ/አቅ/ደ/ስራ ሂደት

ወ/ጤ

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