

The Journey of the Pill

Findings of the NCD Commodity
Supply Chain Assessment in Kenya



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Foreword



In setting its Kenya Health Policy 2012-2030 agenda, Kenya aims to respond to the health needs of the population, in hopes of achieving the highest possible standard of health. The policy's six strategic objectives include a focus on halting and reversing the rising burden of noncommunicable diseases (NCDs). Kenya, like most developing countries, is facing a significant burden of NCDs. The 2015 STEPs cross-sectional household survey was the first NCD survey conducted in Kenya and showed that NCDs are among the country's leading causes of morbidity and mortality. At the time, NCDs were responsible for 27% all deaths in Kenya.

Access to essential NCD drugs and products remains a significant bottleneck in the response to NCDs globally and in Kenya. A global landscape report released in 2015 found the availability of NCD essential medicines and technologies (EMTs) at levels insufficient to meet demand, greater availability in the private sector than the public sector, and high costs to the end user. Furthermore, the report highlighted the need for strengthening national and subnational health systems, monitoring processes, and supply chain management systems for the public and private sectors. The irregular supply of affordable NCD EMTs increases risks for complications and has a disproportionate impact on the poorest populations.

It was critical to gain a better understanding of Kenya's supply chain system of NCD drugs and commodities, bottlenecks, and challenges to address this growing burden. The Ministry of Health Department of Non-Communicable Diseases, in collaboration with PATH, conducted an NCD supply chain mapping assessment in 2019 to understand what patients encounter as they access NCD care services at private, public, and faith-based health facilities.

This NCD supply chain assessment, *The Journey Of The Pill*, will define and inform the next steps in improving access and availability of NCD medicines and commodities to PLWNCDs if we are to turn the tide of morbidity and mortality due to NCD diseases in Kenya. This assessment will further inform the NCD components of achieving Universal Health Coverage and ensuring no one who needs NCD care and treatment is left behind.

The Ministry of Health, Department of Non-Communicable Diseases will facilitate the wide dissemination of the assessment findings to NCD stakeholders at national, county, and sub-county level to better inform our country's collective NCD response.

Dr. Waqo Ejersa
Head, Ministry of Health Department of Non-Communicable Diseases



Noncommunicable diseases are a major global health issue, accounting for more than 15 million premature deaths annually. And despite years of progress, patients still struggle to manage their diseases. An important factor in care for NCDs is access to medicines and health products. PATH believes ensuring this access is key to helping people across the world manage their diseases and prevent unnecessary deaths. The COVID-19 pandemic has made the gaps in NCD care more apparent. We believe our work in strengthening the supply chain in Kenya plays a vital role in the country's ongoing efforts to build a resilient health care system in the face of future crises.

PATH works in over 70 countries globally to develop and scale solutions—including vaccines, drugs, devices, diagnostics, and innovative approaches to strengthening health systems worldwide. We have been a trusted partner of the Government of Kenya since the 1990s. Our partnership with the Ministry of Health on the No Empty Shelves study in 2014-2015 served as an important precursor to this *Journey of the Pill* assessment. Our partnerships with the Government of Kenya, PEPFAR, Novo Nordisk and others have reached hundreds of thousands of Kenyan citizens. PATH began working on NCDS in 1996, focusing on women's cancers. In 2012, the program expanded to begin addressing the expanding global burden of diabetes and cardiovascular disease.

Kenya has been a leader in testing innovations to support the realization of Universal Health Coverage for its citizens. This assessment is part of a comprehensive set of programming designed to contribute to Kenya's aspirations by strengthening primary health care NCD services, building a culture of quality data use for NCD planning and care, and improving access to NCD commodities. Most recently, with the support of Access Accelerated, we have launched the NCD Navigator, a dynamic tool that provides Kenya's Ministry of Health with data to direct strategy execution and resource allocation. This is an important component of this program of work. I thank both Dr. Maree and his colleagues at the Ministry of Health for their help in completing this NCD commodity supply chain assessment. We look forward to working with them to implement the recommendations found in the report as an important contribution towards achieving universal health coverage in Kenya. We are grateful to Access Accelerated for their visionary approach to bringing industry together to collaborate with partners and support ground-breaking work that achieves system change to improve the lives of people living with NCDs.

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- Kenya Medical Supplies Authority (KEMSA)
- Mission for Essential Drugs and Supplies (MEDS)
- The management and technical staff of the public, private, and faith-based health facilities, retail pharmacies, manufacturers, and supply chain organizations

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In addition, we thank the PATH Kenya team for facilitating the technical and logistical aspects of this study including Dr. Edward Kariithi, Dominic Mutai, Vaishaleeben Patel, and Dr. Willis Omwoyo, who were co-investigators for the study. The study assessment team was provided additional data review and writing support by the PATH global team and included Marilyn Noguera, Kinsy Hood, Laina Mercer, Dr. Josphat Samoei, and Roshini George. Our thanks to Access Accelerated for supporting this important work.

Abbreviations

CCE	cold chain equipment
CS	commodity security
DHIS2	District Health Information Software 2
eLMIS	electronic logistics management information system
EPI	expanded program on immunizations
FBO	faith-based organization
HCW	health care worker
HTP	MOH Health Products and Medical Technologies Department
ICD	Inland Container Depot
KEMRI	Kenya Medical Research Institute
KEMSA	Kenya Medical Supplies Authority
KEML	Kenya Essential Medicines List
KEPH	Kenya Essential Package for Health
KHIS	Kenya Health Information System
KRA	Kenya Revenue Authority
MEDS	Mission for Essential Drugs and Supplies
MOH	Ministry of Health
MSF	Médecins Sans Frontières.
NCD	noncommunicable disease
NES	No Empty Shelves
PHC	primary health care
PLWNCD	people living with noncommunicable disease
SKU	stock keeping unit
SOP	standard operating procedure
SSD	Supply Services Division
UHC	universal health coverage
WHO	World Health Organization

Executive summary

Background

Noncommunicable diseases (NCDs) account for two-thirds of the global burden of disease and lead to 40 million deaths each year. Upwards of 75 percent of these deaths occur in low- and middle-income countries (LMICs) with linkage to lack of availability and affordability of NCD medicines and supplies. Kenya, like many LMICs, is undergoing an epidemiological transition marked by a decline in morbidity and mortality due to communicable conditions and an increase in the burden of NCDs. NCDs are estimated to account for 27 percent of all deaths in the country; the probability of dying in Kenya between the ages of 30 and 70 years from cardiovascular disease, chronic respiratory disease, cancer, or diabetes is 13 percent.¹

The World Health Organization (WHO) estimates that one-third of the world's population lacks access to essential medicines and diagnostics. In the poorest regions, this proportion increases to 50 percent.² Improving access to existing essential medicines and vaccines could save 10 million lives per year.³ The Kenya STEPS 2015 survey found that medicines and behavior change can halt up to 80 percent of premature deaths from heart disease, stroke, and diabetes.⁴ The 2014 to 2015 No Empty Shelves (NES) project,^a by PATH in partnership with the Kenya Ministry of Health (MOH), found that among products surveyed in the public sector, no medicine was available at WHO's target (80 percent of private and public facilities) in the *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020* and only the private pharmacy sector achieved the *Global Action Plan* target for several medicines. Besides lack of access, annual out-of-pocket costs were frequently outside the reach of most citizens. The Kenya STEPS 2015 survey also found that the cost of NCD care forces millions of people into poverty annually.

A reliable supply chain is often referred to as the “backbone” of a health system. In addition to meeting the demand for drugs and medical supplies, it serves to safeguard a country's investments in health commodities, which is particularly important as countries ramp up efforts to work toward universal health coverage.

Assessment overview

The aim of this *Journey of the Pill* assessment is to identify strengths and inefficiencies in the supply chain. It builds on PATH's earlier assessment from the NES project that focused on medicines and products to treat diabetes, hypertension, and dyslipidemia in Kenya and Senegal. Further defining the journey of medicines will help inform the MOH and other stakeholders of future actions to strengthen commodity security for NCDs. This assessment was conducted in six high-burden counties, with data collected from 57 sites. This included 35 public facilities, four private clinics, and five faith-based clinics and 13 private wholesale and retail pharmacies. Batch tracking was completed on five tracer medicines. The assessment was conducted from August 2019 to October 2019, and retrospective data from transaction records to determining lead time calculations were reviewed back to May 2018.

Findings and recommendations

The results presented follow the journey of the pill from manufacturing to dispensing to people living with NCDs (PLWNCDs). A concentration of red flags or challenges were noted in the ordering phase and the supply management phase; report recommendations focus on these two areas. A prevalence

^a The NES study conducted 77 pricing and availability surveys in five counties and performed 55 supply chain interviews to assess system strengths and bottlenecks, as well as availability, price, and affordability of diabetes medicines and products.

of stockouts with a high level of variance across select commodities and across counties assessed was also noted. Price markups were measured and observed as far exceeding the benchmark of 33 percent advised by the Pharmacy and Poisons Board for the private sector.

Leadership and governance

The leadership and governance of supply chain organizations is paramount to making measurable process improvements that will result in increased availability and affordability of priority NCD commodities in the public, FBO, and private sectors. Address the challenges in the NCD supply chain by strengthening leadership, governance, and financing of the NCD supply chain at the central and county levels.

Ordering and supply management

Our assessment highlighted several red flags related to supply management at the facility level, including weak implementation of standard operating procedures, inadequate data collection and use, and data limited to facility stock movement rather than linked to patient treatment. Ordering decisions are further confounded by interfacility supply sharing that skews consumption data. Supply management for NCD medications is opaque and inefficient, with a dependency on individual actors and a paucity of high-quality data. High-quality data are important for quantification at the central level, so the issues around data quality and data use were highlighted as a concern not just for the facilities and the counties where the issues were noted, but also for national procurement of medical commodities and supplies.

The ordering system

In Kenya, all counties are mandated to procure medicines and medical supplies from the Kenya Medical Supplies Authority (KEMSA) via a digital system. The only exception has been when KEMSA is unable to deliver the required quantities of products, in which case counties turn to the Mission for Essential Drugs and Supplies (MEDS), a faith-based organization (FBO) proven to be a reliable backup provider of pharmaceutical and health products. All FBO facilities are obligated to order their supplies from MEDS.

Overall, distribution and transport systems for NCD commodities were found to be functional, and no major issues were noted with the delivery mechanisms and digital ordering system. However, there were practical limitations in the public system. Orders were only activated and fulfilled at 100 percent if the following conditions were met: the facility had drawing rights to cover cost of commodities; the county had budget available; KEMSA approved the county's credit; and supplies were available at KEMSA. As a result, order cycles were variable, and it was estimated that orders were filled at approximately 75 percent. Staff reported difficulty in retrieving the data they required to track orders over time. These conditions presented increased risk of stockouts at the facility.

Supply management

While there were issues with data from the pharmacy stores, there were no standard registers or record-management tools at the pharmacy dispensing areas to record stock dispensed to patients other than antibiotics. As a result, when reviewing drugs dispensed, there was no correlation between medicines issued versus patient numbers. There also were no details captured on medicines dispensed by patient and by treatment regimen. Further, the electronic systems, which were found in the Level 4/Level 5 facilities, did not generate reports to support ordering. Instead, they were oriented toward financial reimbursement for service. In these facilities, patient files were electronically linked to the various departments and patient records/prescriptions appeared online for dispensing. However, if

the medicine was not in stock at the dispensing point, the patient would not receive anything and there would be no record of a missed prescription.

Special considerations: Insulin

Lack of accompanying consumables created challenges in patient adherence. For example, though insulin might be available, syringes and needles were not, forcing patients to procure these supplies from the private sector at a much higher price.

Packaging insulin with syringes and needles could ensure patients have access to needed supplies. Including blood glucose monitors, lancets, and testing strips kits should also be considered. KEMSA should also be incentivized to review each county's digital order to ensure these consumable medical supplies for insulin are included, which would enhance patient compliance from an access and affordability perspective.

Stockouts

All five tracer items were noted to be out of stock at least once during the review period in all six counties. The main reasons for stockout periods were limited supplies issued to health facilities due to budget limitations, the causes of which are discussed in the body of this report. Although there was limited information available on stockouts in the private sector, they appeared to be rare. None of the FBO facilities reflected stockouts.

Price markups

Although not formally regulated, the standard for price markups for the private sector is set at approximately 33 percent. However, markups far exceeded this standard and were noted as a significant issue impacting price of tracer medicines to people living with NCDs. Markup percentages were considerably higher in the faith-based and public sector and more widely variant between facilities as compared to the faith-based and private sectors. However, the end price remained higher in the private sector in most cases. Product pricing showed a great deal of variability, with the markup percentages ranging from 346 percent for amlodipine, 288 percent for metformin, 281 percent for hydrochlorothiazide, 137 percent for insulin-prefilled pens, and 47 percent for insulin biphasic vial. The private sector was not subject to regulations or monitoring regarding their pricing structures.

Opportunities to leverage existing infrastructure

The assessment highlights some of the gaps between the supply chain capabilities that exist in the NCD space versus other disease areas in Kenya. For example, gaps noted in areas such as ordering, supply management, cold chain storage, and capacity of supply chain personnel, have been addressed in disease areas through investment in infrastructure, data collection, training, and capacity building. This provides an opportunity, therefore, to leverage and benefit from existing infrastructure and learn from other disease areas that have faced and overcome the challenges noted in this assessment.

Conclusion

The purpose of the assessment described in this report was to map the journey of the pill for NCD-related medicines and products in Kenya from manufacturers to end users, to identify and quantify gaps and bottlenecks in the supply chain. Results will be useful for MOHs and other stakeholders who are charged with designing interventions to strengthen supply chain management and efficiency, which in turn will serve to buttress the massive efforts underway to work toward universal health coverage. These findings have illuminated opportunities to harness, standardize, and digitize better

data, and train health workers on the quantification, procurement, and dispensing and reporting systems comprising the supply chain for NCD commodities. These recommendations, which can be indicative of issues affecting supply chain security beyond Kenya, will serve to make lifesaving medications more accessible and affordable to people in low- and middle-income countries who are suffering physically, emotionally, and financially from NCDs.

Based on these results, the following primary recommendations were made:

- Leverage primary health care (PHC) for PLWNCDs by implementing policy and practice changes to allow for lower level facilities to store and dispense critical NCD medicines and products while building capacity of health care workers to ensure rational use of NCD medicines at the PHC level.
- Improve the quality and use of supply and service delivery data from NCD treatment at facility level to inform quantification and rational use of NCD commodities, working with county-based pharmacists and facility medical therapeutic committees.
- Digitize supply chain functionalities with a focus on linking dispensing and ordering transactions and enabling timely data capture and analysis.
- Collaborate with the Coalition for Access to NCD Medicines and Products to develop and test a demand forecasting methodology tailored for NCD medicines for use in routine ordering and in annual national quantification to inform budgeting and national procurement.
- Recognize unique requirements of insulin administration—including the need for syringes, blood glucose monitors and strips, along with monitored cold storage at facilities—and propose solutions.
- Invest in short-term solutions to improve cold chain monitoring while planning to invest in expanding long-term cold chain capacity through the Kenya National Health Supply Chain Strategy.
- Establish a monitoring system and publish price markups to achieve a national standard and reduce current variance within counties and across Kenya.
- Conduct a costing assessment, focused on hypertension, diabetes, and hyperlipidemia to understand the cost drivers for NCD commodities and inform policy recommendations to rationalize pricing, strengthen advocacy, and plan for funding needs to address NCDs and inputs to the Costed National NCD Strategy and Kenya Health Supply Chain Strategy.
- Inform and prepare PLWNCDs and the public to advocate for available and affordable NCD medicines and products as a basic human right.
- Assess supply strengthening activities across disease areas and prioritize them based on their applicability and potential to influence NCD supply security and support collaboration across geographies and therapeutic areas to support shared learning and development of innovative solutions.
- Integrate the lessons learned across supply-related efforts to develop a National NCD Supply Chain Strategy and propose NCD recommendations to be considered for the National Supply Chain Strategy.

1. Introduction to noncommunicable diseases

Noncommunicable diseases account for two-thirds of the global burden of disease and lead to 40 million deaths each year. Upwards of 75 percent of these deaths occur in low- and middle-income countries. The lack of availability and affordability of NCD medicines and supplies contributes to the NCD burden. In addition, NCDs disproportionately affect women and place a huge economic burden on families and communities. For example, in Kenya and elsewhere, the cost of NCD care has been shown to force millions of people into poverty every year. Furthermore, despite research that shows medicines and behavior change can prevent up to 80 percent of premature deaths from heart disease, stroke, and diabetes, only 1.3 percent of all development-assistance funding for health is devoted to preventing and controlling NCDs (including diabetes, cardiovascular disease, and breast and cervical cancer).⁵

PATH has years of experience in providing technical assistance to countries working toward improving access and affordability to NCD medicines and products. For example, in 2014 and 2015, PATH, in partnership with the Kenyan MOH, implemented the No Empty Shelves (NES) project in Kenya that illustrated the lack of medicines and high prices for drugs. Specifically, the study showed that in public health facilities in Kenya, the availability of oral medications on the 2010 Essential Medicines List ranged from 30 percent to 56 percent, and the availability of those medications in demand but not listed ranged from 0.0 percent to 53.3 percent. In addition, the NES study identified retail markups ranging from 25 percent to 884 percent at public sector county hospitals and from 68 percent to 262 percent at private sector pharmacies and a high percentage of out of pocket costs associated with required health products such as syringes and blood glucose monitoring strips. Although drugs tend to be more expensive in the private sector, limited public availability pushed patients to purchase supplies there and experience higher, and in some cases catastrophic, out-of-pocket costs, despite cost incentives to obtain NCD medicines from the public sector.

PATH also launched the Coalition for Access to NCD Medicines and Products, which serves to generate evidence on barriers to accessing NCD medicines, and currently serves as the Secretariat. In this role, the Coalition contracted inSupply Health, an affiliate of JSI Research & Training Institute, to undertake a supply chain mapping and landscaping desk review for the NCD supply chain in Kenya. This review highlighted global, regional, and Kenya-specific best practices in supply chain with the aim of improving the efficiency and effectiveness of the NCD supply chain in Kenya.

The health supply chain is often referred to as the “backbone” of the health system. It comprises the people, processes, technology, and resources that ensure the needed health commodities reach the right communities at the right time at the right cost. The findings from the above bodies of work suggest that challenges across multiple supply chain management functions contribute to the low availability of NCD medicines and products, especially in rural areas and at the primary care level. Weak systems and processes for key logistics functions in supply management contribute to shortages in NCD commodities in the public sector.

The purpose of the assessment described in this report was to map the journey of the pill for NCD-related medicines and products in Kenya from end to end to identify and quantify gaps and bottlenecks in the supply chain. This report represents findings from the assessment, which were verified, analyzed, and finalized with stakeholders in the first quarter of 2020. Results will be useful for the MOH and other stakeholders who are charged with designing interventions to strengthen supply chain management and efficiency, which in turn will serve to buttress the massive efforts underway to work toward UHC.

2. Aims and methods

The aim of the assessment was to identify strengths and inefficiencies in the supply chain management systems at all levels through an end-to-end NCD supply chain assessment by mapping tracer medicines from the time of manufacture or entry into the country to the time of dispensing to patients. This would define the journey of medicines to inform future actions to strengthen supply security.

2.1 Methodology

2.1.1 Design

A cross-sectional mixed-method approach was used to collect both qualitative and quantitative data at various levels along the supply chain for five tracer items. The five tracer products selected were tracked through the batch numbers of products delivered to KEMSA from May 2018 to August 2019. Institutional Review Board (IRB) approval was received from the Kenya Medical Research Institute (KEMRI) for the assessment.

2.1.2 Data collection

Data were collected between August and October 2019 using an electronic Microsoft Word questionnaire. Hard copies of the questionnaire were used in locations with unreliable power supplies. Data were then transferred into a Microsoft Excel database for analysis.

2.1.3 County and facility selection

Initial data on distribution to all public health facilities in the country were gathered at the central level from KEMSA, the Mission for Essential Drugs and Supplies (MEDS), and private suppliers, where possible. The MOH Department for NCDs and PATH agreed on the selection of the six assessment counties during the initiation phase. The counties and health facilities by type that the team did visit are shown in Table 1, and a detailed list of all facilities, including the retail pharmacies visited is in Appendix 2.

Three criteria were used for selecting the counties:

1. National NCD high-priority counties (i.e., UHC counties—Machakos, Kisumu, Nyeri, and Isiolo—within the six select counties).
2. Disease burden for diabetes, hypertension, and cancer.
3. Supply volume distributed to the various sectors within the select counties over a one-year period.

Table 1. Health facilities visited during the data collection

Sector	Nairobi	Machakos	Kisumu	Nakuru	Nyeri	Isiolo	Grand total
Public sector	6	5	6	7	6	5	35
Private sector	0	0	1	1	1	1	4
Faith-based organization	0	1	1	1	1	1	5
Total	6	6	8	9	8	7	44

At the county level, a combination of purposive and simple random-sampling strategies was adopted in selecting sites. PATH worked with the various county health management teams to select these sites. A mix of facilities were selected from each sector to balance the visits across sectors and levels of care within the given time frame.

To select the public health facilities at the county, the following steps were employed:

1. A county referral hospital was purposively selected.
2. Three subcounty hospitals were randomly selected.
3. Two health centers reporting NCD data for 2018 into the national health management information system were randomly selected.
4. One dispensary reporting NCD data for 2018 into the national health management information system was randomly selected.

To pick the retail pharmacy to conduct the interview, the following purposive sampling criteria were used:

1. High volumes of over-the-counter sales.
2. Within one-hour travel from the county referral hospital.

A private hospital and a faith-based hospital were purposively selected based on the following purposive sampling criteria:

1. Highest burden of targeted NCDs for the type of facility in their county.
2. Within three hours of travel from the county capital.
3. Highest outpatient attendance.

The above sampling strategy yielded one county referral hospital, three subcounty hospitals, two health centers, one public dispensary, one faith-based hospital, one private hospital, and one retail pharmacy outlet for a total of ten facilities in every county. County MOHs reviewed and approved the selections. The team was not able to visit and interview every facility sampled. Table 1 summarizes the facilities visited and a list of facilities visited in each province is provided in Appendix 2.

Interviews were conducted with recipients at each point along the supply chain, including with a broader set of stakeholders. These included staff from the national NCD program, MOH Finance Department, MOH Procurement Department, KEMSA, county medical offices and stores, and warehouse facilities. During the interviews, preselected tracer products were mapped through public, private, and FBO facilities from point of entry into the country until final point of use. Specifically, for the public sector, several medicines and insulin syringes were tracked from customs to KEMSA and then to hospitals, health centers, and dispensaries. For the private sector, the selected imported products were traced from customs to wholesalers, distributors, hospitals, clinics, and pharmacies. FBO products were traced from customs to the MEDS warehouse and then to the various dispensing and use sites. Finally, products manufactured in-country were traced from the factory through the

same channels described above. In addition, supply chain markups were measured through collection of unit prices of the products across the supply chain up to the time a patient receives the product.

2.1.4 Tracer drugs selection

The tracer medicines listed in Table 2 were selected from the Kenya Essential Medicines List (KEML) and a review of volume data from KEMSA. The five tracer medicines selected were the most frequently prescribed for the three most prevalent NCDs: hypertension, diabetes, and breast cancer. All selections were reviewed by the MOH and were based on drug classes recommended by WHO in their *Package of Essential Noncommunicable (PEN) Disease Interventions for Primary Health Care in Low-Resource Settings* as first-line therapy suitable for treatment within primary health care services for hypertension and diabetes.

The items were tracked through the supply chain in all the sectors using batch numbers, their documentation, and physical checks at the facilities. Price markups were traced through analysis of KEMSA unit prices, purchase prices, and selling prices in the management of these three critical diseases. The strengths highlighted in bold font are those included in the KEML, along with their corresponding level of use.

Table 2. Tracer medicines for hypertension, diabetes, and breast cancer.

Category	Class	Medicine name and strength	Level of Use
Hypoglycemic	Biguanide	Metformin (500 mg , 850 mg, and 1,000 mg)	L3
	Hormone	Insulin biphasic 30/70 premixed insulin	L4
Antihypertensive	Calcium channel blocker	Amlodipine tablets (5 mg and 10 mg)	L3
	Diuretic	Hydrochlorothiazide tablets (25 mg and 50 mg)	L3
Antiestrogen	Estrogen receptor antagonist	Tamoxifen tablets (20 mg)	L5
Products		Insulin syringes, prefilled pens, and needles	

2.1.5 Quantitative data collection

Quantitative data were collected to verify and reconcile distribution and receipt delivery documents cascading down the supply chain system. To capture the timeline of the journey of the pill, the dates of manufacture, importation, purchase by KEMSA/MEDS, order submission, order credit check by KEMSA, delivery, and receipt at the health facility were obtained. Price markups were calculated using KEMSA pricing data compared to price marked on products at point of patient purchase.

Review of stock keeping records at facilities provided quantitative data on availability and use of essential logistics data to inform resupply orders, monitor stock levels, record expiries and wastage, determine stockout periods, and track receipts, issues, and stock transfers.

2.1.6 Qualitative data collection

Qualitative data were collected through in-depth interviews. Data focused on system challenges, bottlenecks, and gaps, as well as best practices at all levels. At the central level, interviews focused on manufacturing, importation, customs clearance, regulatory requirements, and demand creation. At the county level, interviews focused on the roles and responsibilities of the county health team for order processing, supply management, and consumption reporting. At hospitals, health centers, and retail outlets, interviews focused on supply systems and processes, timeliness of deliveries, stockouts, and logistical aspects of medicine distribution. Recipients of the products were interviewed to confirm receipt and document any problems encountered with receiving and/or forwarding to the next distribution point. A questionnaire was used to gather information on general challenges, including those related to supply planning and ordering; stock management; and frequency and causes of stockouts, delays, and price markups.

A total of 83 people contributed to the assessment through direct interviews and contribution of information on either facility- or county-level supply chain–related information. Most of the information was obtained from the personnel directly involved in ordering, receiving, handling, and managing the tracer supplies. The Pharmacy and Poisons Board’s registration lists, facility stock cards, standard operating procedures (SOPs), and software programs were observed for their content and ease of use.

3. Findings

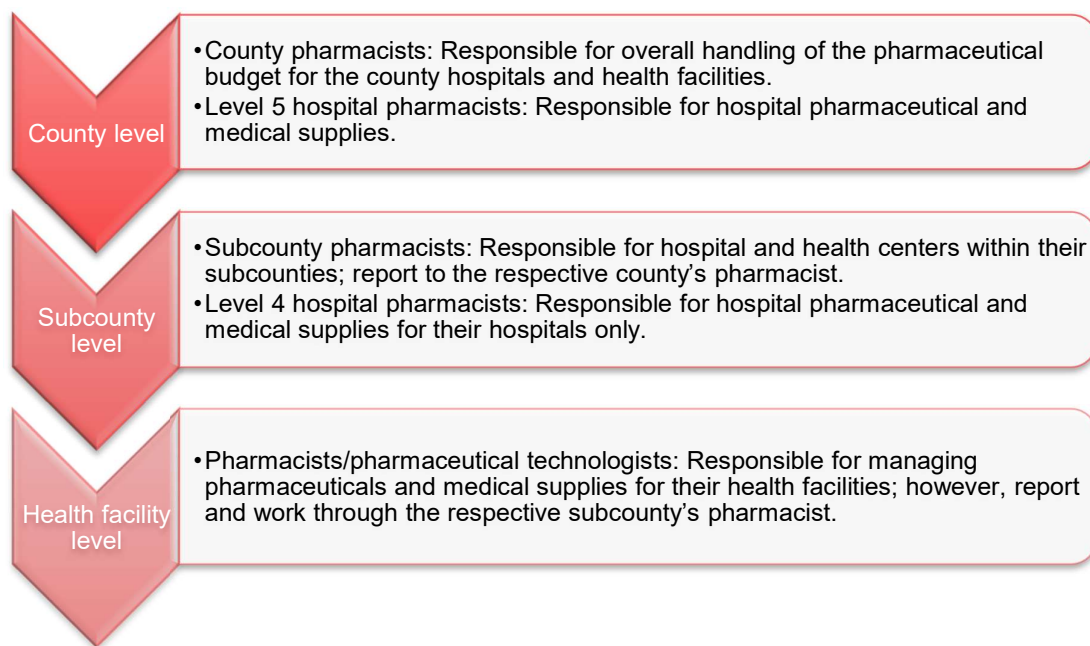
3.1 Overview of the public, faith-based, and private sector supply channels

3.1.1 Public sector

While the MOH is the main body responsible for all health-related activities in Kenya, the national NCD program, within the MOH, sets NCD policy, develops and disseminates standard treatment guidelines, and coordinates program activities across Kenya. Beginning in 2013, power and responsibilities began to devolve from the national government to the county governments. A department of health was established in each of the country's 47 counties. Subsequently, county health teams were also established. These teams comprise various coordinators, program managers, and a county pharmacist who heads the supply chain activities for his/her respective county (see Figure 1).

Health facilities are classified into the following six tiers ranging from community health services, dispensaries/clinics, and health centers, to primary, secondary, and tertiary hospitals. Appendix 1 further describes the Kenya Health System tiers.

Figure 1. Organizational structure of the county health teams



Financing of NCD medicines

Kenya is undergoing a transition to a UHC policy which will be rolled out to all 47 counties beginning in January 2020 with the goal of national coverage by the end of 2021. UHC is targeted at strengthening primary health care to provide services to all residing in the catchment area of the primary level facilities, from the community level (Level 1) to the sub-county hospitals (Level 4) in line

with Kenya Essential Package for Health (KEPH). UHC implementation will raise the profile of NCD prevention, care, and treatment resulting in higher demand for services and corresponding NCD commodities. The scale-up of services was guided by the learning gained in the four pilot counties of Isiolo, Kisumu, Machakos, and Nyeri from May 2018 to December 2019.

The UHC guidelines support:

- Improved financing for health. This includes NCD-related health products and technologies which were previously not covered in the policy for health commodities financing.
- Increased availability of quality essential services. This includes NCD services and related commodities in line with KEPH and KEML. This covers facility infrastructure improvements such as cold chain systems, human resource availability, health products and technologies, and robust data management systems (EMR and logistics management information systems (LMIS)) among others.

UHC provides:

- Medicines and commodities to Level 1-4 facilities through a draw-down facility from KEMSA supply chain. The improved quantification of national commodity needs is dependent on better quality program and supply chain data.
- Recruitment of health care workers (HCWs) to support UHC implementation at Levels 1-4, including HCWs to support community level services.
- Basic point-of-care equipment to support health service delivery at Levels 1-4, such as blood pressure machines, thermometers, anthropometric equipment, glucometers, pulse oximeters, trauma and delivery set, among others. A complete list is included in Appendix 3.

The UHC benefits package is anchored in the KEPH and includes NCDs. The NCD commodities included in UHC follow the level of use established in the KEML and the KEPH. While an updated KEML was published in November 2019, the 2015 KEPH is undergoing revisions to align with UHC, updated clinical guidelines, and the KEML.

Under the legacy health system, the NCD program determined annual program-based financing using patient flow data for the PHC level. Their planning included NCD commodity needs as well as all the other financial inputs needed to provide NCD services to the population and was funded by the national treasury. All health commodity financing was based on county budget allocations that were implemented via a 'draw-down' mechanism. The annual budget ceiling was established from program funding need inputs. Annual budget ceilings did not match NCD needs because of weaknesses in the NCD monitoring and evaluation data. Because counties needed available funding before a commodity order could be placed, budget limitations and delays in availability of funds resulted in frequent stockouts. In the legacy system, health facilities charge a nominal fee to clients to fill prescriptions at the health facility, generating discretionary site-operating funds.

With UHC, the new commodity financing policy will include a funding line item for procurement of NCD products and technologies for the first time. While this policy commitment will improve the availability of funds for NCD commodities, for commodity financing to meet demand, Kenya needs to strengthen NCD service delivery data. These efforts are in progress.

The initial intention under UHC was to completely remove user fees at Level 1-4 health facilities and for the national government to directly finance UHC. The pilot phase showed this direct financing by

the national government was impractical. The resulting UHC financing system in the scale-up phase is a hybrid that includes direct financing and subsidies by the national government and social insurance through National Health Insurance Fund (NHIF).

Level 1-4 services are free of charge for clients who are covered by the NHIF, which reimburses health facilities through their counties for the cost of services and commodities provided to insured clients. Persons not registered with NHIF will need to cover the cost of user fees themselves. Patients accessing health services at Level 5-6 facilities are charged user fees. NHIF covers

most services for registered patients except specialized care interventions. Health facilities will need to provide the National Health Insurance Finance Corporation with patient-level service information including cost of commodities for NHIF reimbursement purposes. In addition to NHIF social insurance funding, direct government funding and subsidies cover other investments needed to implement UHC, such as capital expenditures and other system strengthening investments.

Under UHC, county level resource allocation will be directly impacted by the service delivery and supply chain data available at the county. It is therefore paramount for counties to ensure this data resource is available. The NHIF will reimburse counties that provide patient and corresponding commodity data. If there are gaps in documentation, counties will not be able to cover 100 percent of their commodity procurement costs, and will need to draw from treasury, as a backup. They will not necessarily be able to receive funds in time to prevent stockouts.

Quantification will need to align county-level NCD commodity needs with county resource plans. As part of the benefits package, there will be a line item for NCD commodity procurement for each county to support this service. County NCD (and other) commodity needs will be financed by the NHIF, providing the public facilities procure their commodities from KEMSA, which is expected to consolidate all KEMSA commodities needs and leverage pooled procurement and economies of scale. NHIF will reimburse counties based on the KEMSA established market price of the products prescribed and dispensed to patients. The established market price of products is included in KEMSA's LMIS ordering tool which exists for each level of health facility. There currently is no provision under UHC for facilities or patients to source commodities from the private sector and get reimbursed.

Two policy-level strategic planning tools under development that have the potential to positively impact the resources available to improve NCD commodity availability are the National Costed NCD Strategy for 2021-2025 and the Kenya National Health Supply Chain Strategy (2020-2025). Both will include costing for NCD commodities and will present an opportunity to strengthen supply chain management of NCD commodities. The National Costed NCD strategy 2021-2025 will include the financing needs for commodities for counties as well as for KEMSA at the central level, including buffer stocks. It is unclear how KEMSA's capital and operating expenses will be funded.

In addition to the Essential Drugs Program, of which NCDs are a component, KEMSA manages essential health commodities with dedicated, disease-specific funding from donors, government, and other partners to meet the costs of a "full-supply" of medicines and diagnostics for priority communicable diseases, such as HIV, Malaria, TB, as well as family planning for the Kenyan population. They invested in information systems that provide quality logistics and patient data and use it to inform forecasting and financing for commodities and supply chain operating costs. NCD commodities would benefit from the same quality supply chain data availability. Under UHC, the

Subsidized insurance costs a family KShs 500 (\$5) per month. For those who cannot pay, social welfare programs at national and county level cover their costs. The goal is for all Kenyan citizens to be registered on social insurance, whether they pay out of pocket or are covered through the existing social safety net.

dedicated funding line for NCD commodity procurement at the county level and centrally has the potential to greatly improve availability of NCD commodities. With quality patient and supply chain data to improve accuracy of NCD commodity forecasting and quantification, evidence-based budgets can be developed and confidently funded.

Routine ordering and logistics management information system

The county pharmacist is allocated a budget for purchase of pharmaceutical and health products (ideally on a quarterly basis). Their task is to provide drawing rights, based on the number of patients, to each facility then allocate a budget amount to each facility based on this information. The drawing rights are determined by calculating the ratio of budget against the workload. Workload is defined through records of total number of monthly patient visits per facility. The county pharmacist shares the budgeted drawing rights with the subcounty pharmacists, who collaborate with lower-level health facilities to generate orders. Subcounty pharmacists and county pharmacists are authorized to adjust orders submitted by health facilities. Adjustments to facility orders typically reflect budgetary limitations rather than ordering errors by the facilities.

The system established quarterly orders from the health facilities to the counties, and the counties to KEMSA. However, funding availability has significantly affected the routine ordering, as requisitions are only released to facilities once funding is made available by the county government.

Orders at health facilities are generated through an electronic logistics management information system (eLMIS). Level 4 and 5 hospitals have direct access to the eLMIS through which orders are placed directly to KEMSA, as these larger facilities also have funding allocations directly from the MOH. Lower-level facilities, such as dispensaries, health centers, and some hospitals, submit orders on the KEMSA LMIS Ordering Tool through the subcounty pharmacists who review and rationalize orders for their catchment areas. These order forms do not include any logistics data other than the desired order quantity. Lack of visibility into facility-level data on stock on hand, average monthly consumption, adjustments for days out of stock, and losses and adjustments hampers supervision and performance management of the supply chain at the facility level and subsequently the sub-counties and counties. Furthermore, it ensures that final order quantities are based purely on funding available and does not provide the central level with supply chain data to improve quantification and financial planning.

Order placement begins when the county pharmacist opens a booking period. This creates a 10- to 14-day ordering window within the system and sends an Excel list of all available products. The subcounty pharmacist is expected to liaise with each facility within their region to ensure that facility orders are within their allocated drawing rights. Requisitions from the facilities are rationalized and consolidated, then submitted into the system online. After this, the county pharmacist reviews and aggregates the request prior to submission to KEMSA for processing. It typically takes the counties about two weeks to complete this review and submit orders to KEMSA.

All counties are mandated to procure medicines and medical supplies from KEMSA by using the national allocated budget or going through the Supplementary Services Division (SSD), a division of KEMSA, where counties can purchase commodities at a subsidized cost using their own funds. SSD is frequently used to source commodities that may be outside of the KEML, such as products needed for secondary or tertiary care. Routine order fulfillment is dependent on stock availability at KEMSA at the time of order submission and financial status of the county, as verified by KEMSA through a credit control check. The county must have available credit to cover the cost of the order before the order can be prepared. If funding is available, KEMSA releases a pro forma invoice to the ordering county with a list of available items, which is confirmed/accepted by the county for onward processing to the warehouse. If KEMSA is not able to supply an item on the order, the county is able to source these items elsewhere. Counties' primary alternative for sourcing medical commodities is MEDS, with very rare orders to private pharmaceutical firms.

At KEMSA, stock is managed electronically using bar coding and an electronic warehouse management system. The general protocol for delivery is within seven working days from receipt of order. KEMSA has eight regional warehouses, and the number is growing to improve ease of movement across Kenya. “Last-mile distribution” (i.e., transporting commodities directly from the regional warehouses to the health facilities) was introduced recently under reforms of the system supported by the World Bank, the US Agency for International Development (USAID), and other donor agencies. In addition, KEMSA has a five-year strategy from 2019 to 2024, which includes renovation and operationalization of two major supply and distribution depots in Mombasa and Kisumu. This will improve timelines and efficiency of deliveries to health facilities while reducing the burden at the central warehouse in Nairobi.

The recent introduction of an eLMIS for order requisition and delivery has improved visibility of stock movement. County and subcounty pharmacists now have visibility of the stock levels at KEMSA and the status of their orders. However, the eLMIS does not reach all the way to the facility level. Facilities have been provided with computers to compile their lists on a pre-populated Excel worksheet, which they send electronically to the subcounty pharmacists who review and submit it to the county pharmacist. This Excel worksheet is uploaded into the eLMIS system.

National procurement teams; national and county pharmacists; and the Pharmacy and Poisons Board, KEMSA, and facility staff have strong influence over supply security for PLWNCDs.

3.1.2 Faith-based sector

The faith-based sector’s MEDS provides three important services in Kenya’s public health sector. It provides health advisory services, quality assurance services, and supports the supply and distribution of medical commodities to the faith-based, as well as private and public health sectors, as necessary. MEDS runs its own fleet of trucks and provides rapid delivery service directly to the facilities. Health facilities are self-sustaining and charge patients nominal fees for basic services, subsequently using these funds for stock replenishment. Initially, MEDS’ mandate warranted services only to FBOs. However, over the years, its services have expanded to include the private and public sectors as well. Following devolution of health care to counties, the counties can opt to purchase supplies from MEDS; they are typically used as an alternative when KEMSA is unable to fill an order. MEDS formerly had more lenient payment terms than KEMSA. However, after many issues with delayed payments, it now typically operates on a cash- or advance-payment basis.

3.1.3 Private sector

Private hospitals and private retail outlets

In the private sector, orders are frequent, driven by demand and stock levels. For example, in Nakuru, Kisumu, and Nyeri, it was noted that orders for supply replenishment were as frequent as daily or every two weeks. Other examples include the Port Florence private hospital in Kisumu where the head office procured medicines through local suppliers as needed. Quantities requested were small and supplies were received frequently. Another private medical clinic, Naromoru Medical Services, purchased drugs every two weeks from MEDS. MEDS delivered orders within two to three days from order placement at a price consistently lower than the private-sector suppliers.

One retailer in Kisumu operates the Maisha Meds Module, software designed for small rural pharmacies and clinics that have limited internet connectivity and electricity. The software tracks all sales, allows sending of SMS reminders to patients, and tracks patient ID, name, age, and gender. It is a robust supply management system that allows taking stock, tracking all revisions to the inventory, and using multiple selling points and tills in an individual facility. The Maisha Meds software also provides detailed business reports, including profit and loss, fast-moving goods, credit provided to

patients, and trade/credit balances received from suppliers. Most importantly, it provides them the ability to order directly from six reputable suppliers with discounts of up to 18 percent off the list price of medicines for these suppliers.

3.2 Tracking the journey of the pill from KEMSA to dispensing

The purpose of the journey of the pill process map (Appendix 6) is to illustrate the steps and institutional roles and responsibilities in the medicines supply chain involved from initiating and placing an order through to distribution, delivery, receiving, inventory management, and dispensing to patients. The lead times for each process in the map were derived from qualitative data collected from standardized interviews and quantitative data collected from KEMSA, MEDS, and facility records for the following drugs: Amlodipine (5 mg and 10 mg), Hydrochlorothiazide (25 mg and 50 mg), Metformin (500 mg, 850 mg, and 1,000 mg), and Tamoxifen (20 mg). The major phases that are illustrated in the map are described in the following section. Red flags, or barriers to supply chain efficiency, were identified during the assessment process and are noted on the process map. The median lead time recorded for the facility ordering and supply cycle from KEMSA to facilities was 118 days, or just under four months, with a range of < 1 to 812 days. Many of the systemic issues documented in this report, such as delays with financing, credit, and product availability resulted in multiple delays in the process that often extend the total lead time for this cycle beyond the resupply interval set for this level of the system. Given the quarterly resupply interval, resolving the two critical issues of funding and NCD product availability is key for KEMSA to be able to fill orders from facilities within established lead times and to appropriate stock levels required by the maximum/minimum system parameters that guide routine resupply order calculations.

The preceding information describes the KEMSA to health facility supply chain, which is composed of two tiers. A short pipeline and investment in transportation to the last mile are preconditions for achieving a relatively short total lead time by most public sector supply chain design standards. KEMSA is reportedly committed to a two-week order processing and delivery lead time for routine orders received from counties. With quarterly resupply intervals, health facilities in theory operate with a four-month maximum stock level, if their orders are calculated based on average monthly consumption adjusted for days stocked out. Local vendor deliveries to KEMSA range from one day to 16 weeks depending on various factors, such as availability and manufacturing lead time. While we were not able to confirm information from KEMSA about their optimal inbound delivery intervals and maximum stock levels used for procurement supply planning at the KEMSA warehouses from local and international origins, we know that their aim is to operate a lean business model. For this assessment report, we will use information about their maximum stock levels, based on information received from other sources.

The majority of NCD commodities are sourced from Kenyan manufacturers. Despite that being an opportunity for increased supply chain agility, we understand that KEMSA maintains the same minimum and maximum stock levels for locally- and internationally-sourced commodities, with the only difference in pipeline length between the two being inbound freight time and importation for internationally-manufactured products. KEMSA maintains a three-month buffer stock and their target maximum stock is 12 months. Kenya's theoretical maximum pipeline length for locally manufactured NCD medicines is estimated at 16 months. Since products like insulin are sourced internationally, and include transit time to Kenya either by ocean or air, as well as a long importation process, Table 4 summarizes the estimated maximum pipeline length from international manufacturers to be between 11 months by air and 22 months by ocean.

Table 3. Shelf life

Drug	Manufacturing shelf life
Metformin 500mg tablets	3 years
Amlodipine 500mg tablets	3 years
Hydrochlorothiazide 25mg tablets	3 years
Tamoxifen 20mg tablets	5 years
Insulin vials	3 years

Table 4. Maximum supply chain length

Supply Chain Segment	Kenyan origin	International origin-air	International origin-ocean
Health facilities	4 months max	4 months max	4 months max
KEMSA (estimate)	12 months max	Assume 3-4 months because of cost/volume	12 months max
Importation	N/A	2 – 2.5 months	4 months
Shipping/transport to KEMSA/Kenya (estimate)	days	2-3 weeks	1-2 months
Total Lead Time	16 months	11 months	21-22 months

Given the manufacturing shelf life of the tracer drugs listed in Table 3, there is a likelihood that locally-sourced NCD commodities will have about 15 months of remaining shelf-life by the time they are dispensed to patients if delivered to KEMSA with maximum remaining shelf-life. Given the longer pipeline for internationally sourced products, overstocking would pose a significant risk of expiry to the Kenyan public sector supply chain. KEMSA's procurement policy requiring 75% remaining shelf-life for commodities delivered to KEMSA, would reduce the remaining shelf-life for the patient and could introduce quality concerns with multi-month dispensing of NCD medicines. Medicines with less than six months remaining shelf-life are typically not issued to health facilities. The KEMSA maximum stock levels in Table 4 need to be confirmed. Assuming they are verified, there are opportunities to introduce agility into KEMSA operations and reduce supply chain risk from holding large quantities of stock. KEMSA can achieve a reduction in their maximum stock levels and shorten the public sector Kenya pipeline by:

- Increasing forecast accuracy by using quality facility-level consumption data adjusted for stockouts.
- Planning staggered deliveries to KEMSA by local and international suppliers over the course of the year as a way of reducing maximum stock levels at KEMSA.
- Employing framework agreements with Kenyan manufacturers of NCD commodities to allow for greater economies of scale, price reductions, more agile procurement, and improved application program interface needs forecasting and flexibility in production schedules and deliveries by local manufacturers.

3.2.1 Local manufacture and importation into Kenya

Products are sourced and registered with the Pharmacy and Poisons Board for importation, a process which takes two to three years, with a retention application every three years. Clearing imported goods through customs requires the involvement of additional authorities—such as the Kenya Bureau of Standards, Kenya Revenue Authority, Port Health, and customs—to process the consignment. Customs delays are among the key challenges reported by private-sector wholesalers and importers around importation of internationally manufactured tracer items. Specifically, government regulations mandate that all goods arriving in Mombasa be transported by the Standard Gauge Railway and cleared at the Inland Container Depot (ICD) in Nairobi. This process is estimated to take up to four months, as compared to air freight consignments that take between two to two and a half months. The ICD is mandated to clear the consignment within four days, but this rarely happens, and the importer incurs ICD-imposed storage charges, which are ultimately passed onto the end user.

Delays at ICD were attributed to a new Kenya Revenue Authority online system, the Integrated Customs Management System, which was reported as lacking functionality and requiring greater human resource capacity than was available at ICD.

Table 5: Manufacturer origin in the public sector

Tracer	Origin and Manufacturers	Different pack sizes
Metformin 500 mg	Kenya (5)	5
Metformin 850 mg	Kenya (2)	2
Metformin 1000 mg	Denmark (1)	1
Amlodipine 5 mg	India (2)	2
Amlodipine 5 mg	Kenya (2)	2
Amlodipine 5 mg	Germany (1)	1
Hydrochlorothiazide 25 mg	Kenya (2)	1
Hydrochlorothiazide 50 mg	Kenya (1)	2
Insulin	Denmark (1)	2

The table above shows the availability of more than one Kenyan manufacturer for different strengths of medicines observed during site visits to public sector facilities as well as other origins. Having multiple options for sourcing NCD medicines can provide more procurement flexibility and increase the ability to supply patients when the primary source of supply fails. However, the numerous different pack sizes of products found in many locations does add additional complexity to stock keeping at the facility level, as each pack size, is a different stock keeping unit (SKU). Consumption and stock on hand data of “equivalent” products then need aggregation before orders can be placed. Of the batches of medicines traced, insulin was only available from international sources. It is necessary to reinforce the use of the selected pack sizes for drugs selected by the KEML for the different levels of the supply chain and to ensure their availability. Simplifying the number of stock-keeping units at all levels is the basis for a more streamlined supply chain that is easier to operate according to established policies and designed to make medicines available. This will greatly improve data quality and increase the possibility of economies of scale, as well as providing suppliers with more reliable demand forecasts.

Strengths:

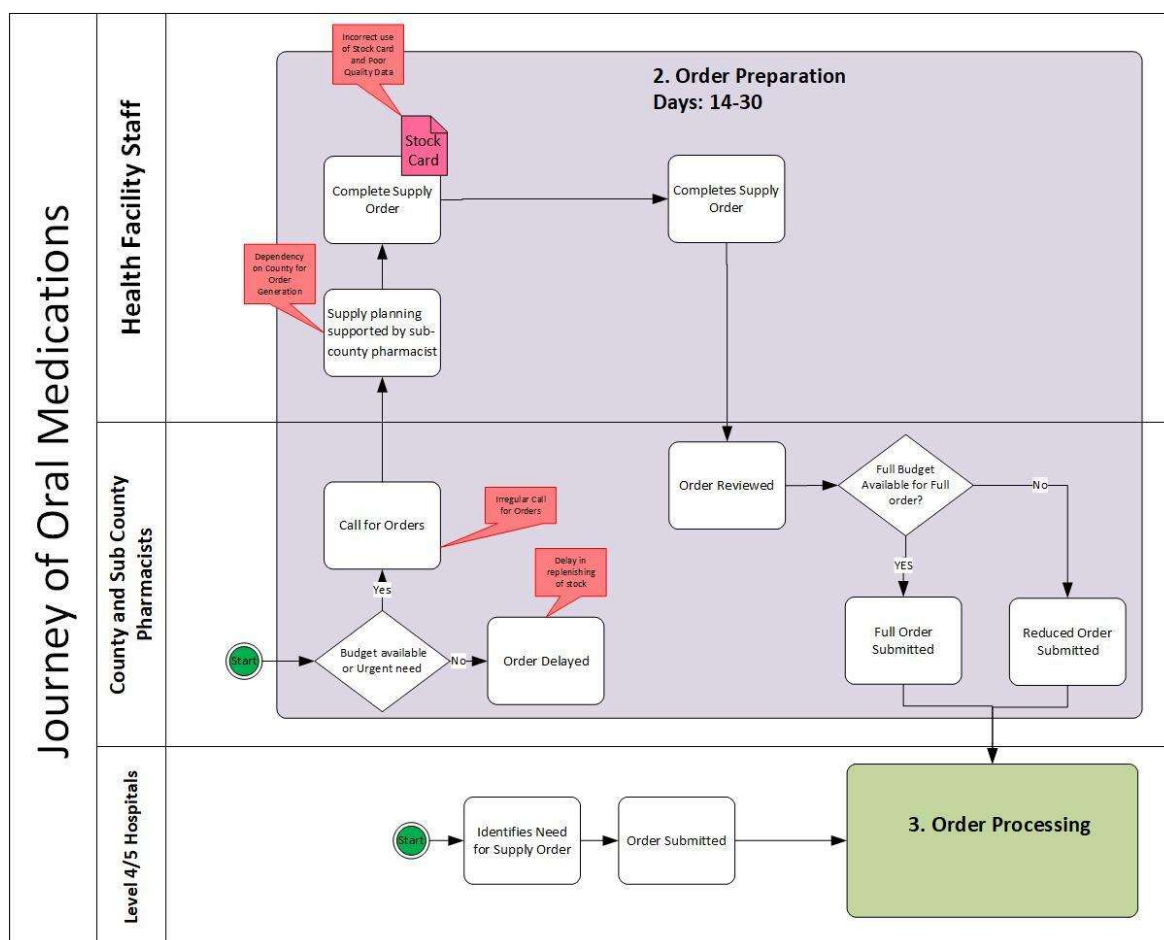
- Two-tier public sector supply chain and reliable transportation for deliveries provides opportunity to reduce total pipeline length by introducing efficiencies in procurement planning at KEMSA.
- Few tiers limits product handling and handoffs, providing fewer opportunities for leakage and damage.
- Last mile distribution provides direct delivery to health facilities.

Red flags:

- Time required for imported products to clear customs.
- Impact of demurrage charges on purchase price.
- Multiplication of pack sizes available in the public supply chain.
- High maximum stock levels used for procurement planning at KEMSA that could be greatly reduced with staggered deliveries over the space of a year.

3.2.2 Order preparation

Figure 2. Order preparation process flow.



The county pharmacists are allocated a budget for purchase of pharmaceutical and health products (ideally on a quarterly basis). They calculate drawing rights for each facility based on workload (patient numbers) and allocate the associated budget for commodities. Workload is defined through the total number of patients visiting each facility monthly, based on facility records. For Level 3 facilities and below, the county pharmacist shares the resulting facility budget with the subcounty pharmacists, who subsequently collaborate with health facilities in their catchment area to calculate orders.

Quarterly order intervals

There is a standard methodology for calculating quarterly health commodity routine resupply quantities for public health facilities documented in various job aids. Steps covered include a physical stock count, the use of a quantification worksheet for calculating average monthly consumption with adjustment for days out-of-stock, determining maximum stock quantity, and quantity to order. This methodology applies to all health products. If followed, the methodology documented in the job aids will greatly improve accuracy of quarterly order quantities. If people use the quantification worksheet correctly to determine resupply quantities of NCD commodities at the facility level, there is an opportunity to report the same data for use at higher levels of the supply chain to provide oversight, track key performance indicators, and provide quality supply chain data for forecasting, quantification, and budgeting purposes. An appropriate platform or mechanism to report that data needs to be identified.

Health facilities submit their orders on a KEMSA Excel form that includes a list of products available, unit price, and a field for the order quantity which then calculates the cost. Order quantity is the only information from the quantification worksheet that is transferred to KEMSA's order form.

County pharmacists then submit orders through the eLMIS and are authorized to adjust requested order quantities made by the subcounty health facilities. Even if the facilities had followed the methodology in the quantification worksheet, this adjustment results in their effort at arriving at an order quantity that reflects true demand is lost. The result is that the orders the county places are driven by budget availability rather than demand and the national data at KEMSA on quantities ordered has no bearing with real need.

Level 4 and 5 hospitals have direct funding allocation from the MOH and submit their orders directly to KEMSA through the eLMIS. The established quarterly orders are subject to delay if funding is not available. Budget availability impacts when county orders are activated. Actual order frequency varies from one to five times per annum. The time range reported for order preparation was between 14 and 30 days. If individual facilities submit their order late, it can delay the aggregated submission for the county. Information on the timelines of order submission from the facility to the subcounty or subcounty to the county was not available.

Strengths:

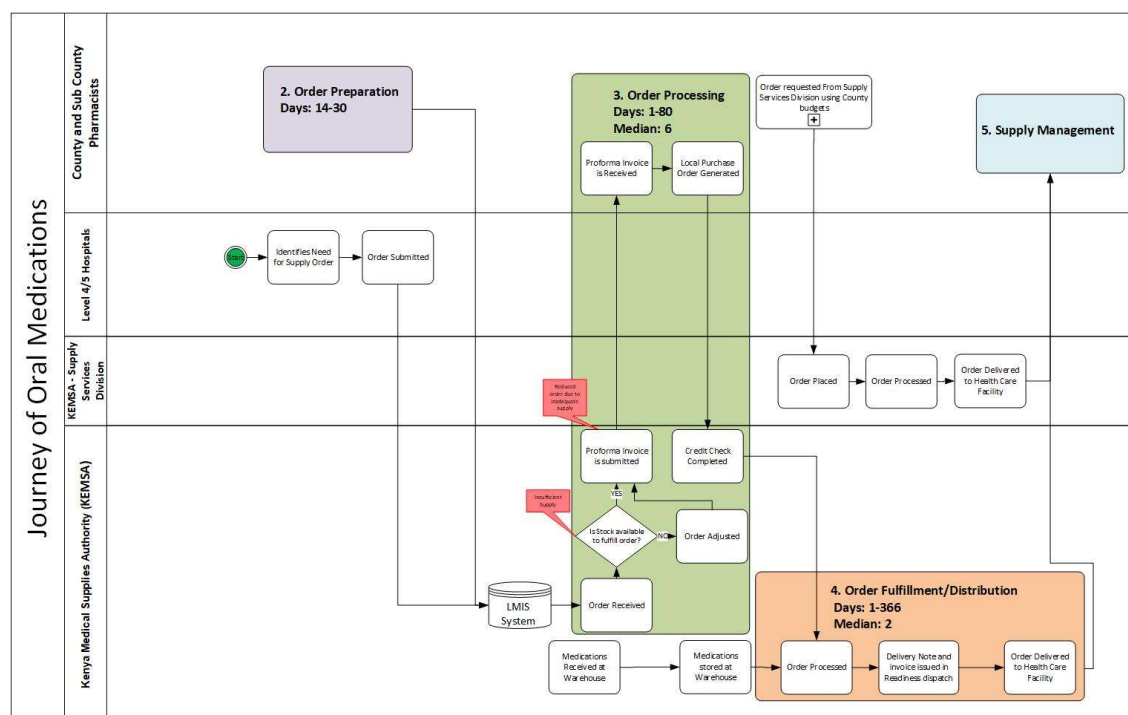
- SOPs and job aids for facility orders based on international best practice exist, even though not all facilities visited had them available.
- Lower-level facilities use an Excel spreadsheet to submit their orders, which facilitates submission to KEMSA via the eLMIS.

Red flags:

- Available county budget is required to activate order process for essential drugs, impacting established order frequency.
- Drawing rights, or budget allocated to essential drugs, for each facility is insufficient to meet demand. There is no incentive to correctly calculate order quantities if the logistics data is lost and the final order quantity is determined by the budget.
- NCD medicines supply competes with other essential drug needs because there is not a specific budget line item for NCD commodity financing.
- Lower-level facilities do not have access to eLMIS system.
- Only 55% of facilities had copies of job aids or SOPs to support correct and standardized ordering methodology.
- Lack of clear accountability for facility supply chain management with facilities ordering and county pharmacist determining final order quantities purely based on budget.

3.2.3 Order processing

Figure 3. Order processing process flow.



Once an order is placed by a county, the finance department at KEMSA will conduct a credit check on the available budget for each county. Once an approval is granted by the finance department, the order will be approved for onward preparation at the KEMSA warehouse. The approved order is picked up by the customer service department at the KEMSA warehouse, where it is then prepared for delivery and sent directly to the facility. There are no intermediaries between KEMSA's regional warehouses and the facilities when commodities are distributed. The median time recorded for order processing was six days with a range of < 1 to 80 days.

Strengths:

- All orders submitted to KEMSA via the eLMIS system.

Red flag:

- Order processing lead time dependent on credit check and stock availability.

3.3 Order fulfillment

KEMSA is a semi-autonomous government agency with the mandate of procuring and supplying essential health commodities for the Kenyan health system. The KEMSA warehouse operates 24 hours a day, seven days per week, which enables them to execute most deliveries across the country within two days. Delivery notes are signed by the receiving personnel at the health facility, and the date and time are indicated on each page of the delivery note. A physical check and count are done within a week, and KEMSA is notified immediately of any discrepancy. Goods are subsequently checked and confirmed as received in good order through an S11 form, an official government accounting form. Each stock card entry indicates the S11 number for the item and quantities received. S11 forms are then filed or sent to the finance office for accounting purposes. Facility order fulfillment is dependent on budgets and KEMSA stock levels; the fulfillment rate was estimated at 75 percent. Facilities supplement incomplete deliveries when possible through the SSD or MEDS using their own funds. The median time recorded for order fulfillment was two days, with a range of < 1 to 366 days.

Strengths:

- KEMSA's continuously operating warehouses and direct delivery to health facilities.

Red flags:

- Limited supplemental funding to augment incomplete KEMSA deliveries with orders through SSD or MEDS.

3.4 Supply management at the facility level

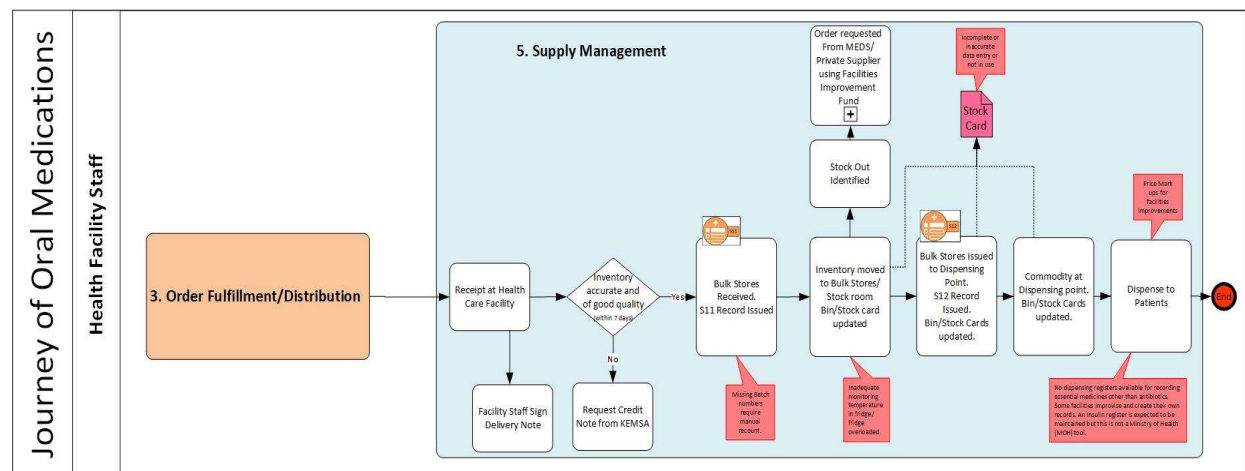
Deliveries and accompanying delivery notes are received at the health facility. Incoming products are entered on stock or bin cards in red pen. While the stock cards in use include columns that allow for recording of receipts and issues, not having a separate column to record losses or expiries makes it difficult to track data on wastage. Stock card usage was inconsistent among the facilities visited, with many of them either not having stock cards, or not keeping them updated. Stock cards and dispensing registers are the foundation of the manual LMIS at the facility level. Their consistent and correct use provides quality data to inform ordering, assess stock status, and even measure supply chain key performance indicators. Facilities that were using stock

cards were recording stock received from KEMSA or other sources and quantities issued from stores to the dispensing area, but the weaknesses in use highlighted in Figure 5 below, highlight the need to strengthen and institutionalize the basic tasks that make up inventory management at the facility level.

Facility staff are charged with conducting physical inventories, receiving, storing, and maintaining product quality of the products, monitoring stock levels, determining order quantities, and dispensing to patients. The assessment team did not observe any standard dispensing register in use for NCDs. Stock and data management is complicated by the many exceptions introduced into the system that need to be managed manually: interfacility transfers to reduce the impact of over or under ordering and the multiplicity of SKUs due to different pack sizes and strengths of one drug acquired to try to make NCD medicines available. Successful completion of these activities depends on trained and accountable supply chain human resources with the appropriate tools and resources, including time, to complete the tasks as outlined by the system SOPs and job aids. In exchange, the supply chain needs to provide the incentive of available supply to meet demand to show the supply chain management tasks performed according to plan to the health system.

While dispensaries are not listed in the KEML as having prescribing authority for the NCDs in this assessment, we did observe instances where KEMSA, public sector hospitals, or other facilities supplied Hydrochlorothiazide and Metformin to dispensaries. One dispensary had received NCD commodities in the past, but despite multiple orders, had not received any in over nine months. Clearly, the existing system is extending to enable PLWNCDs to access treatment closer to home. If the system is going to provide access to some NCD commodities at Level 2, carefully designed SOPs need to support a standardized approach to ensure the supply chain and appropriate level of service capacity extend further down the health tiers in a way that provides access to NCD commodities safely and consistently.

Figure 4. Facility inventory management process flow.



3.5 Logistics management information at the facility level

Consistent and correct use of stock keeping records, such as stock cards and dispensing registers at facilities are a fundamental part of any LMIS. Reports, or combined order and reporting forms, whether manual or electronic, provide essential logistics data visibility at higher levels to assist order fulfillment and inform quantification. We found that less than 50% of the facilities visited had updated

stock cards, and a review of those that were updated showed some of the following problems with their use.

- Not using one card per SKU. Every strength and pack size combination are a unique item and need to be tracked separately on different stock cards.
- New stock cards were started each year and previous year cards were unavailable, complicating access to data on historical consumption and stockout periods, both key information for quantification and supply chain monitoring.
- Incomplete data entries, missing dates, lack of origin/destination.
- Only maintaining a running balance on stock cards, not including dates, origins, receipts, or issues.
- Data not entered chronologically, resulting in useless information.
- Missing entries spanning many months.
- Record of relatively large order quantities received compared to quantities issued over time with upcoming expiry dates, suggesting problems with ordering, no stock status assessments to confirm the number of months of stock it represents, and lack of measures to transfer stock for use before it expires.

Lack of consistent and quality stock management data across all assessed counties make it impossible to draw any significant conclusions about order fill rates, and in many cases, days out of stock, and therefore consumption.

- **Stock keeping records:** Bin/stock cards were used in the pharmacy. Although patient data were captured under administrative or finance interventions, there were neither standard registers nor electronic record-management tools in place at the pharmacy dispensing level to record stock dispensed to patients, other than for antibiotics. Instead, each facility maintained its own record keeping for monitoring stock movements for the purpose of tracking either funds collected per prescription or the stock movement itself. Stock cards were not systematically completed by pharmacy staff at the time of stock receipts, and destination of issues data were not clearly indicated. Where stock cards were available, we observed instances of overstocks and evidence of expired tracer drugs, in addition to stockouts.
- **Consumption data records:** There were no specific registers in use for recording NCD patient diagnosis, treatment, or medications consumed at any of the facilities visited, including at Level 5 referral hospitals which all have electronic dispensing systems available. The MOH NCD program will be introducing new NCD service records and reporting forms for diabetes management and hypertension, which include patient files, daily and permanent registers, and a monthly summary report. Figure 5 shows the percentage of health facilities with manual records adapted for reporting three high-prevalence NCDs.

Records of past orders submitted were unavailable due to a lack of office supplies to print and file orders records. Facility level LMIS reports do not exist in the system that manages NCDs. It is unclear whether facilities using the eLMIS are providing that level of logistics data visibility to the national level.

Figure 5. Facility stock management record keeping

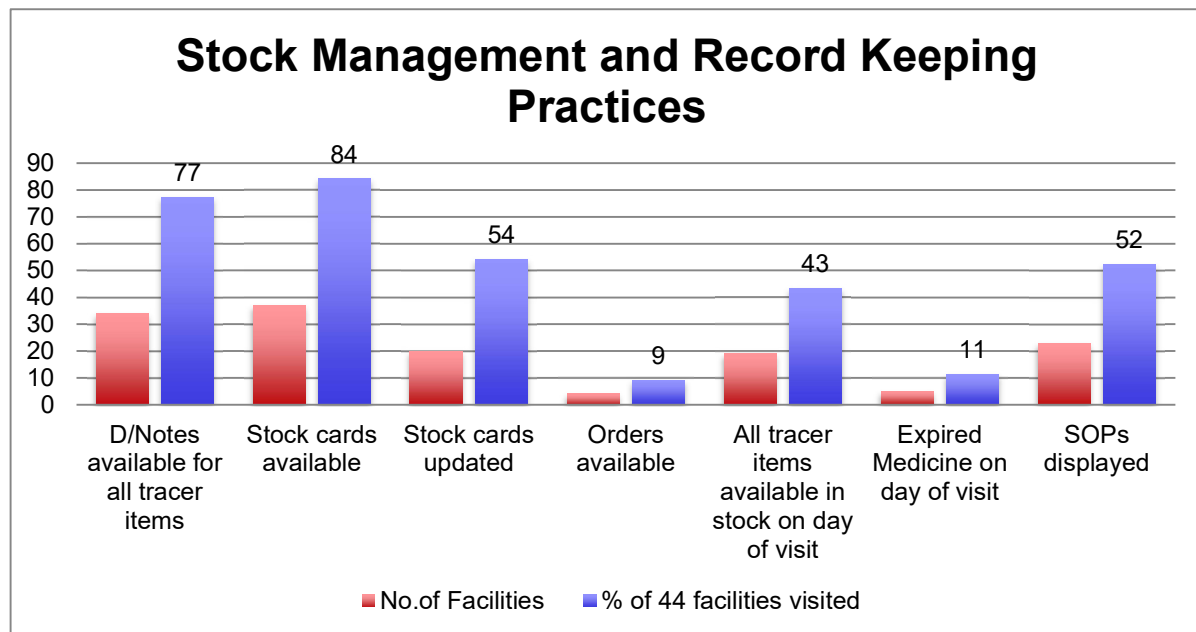


Figure 5 presents our findings on the availability and use of stock cards, orders submitted and delivery notes at the sites (including retail pharmacies) visited and information on availability of tracer drugs and expiries on the day of the visit. Fewer than half of all facilities had every tracer product in stock, and 11 % had records of products that had expired in the last 12 months (despite only 20 having stock cards updated). While records of deliveries and the availability of stock cards was relatively high, the low observed use of stock cards, lack of available data about orders placed, and inconsistent use of registers to record consumption data suggest that the essential data items of monthly consumption, days out of stock, stock on hand, and losses and adjustments are not consistently available to inform routine order quantities. It also suggests that the same data is not available at the central level on a national scale to inform accurate quantification and drive procurement that would improve availability at KEMSA assuming sufficient budget. Facility level records and consistent reporting of essential data up the supply chain are elements that will be needed to improve the availability of NCD medicines at all facilities.

There is a need to instill and reinforce a supply chain data use culture to ensure that stocks are available to fill facility orders. The system needs sufficient staff with clearly defined supply chain responsibilities in their job descriptions who are provided with the tools and incentive, through training and systems of accountability and support to fulfill stock management responsibilities. During site visits, we observed lack of a backup to maintain stock keeping records when the regular pharmacists were not available. Logistics record keeping is an essential practice that should be supported by a reliable transition of responsibility between people when needed.

Strengths:

- Evidence in the documents reviewed and in interviews of individual staff of their commitment to their supply chain management responsibilities to ensure their health facility has what it needs to serve patients.

Red flags:

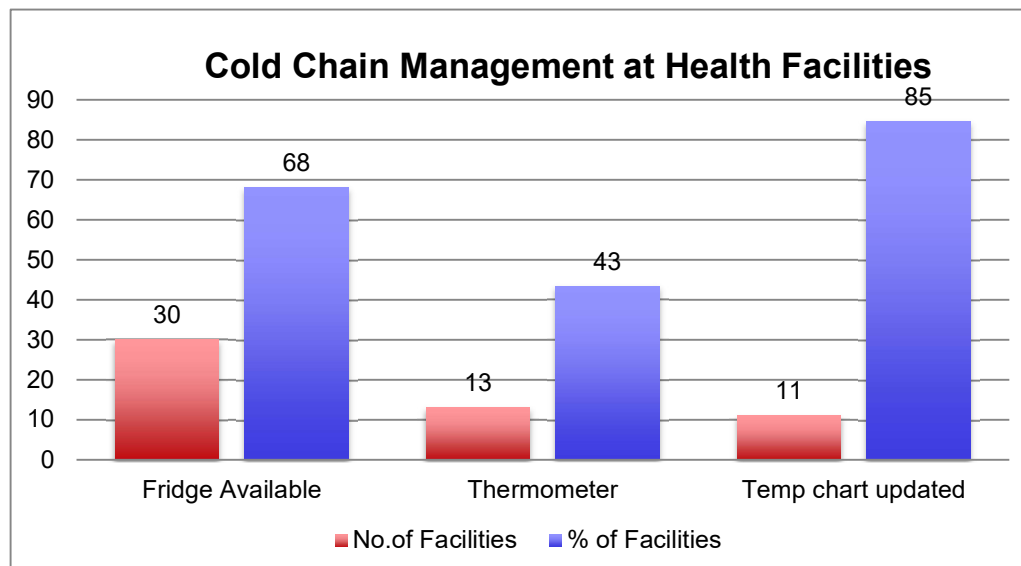
- At most health facilities, the three essential supply chain logistics data (stock on hand, adjusted rate of consumption, and losses/adjustments) are unavailable, incomplete, or unreliable for informing routine ordering and assessing basic key performance indicators.
- Lack of SOPs and back up staff result in a dependency on individuals and their performance and reflects vulnerability in the system.

3.6 Storage conditions and cold chain management

Forty-three out of 44 (97 percent) of the pharmacy stores where the tracer drugs were sold showed very good storage conditions. However, in two (5 percent) instances, poor or damaged infrastructure was observed. No major issues or concerns were noted around storage conditions except for cold storage. Cold chain equipment (CCE) for expanded program on immunizations (EPI) cannot be used for other products.

Cold chain management practices require attention to ensure insulin safety standards. Although all refrigerators were in good working condition, mostly residential, general-purpose refrigerators were found in 68 percent (30/44) of the pharmacy stores and dispensing areas that had cold chain equipment. In the few instances where high-volume, commercial refrigerators were observed, they were filled beyond capacity with insulin and other cold chain items, which compromised temperature control due to reduced air circulation. Furthermore, this complicates first-expiry/first-out stock management. Only 43 percent of the refrigerators had functional thermometers to monitor the temperature. It is encouraging that of those facilities with thermometers, 85% were maintaining temperature logs. Figure 6 provides a summary of cold chain management at the 44 health facilities visited.

Figure 6. Cold chain management at health facilities.



Strengths:

- Availability of cold chain at 30 of 44 assessed sites, and high level of use of temperature charts where thermometer available.

Red flags:

- Weak cold chain temperature monitoring and control for insulin storage.
- Cold chain storage capacity (volume) constraints.
- Lack of commercial cold chain equipment.

All Level 5 hospitals had walk-in cold rooms, except for Machakos. The cold room in Nyeri County Referral Hospital was not functional. This highlights some major weaknesses in cold chain management of insulin. There were no SOPs in place to address temperature fluctuations that compromised product efficacy and safety. These challenges warrant further investigation for the insulin cold chain.

3.7 Stockouts

The assessment collected data about the availability of tracer drugs on the day of the facility visits as well as frequency and duration of stockouts over the last 12 months by reviewing stock card entries. While 43% of health facilities had all tracer drugs available on the day of the assessment's visit, the duration of stockouts over the last 12 months provides a picture of the cumulative impact of stockouts on availability of NCD tracer drugs over time. Stockouts were defined as the complete absence of the medicine or health product at the point-of-service delivery to the patient.⁶ Multiple stockout periods lasting from several days to many weeks and even months were recorded at 22 of the facilities that had stockout data available (3 in Isiolo; 1 in Kisumu; 5 in Machakos; 4 in Nairobi; 3 in Nakuru; 6 in Nyeri), many of which were secondary and tertiary-level facilities. The four figures that follow present stockout data for the strength of NCD tracer drugs listed in the 2019 KEML. Each bar represents the average number of days the product was stocked out at the facilities in the county that had data available. The bars are color coded to distinguish UHC from non-UHC counties.

Figure 7. Amlodipine 5 mg average days stocked out over 12 months

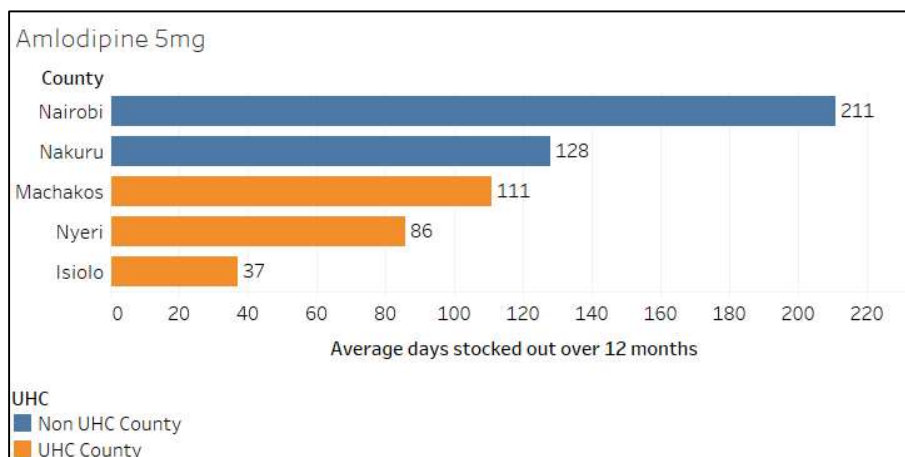


Figure 8. Hydrochlorothiazide 50 mg average days stocked out over 12 months

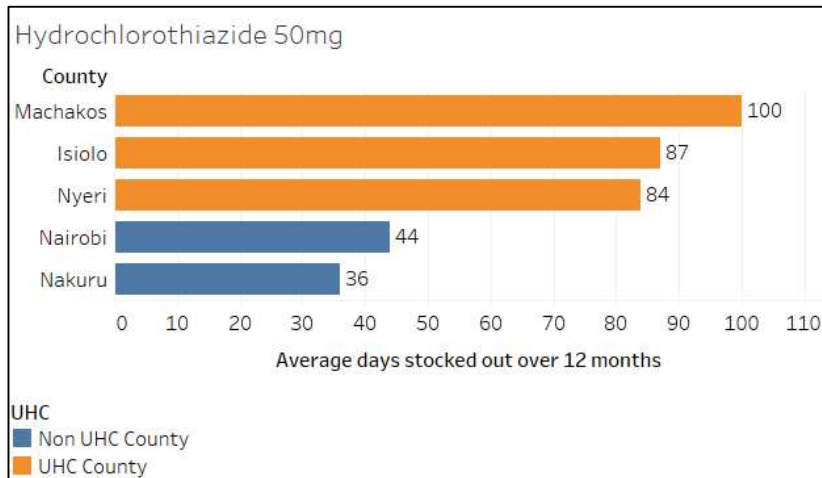


Figure 9. Metformin 500 mg average days stocked out over 12 months

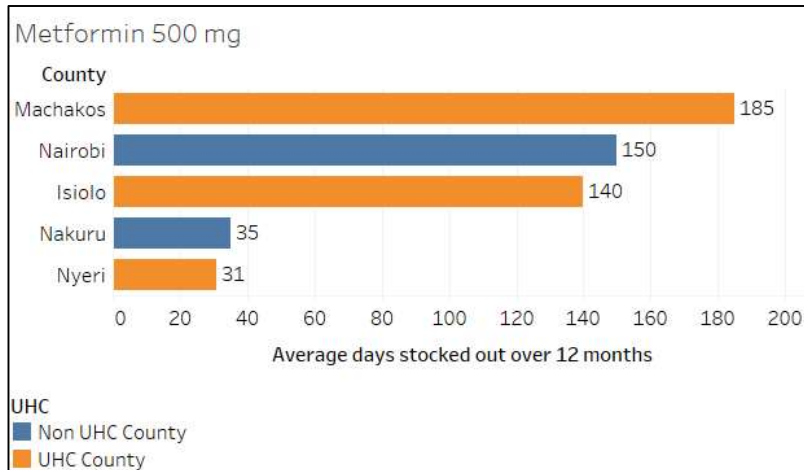
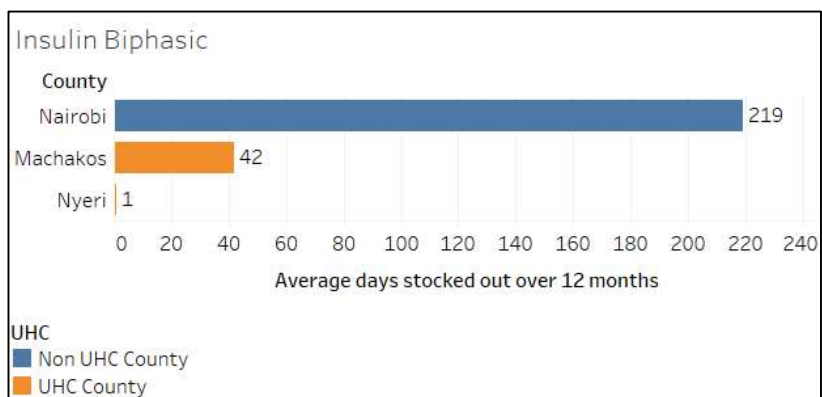


Figure 10. Insulin biphasic 30/70 premixed insulin average days stocked out over 12 months



While we did not collect stock availability data on insulin syringes and needles, they were consistently not available within pharmacy dispensing areas, which causes patients to need to purchase these consumables in the private sector.

Tamoxifen 20 mg is designated to be used at Level 5 health facilities. Data from stock keeping records from the five Level 5 facilities visited during this assessment was very limited and did not allow for any visibility into stockouts for this product. One referral hospital received their first order of Tamoxifen for a new cancer clinic that opened in August 2019. Another referral hospital had some stocks from the Novartis access program and because stock cards were not used, there was no data on stockouts, and the storekeeper interviewed had no additional information. A third referral hospital has a cancer clinic, uses stock cards, and did not appear to have had any stockouts in the last 12 months. The other two Level 5 facilities visited did not stock Tamoxifen.

Additional observations on stockouts were made regarding their location and duration. For example, in Nairobi, Machakos, and Nyeri counties, the stockouts occurred in a high number of facilities and for a longer duration. Kisumu and Nakuru counties' data on stockouts were low due to unavailable and incomplete stock cards or, in the case of the latter, new stock cards were used at the start of every financial year, resulting in loss of historic data.

While many of the weaknesses identified earlier in this report contribute to poor supply chain management, we received no stockout data from KEMSA for the four tracer drugs displayed above. The study team was unable to determine to what extent lack of availability at KEMSA contributed to these issues.

Although there was limited information available on stockouts in the private sector, they appeared to be rare, as only one was noted, in the county of Port Florence, Kisumu. Supplies were purchased more frequently in private sector facilities and the private War Memorial Hospital in Nakuru County purchased their supplies daily. None of the FBO facilities visited reported experiencing stockouts.

Red flag:

- High frequency and long duration of stockouts evident across all six counties over 12 months.
- At the time of this assessment, there was no consistent difference in availability between UHC and non-UHC counties.

3.7 Price markups

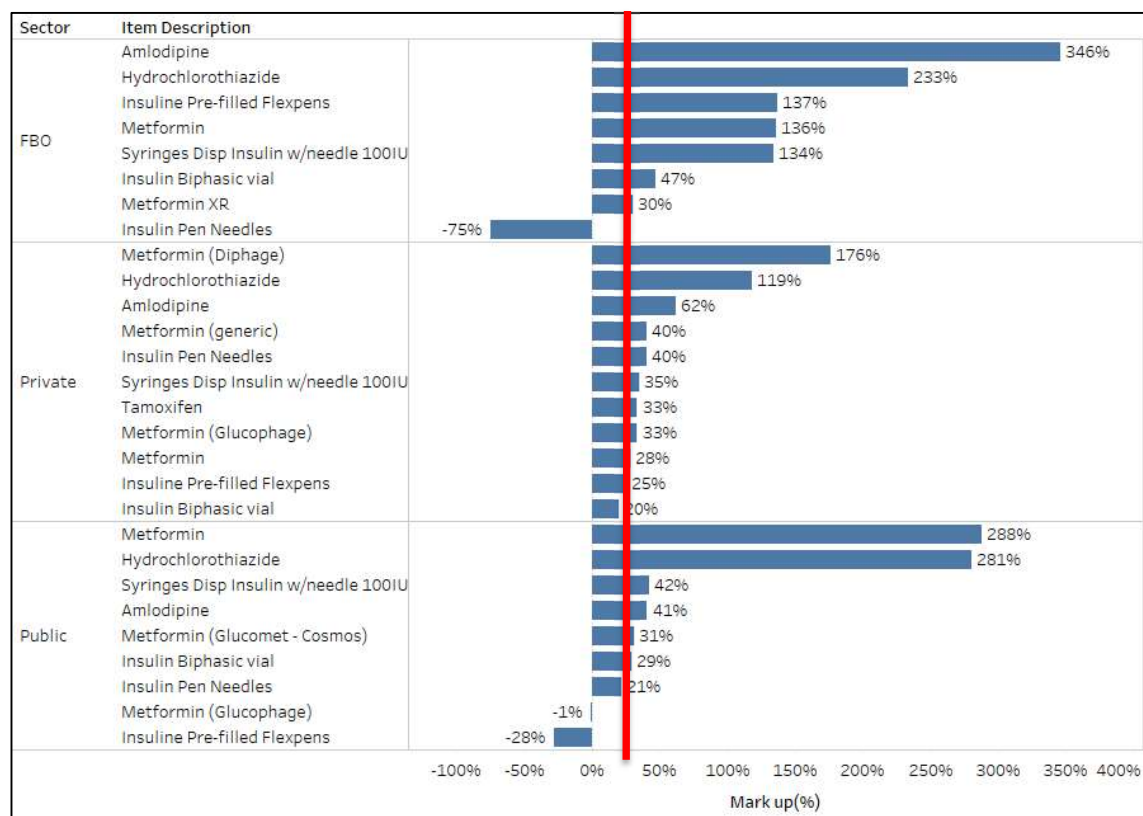
Price markups were noted as a significant issue that impacted price affordability of the tracer medicines to the PLWNCDs (Figure 8), particularly in the public sector. Distributors (KEMSA, MEDS, and private wholesalers) and health facilities and pharmacies all mark up prices over what they pay to procure them. However, while the price markups appeared to be higher in the public sector, the actual cost of goods was greater in the private sector. KEMSA likely benefits from economies of scale that allow them to procure supplies at lower rates. This would allow the markups to be higher in the public sector while the actual price to the consumer remains lower.

In the public sector, patients are charged nominal fees for pharmaceutical and health supplies to generate support funding for the facility. This fund is called "The Facility Improvement Fund," which allows the management to reinvest the funds to purchase further supplies in case of stockouts or emergency needs. This is mainly the case in the non-UHC counties and where PLWNCDs do not have a NHIF card or another type of insurance coverage. Key findings include the following:

- **Public sector:** As shown in Figure 8, markup percentages were significantly higher and more widely variant between facilities in the public sector compared to the faith-based and private sectors. Product pricing showed a great deal of variability, with the markup percentages most notable for Metformin (288 percent) and Hydrochlorothiazide (281 percent). Markups for other products ranged from 41 percent for Amlodipine to insulin at 29 percent. Syringes were often not

available through the public sector but were procured through the private sector, increasing patients' out-of-pocket expenses.

Figure 8. Markup percentages across sectors for all tracer medicines.



- FBO sector:** MEDs provided special-offer prices, which depended on volumes ordered; special offers on shorter expiries; and bonuses such as free packs for minimum purchases. MEDS tended to have more patient packs (i.e., packs of 28s and 30s), which facilitate dispensing. However, even the FBO sector had notable markups, with the highest for Amlodipine at 346 percent, Hydrochlorothiazide at 233 percent, insulin prefilled pens at 137 percent and Metformin at 136 percent.
- Private sector:** Overall, the private hospitals assessed had higher percent markups on products compared to the private retail sector; however, neither maintained the established 33 percent threshold for markups on all products. The markup percentages in the private sector were less variant across facilities and were concentrated between 40 percent and 20 percent for products such as generic Metformin, insulin pen needles, and Tamoxifen. Products that fell outside of this range included Metformin Diphage at 176 percent, Hydrochlorothiazide at 119 percent markup and Amlodipine at 62 percent.
- The private sector and MEDS provide flexibility in pricing schedules depending on volume orders. They made special price offers, such as discounts on varying order quantities; special offers on shorter expiries; and bonus offers, such as free packs for minimum purchases (i.e., three packs for the price of two).
- The impact of access programs for insulin can be seen in the faith-based and public sector with negative markups for insulin prefilled pens in the public sector and insulin pen needles in the FBO sector. Insulin syringes, which were often not available through the public sector, were available in a higher number of private suppliers.

4. Discussion

This assessment describes the journey of the pill from manufacturer to point of dispensing to a person living with an NCD. The challenges identified provide opportunities for strengthening supply security for PLWNCDs. In the assessment of the journey of the pill, the concentration of “red flags” or challenges were found in the order preparation and supply management phases, as outlined in the process flow diagrams. The challenges noted are consistent with a previous NCD landscape assessment and study conducted as part of the NES project and were supported by work contracted by the Coalition for Access to NCD Medicines and Products which illuminated barriers to supply security with a focus on demand forecasting. The specific areas highlighted in our assessment are consistent with the health systems approach to improving access to health products prioritized in the *WHO Road Map for Access to Medicines, Vaccines and other Health Products 2019-2023*. Financing of health products, governance of health products, a health workforce that ensures access to health products, and Information on health products for decision-making will all be essential to improving availability of NCD commodities in Kenya.

The data gathered as part of this assessment were dependent on two factors: the completeness and accuracy of the records at each phase of the journey—including the facilities, counties, warehouses, and central stores—and the willingness of the interviewees to respond to the interview questions. As a result, there are gaps in the data collected. Some of the key issues are noted below:

- KEMSA stock data were not available at the time of writing this report.
- Not all the delivery notes at health facilities matched with the KEMSA data extracted from the warehouse management system.
- Not all the facilities visited during this review were captured in KEMSA's warehouse management systems' dataset; hence, it was not possible to obtain timelines for every delivery note or for every product line.
- Facility stock card data was often incomplete.
- Private-sector interviewees provided limited information and data.
- There are new initiatives underway that are not completely captured within the report as they are in early operational stages, such as the MOH introducing new registers and patient treatment cards for patients on hypertension and diabetes treatment.
- Facilities were selected by a combination of random sampling and purposeful sampling. As such, the data collected were representative of the six selected counties and pointed to areas of concern for consideration in other counties in Kenya. This report presents results and analysis; the conclusions and recommendations will benefit from further analysis and stakeholder engagement.

Our assessment highlighted several red flags within the supply management phase outlined in the process flow diagram. These red flags were primarily related to along the supply chain. Lack of SOPs in most facilities results in unclear accountabilities and dependency on individuals to manage facility-level ordering. Resupply decisions were further confounded by poor tracking of interfacility stock transfers that skewed consumption data and the use of consumption data for forecasting if the data were not adjusted for days stocked out. The state was opaque and inefficient with a dependency on individual actors.

As referenced in the report *Diabetes Supplies: Are They There When Needed?*, quality NCD data needs to be integrated into existing surveillance, monitoring, and management information systems. Despite having some well-designed supply chain management tools and processes at the facility level, as documented in job aids and SOPs that were observed, the lack of a mechanism to report essential supply chain data (consumption, stock on hand, and losses/adjustments) from facilities up the system does not provide the end-to-end visibility needed to improve ordering, supervision, supply chain performance monitoring, forecasting, and quantification of NCD-related commodities at the central level. Zimbulu (2016) particularly recognized the dependence on bin cards and consumption data at the facility level to forecast demand and inform procurement at the national level. Other authors have also cited the absence of adequate data collection tools as a contributing factor^{7,8} affecting the quality of available data and the impact of forecasting estimates.

Resolving all the previously stated issues will not improve NCD commodity availability without first resolving the funding for NCD commodities and credit constraints that essentially drive the system that we assessed. We observed that standard operating procedures and data collection tools became irrelevant because the deciding factor for the quantities of NCD commodities that a facility received and the timing they were delivered was entirely dependent on the funding and their credit standing with both the public and private suppliers.

Many efforts have been made to strengthen supply chains in Kenya. Some of these supply management challenges have been addressed in other disease areas such as HIV/AIDS. For example, the USAID Kenya Pharma program established and operated a pharmaceutical supply chain management system to provide drugs, supplies, and equipment needed for HIV/AIDS care and treatment and also delivered drugs, supplies, and equipment to other HIV/AIDS programs funded by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR). The electronic supply chain management system (e-SCM) provided an electronic system for recording procurement, stock, and orders, while a field operations team supported health workers in using the tool successfully. These efforts are supported by national quantification and extensive data collection efforts to ensure consistent availability of medicines and products. Last mile delivery efforts have also expanded in other areas of health to include the use of peers to deliver medicines reducing the burden on the health system and increasing access for end users. On a global level, lessons learned from other areas of health are being gathered through a partnership between the UN Interagency Taskforce on NCDs, PATH, and WHO to generate case studies and elevate access innovations that are transferable to NCDs. The outcome from this work may be a catalyst for strengthening NCD supply.

The results of the *Journey of the Pill* assessment underscore the need to improve the availability and use of records and reports that make up the logistics management information system for NCD commodities, support data driven supply management processes, and provide end-to-end supply chain visibility at the national level to inform forecasting, financing, and procurement of NCD medicines and consumables. Developing a demand forecasting model for the county and central levels that leverages demographic and service data and complements logistics data on NCD commodities will lead to improved forecasting and budgeting for NCD commodity supplies at all levels. Forecasts based on quality data are essential to support advocacy for enhanced budget allocation and help close the gap between the supply and the unmet need.

To administer insulin and safely titrate dosages to achieve optimal clinical outcomes and avoid deadly acute complications such as diabetic ketoacidosis or severe hypoglycemia, people treated with insulin require syringes, blood glucose monitors, and testing strips and insulin requires adequate cold storage to retain its efficacy. Nonpharmaceutical items are ordered by the nurse responsible for these supplies, resulting in insulin syringes being ordered separately from insulin. As a result, at most facilities, insulin syringes and monitoring strips were not available for dispensing with insulin, which forced patients to purchase these from private pharmacies and to incur high out-of-pocket costs. The Global Landscape Report, released by PATH in 2015, highlighted the high percentage of out-of-

pocket costs associated with these essential health products and the dependency of PLWNCDs on private retail outlets for access leading to repeated use of syringes and risk of complications. Patients had to purchase syringes from the private sector due to poor availability in public facilities and while most public facilities had glucometers, a lack of accompanying test strips prevented providers and patients from properly monitoring blood glucose levels in several countries. In addition, there was no evidence that the cold chain is maintained to standards at the facility level, as cold storage temperatures were not monitored and lack of air circulation in full cold chain equipment and unreliable electricity can pose a threat to maintaining adequate range of temperature.

Stockouts were evident across all six counties for the tracer medicines, with variances noted by county and by medicines. In comparing the availability of tracer drugs between the UHC and non-UHC counties, we documented the following:

- Non-UHC county health facilities experienced the most days stocked out of Amlodipine 5mg over the course of 12 months, with Nairobi averaging 211 days and Nakuru, 128.
- Health facilities in the three UHC counties of Machakos, Isiolo, and Nyeri experienced the most days stocked out of Hydrochlorothiazide 50 mg averaging 100, 87, and 84 days, respectively.
- Metformin 500 mg was mixed, with two of the three counties with the least availability being the UHC counties of Machakos (185 days stocked out) and Isiolo (140 days stocked out), compared to Nairobi (150 days). The UHC county of Nyeri and the non-UHC county of Nakuru had similar availability reporting 31 days and 35 days stocked out, respectively.
- Only two UHC counties and one non-UHC county facilities had insulin stock-keeping records that allowed this indicator to be calculated. The non-UHC county of Nairobi had the least availability, with 219 days out of stock compared to Machakos, which was stocked out for 42 days and Nyeri, which reported one day.
- Kisumu, a UHC county, did not have historic data available during the assessment visits to allow us to report on this indicator.

Stockouts are a symptom of system failure. Reported influencing factors on stockout periods included weak supply management and non-use of available tools, limited supplies issued to health facilities, budget constraints, and lack of available county credit at central stores. A review of the LMIS forms encountered during the assessment highlighted the lack of a mechanism to report essential logistics data from health facilities to the central level. In addition, in all the counties participating in the UHC project, the health facilities have observed a very high upsurge of patient influx due to the provision of free health care. This has affected the forecasting and planning of supplies tremendously, as there is poor visibility on consumption and actual utilization of the products ordered.

In the immediate term, the availability and correct use of existing stock management tools needs to be reinforced for facilities to order in a correct and standardized way. A mechanism to collect facility-level NCD supply chain data for consolidation at the central level should be explored. Following national scale up of UHC, further analysis is needed to monitor the functioning of the supply chain for NCDs, given the systemic changes in financing of drug supply, and identify root causes of the stockouts by county and best practices to adapt and replicate. This would help determine interventions beyond strengthening of stock management at the facility level and forecasting at the central level.

Across all sectors, markups have existed for all tracer medicines. In the public sector, the facility markup percentages were significantly higher and more widely variant across facilities compared to the faith-based and private-sector facilities. However, this should not mean that the price paid by PLWNCDs in the public sector is higher than the private sector, as procurement prices paid by the private sector and the public sector are not equal. Initial lower prices available through KEMSA have resulted in lower prices to PLWNCDs at public sector facilities. The lowest range and markup were

seen for insulin. However, syringes had limited availability in the public system and were subject to private sector markups, which increased the overall cost of insulin administration. Given the strategy for financing UHC at the primary care level, much of the public sector markup discussion is likely no longer current. However, unless the public sector supply chain can transform the availability of NCD commodities at their facilities, PLWNCDs will either need to seek services at an FBO or purchase their medicines and consumables in the private retail sector.

Despite the mandated 33% markup maximum by the Pharmacy and Poisons Board and all pharmaceutical products being exempted from the government value-added tax, price markups within the private sector frequently exceeded this benchmark across all facilities.

The price markup data provide a clear indication that increasing affordability of commodities for PLWNCDs is more complex than just lowering procurement prices and must consider system influencers post-procurement that drive up cost for PLWNCDs and governments. Further analysis is required to understand the market dynamics and these cost escalators post-procurement.

This discussion is based on an analysis of the data and highlights areas for early intervention to strengthen supply security for PLWNCDs. The following recommendations describe a roadmap for greater commodity security for PLWNCDs. With PATH support, the MOH is establishing structures such as the NCD supply chain technical working group to move these recommendations to action and ensure barriers specific to NCD medicines and health products are addressed as part of the National Supply Chain Strategy. It is recognized that a multi-sectoral approach is needed if we are going to achieve the goal of access to affordable quality medicines and health products for PLWNCDs.

5. Recommendations

Access to and affordability of NCD medicines and products is a human right and a critical step towards UHC. However, this end-to-end supply chain assessment found bottlenecks impeding supply flow, frequent stockouts, and high price markups resulting in constrained and unreliable access and poor affordability for PLWNCDs. Based on these findings, we recommend the following interventions:

5.1 Strengthen leadership, governance, and financing of the NCD supply chain at the central and county levels

The leadership and governance of supply chain organizations is an ingredient of paramount importance in driving measurable process improvements that will result in increased availability and affordability of priority NCD commodities in the public, FBO, and private sectors.

- Establish a national NCD Supply Chain TWG to address the challenges in the NCD supply chain. The TWG will support the MOH to review bottlenecks identified in this report and adopt recommendations that will inform the Kenya Health Supply Chain Strategy and National NCD Strategy 2021-2025 on NCD commodity management. This coordination and technical support at national level by the national NCD supply chain technical working group will be devolved in a phased manner at the county level. The county technical working groups will provide technical support and leadership for NCD commodities management including commodities reporting, forecasting, and budgeting at county level which will inform national level supply chain commodity management.
- As part of the data review meetings being supported by the PATH/Access Accelerated partnership, include NCD commodities as a distinct session linked to the national NCD supply chain technical working group. Link this NCD-specific group to the broader supply steering committee being established under the Chief Pharmacist to integrate NCDs into broader supply chain-strengthening efforts and leverage lessons learned from other health areas to target bottlenecks specific to NCD medicines and products.
- Determine an essential list of key performance indicators to be used for the NCD supply chain to enable the TWG, counties, and sub-counties to regularly monitor availability, identify problems, act to resolve them, and continuously improve the functioning of the supply chain.
- Address NCD supply chain and commodity financing needs in the Costed National NCD Strategy and Kenya Health Supply Chain Strategy.
- Regularly monitor and resolve financing bottlenecks impacting on the resupply order quantity decisions of health facilities to improve availability and reduce stockouts. Conduct and report root cause analysis to identify sustainable solutions to financing of NCDs, given policy commitment to UHC.

5.2 Improve NCD supply chain data quality and use

1. **Tools:** Paper-based and digital tools are needed that enable collection, reporting, and interpretation of data to inform supply management decisions at all levels of the supply chain.
 - Work with the MOH and partners to review existing commodity management forms that make up the LMIS and SOPs for routine ordering for applicability across therapeutic areas to be implemented widely and provide for clear accountability for all health facilities. Review options

to report and provide end-to-end visibility of facility NCD supply chain data, specifically stock on hand, days stocked out, consumption and losses, and adjustments.

- Given the record keeping required to implement UHC at the facility level, ensure facilities have a mechanism to record their submitted medicine orders and enable facility staff and supervisors to review order accuracy and calculate order fill rates. The KEMSA order form by facility level can be archived electronically as well as printed to create a record for facilities not connected to the eLMIS.
- Identify opportunities to link patient-level data to the national HMIS/LMIS systems. Patient-level data combined with supply chain data will provide more accurate information to inform programmatic and logistical decisions in a more efficient, coordinated, and effective way.
- Support the county NCD focal person who leads NCD implementation as a member of the County Health Management Team with resources for coordination and supportive supervision to enable effective distribution and use of NCD data collection tools recently developed by the MOH. Focus will be given to data quality assurance and data review meetings to promote NCD data quality and use.

2. **Quality data:** Integrate NCD patient and supply chain data into existing surveillance and monitoring systems that provide data to support access to NCD medicines and health products.

- The NCD Department of the Kenya MOH, in collaboration with PATH and Access Accelerated, has invested in improved NCD data collection for input into District Health Information Software 2 (DHIS2) which in 2020 has transitioned into the Kenya Health Information System (KHIS). Efforts must be made to ensure data to inform demand, supply, and unmet needs are captured in these datasets, as is the case for other disease areas.
- Leverage the data from this and previous assessments, and the NCD Navigator as background data to inform discussions, conduct national roundtables with each sector (industry, government, civil society, and implementing nongovernmental organizations) on their specific role as part of a multisectoral response to address factors affecting availability and affordability of medicines and health products for NCDs in Kenya. Monitor progress through the NCD Navigator.
- Layer facility supply chain data (stock on hand, consumption, days out of stock, wastage/expiries) onto the NCD Navigator data platform to support monitoring and evaluation of progress, inform planning to match supply to demand, and monitor supply, demand, and unmet need.
- Digitize supply chain functionalities with a focus on linking stock management, dispensing, and ordering transactions and enabling timely data capture, analysis, and reporting up the supply chain.
- Determine a basic list of supply chain key performance indicators for health facilities and KEMSA to be regularly tracked by sub-county pharmacists and reported to the council pharmacist and the NCD Department of the Ministry of Health to help monitor NCD supply chain performance and prioritize interventions.

3. **Training:** Given the call for better data collection and supply management, training workshops, peer support, on-the-job training, and job aids are recommended to strengthen data collection and data use for supply management:

- Engage county pharmacists to provide on-the-job training sessions with health facility staff on supply management, including SOPs and supporting documentation.
- The health facility, in collaboration with subcounty pharmacists, should hold regular review meetings to analyze NCD patient and supply chain data to triangulate consumption data with patient numbers, stock movement, and order quantity calculation.
- The MOH should engage county health teams to strengthen record keeping and management of data for managing inventory and dispensing of medicines for NCDs through enhancing trainings and supervision visits, prioritizing high-burden facilities.

5.3 Identify and leverage existing supply management infrastructure and capabilities

Commodity security (CS) is a shared concern and collaboration across geographies and therapeutic areas is needed to support shared learning and development of innovative solutions. To achieve NCD CS, the MOH needs to be able to forecast, finance, procure, and deliver the priority NCD products where and when they are needed. This happens for some commodity categories in Kenya, such as HIV. NCDs can learn from different therapeutic areas and regions.

All the above will be needed to correctly order and deliver the right quantities of the right products to patients at the right time.

Learn across therapeutic areas:

Leaders in HIV, TB, malaria, and reproductive health supplies have worked for decades to strengthen security for their priority commodities. Their learnings can be applied to NCDs to accelerate progress to achieve available and affordable commodities and promote adherence. Kenya has made great progress in addressing supply management challenges in these therapeutic areas. Electronic supply management systems, essential data collection, national quantification, and capacity building for health workers have all supported the reduction in stockouts, and limited price markups. The NCD division should work closely with the MOH Health Products and Medical Technologies department to identify opportunities to leverage existing infrastructure and capabilities for NCD medicines and products. Recommendations include:

- Conduct an inventory and assessment of supply management systems and solutions employed in Kenya for other areas of health such as HIV/AIDS, TB, and family planning to identify key contributors to consistent availability of medicines and products in these areas.
- Explore the possibility of adopting or extending mechanisms for reporting facility essential supply chain data needed for annual forecasting and quarterly supply planning by an NCD quantification working group.
- Prepare strategic procurement plans that allow for consumption needs and buffer stock as service capacity expands. If multi-month prescription/dispensing is implemented, and more PLWNCDs are diagnosed and enrolled in care and case management, additional investment in commodities will be required as the supply chain extends to the PWLNCD and they hold a longer period of stock.
- Identify components of existing infrastructure and capabilities that can be leveraged for NCDs.
- In partnership with WHO, recommend hosting a meeting focused on NCDs and supply chain with invitees selected from technical experts across HIV, TB, and reproductive health to codify their lessons learned as they relate to NCDs and establish an integrated learning network.

Across geographies: Regional peer learning networks

The challenges faced with access to NCD medicines and products are not unique to Kenya but have been reported in many LMICs and in East Africa. PATH has worked with the East Africa Community and cohosted a meeting with the East African Community Secretariat and NCD national leads, and many of the challenges found in the assessment resonated across the region. Therefore, more specifically, the recommendations are to:

- Establish a regional peer learning network, leveraging other supply chain efforts such as the African Resource Center, so that prescribers, procurement personnel, and those involved with forecasting and quantification can share learnings from interventions piloted to address supply chain barriers.

Ensure that NCD supply chain and commodity needs are reflected in the National Supply Chain Strategy specifically calling out those barriers that are unique to NCDs as a priority for action.

- Integrate lessons learned across supply-related efforts in other therapeutic areas to develop a National NCD Supply Chain Strategy and propose NCD recommendations to be considered for this strategy.

5.4 Strengthen evidenced-based demand planning for NCD medicines

While the patient and supply chain data generated is strengthened to inform demand forecasting at the central level, an innovative forecasting model is needed that is tailored to accommodate for the NCD data gaps and unstable and emerging demand for services, the following actions are recommended:

- Strengthen evidence-based demand planning and ensure adequate and sustainable financing for a “full supply” of NCD medicines and health products in urban, peri-urban, and rural facilities. National and county quantification based on a solid methodology will provide the evidence needed to justify budget requests. In addition, track funding allocated to these products over time as part of the national UHC program.
- The Coalition for Access to NCD Medicines and Products is developing and testing an innovative methodology for demand forecasting. A technical working group has been convened (see Appendix 5) to develop this methodology and represents clinical, NCD, and demand forecasting experts. Building on this work, the recommendations are to:
 - Test, revise, and adopt a demand forecasting method that accounts for current gaps in NCD drug consumption data, inconsistent market dynamics, and funding to improve the accuracy of forecasting to reduce stockouts of lifesaving drugs.
 - Assemble an NCD quantification working group at central and county levels, composed of relevant stakeholders, including the Department of Health Products and Medical Technologies, KEMSA, and MEDS, that meet quarterly to complete the national quantification and update it quarterly throughout the year. The group will review forecasting assumptions, track planned incoming shipments, collect facility and KEMSA stock on hand and stockout data, and ensure that the central level has full supply of NCD commodities to meet health facility needs. They will utilize the forecast methodology discussed above.
 - Use the estimate of unmet need calculated using the forecasting method to advocate for greater investment in NCD medicines.
- Provide training and capacity-building for Level 2-4 facilities with a focus on NCD medicines and skills specifically related to stock record management, supervision, and monitoring to ensure stock records at health facilities provide a credible data source and that the data is effectively used for decision making at the facility level and available to be reported above.
- Strengthen software systems by engaging local developers to incorporate global best practices in eLMIS design into existing systems to improve the availability, quality, and use of supply chain data needed to improve facility supply chain management.
- Increase forecast accuracy by using quality facility-level consumption data adjusted for stockouts to calculate routine resupply quantities.
- Plan staggered deliveries from local and international suppliers to KEMSA over the course of the year to reduce maximum stock levels at KEMSA and shorten pipeline length, reducing risks to expiry.

- Enter into multi-year framework agreements with Kenyan manufacturers of NCD commodities to allow for greater economies of scale, reduce transaction costs, increase procurement agility, and provide manufacturers with data visibility to inform their application program interface needs forecasting and allow for greater flexibility in timing of production schedules, deliveries, and responsiveness by local manufacturers.

5.5 Leverage primary health care for PLWNCDs

To increase access and availability, we recommend policy and practice changes to allow for lower level facilities to store and dispense critical NCD medicines and products. Health care workers will need to be assessed for their knowledge and trained to ensure rational use of NCD medicines at the primary care level. This will improve access for most clients at the community level while reducing the economic costs for PLWNCDs such as travel for care and time away from work. It will also redistribute high volumes of clients from the hospitals to lower level facilities, allowing hospitals to focus on managing complicated and severe cases.

- Establish enabling policies for Level 2 and above facilities to provide prevention, diagnosis, treatment, and monitoring for PLWNCDs, as per WHO recommendations.
- Transform national health insurance scheme to support NCD medicines and health products to be dispensed at Level 2 facilities and above.
- Engage community health workers in strengthening last mile delivery systems for NCD commodities.

5.6 Establish price monitoring system and publish price markups to achieve a national standard and reduce current variance seen across Kenya

The wide variation in markups for some NCD medicines and supplies in each sector requires rationalization based on understanding the cost drivers, and then a review of markup and pricing policies to ensure the unique costs of both procurement and distribution are built into the price of each medicine. A single markup rate (e.g. the current 33%) may not apply across all medicines, since high cost medicines yield more money from the same markup rate than low cost medicines. While distribution costs may be the same for most, insulin, which requires cold chain, faces an additional cost escalator. Finally, PLWNCDs should be aware of the price they are expected to pay (if any) and therefore must be informed and empowered with price information for the products they require.

Recommendations include:

- In collaboration with the MOH Department of Health Products and Medical Technologies, review and revise national supply chain strategies to ensure value for money procurement policies informed by a costing assessment exercise, among others.
- Conduct periodic price assessments at service delivery points to inform commodity pricing for procurement and budgeting purposes
- Publish and post NCD price sheets at public health facilities and collaborate with NCD advocacy organizations to provide pricing information to PLWNCDs so that they can demand the right price for the products they need.

5.7 Support insulin access, affordability, and adherence

Insulin is a complicated treatment because it cannot be utilized without a syringe, nor titrated without blood glucose monitors and strips, and it requires temperature stable refrigeration. Ensuring availability of each of these components is critical for adherence and treatment success. With the upcoming 100th anniversary of insulin's first use to treat a patient and the heightened awareness of the needs of people living with diabetes, the following is recommended for harmonizing the pricing, order, and delivery process, and improving storage for insulin:

- Assess existing eLMIS tool/software to determine the feasibility of adding reminders that would trigger ordering of consumables necessary to safely administer insulin. This would improve access and affordability of these products and, as such, enhance patient compliance.
- Review cold storage in facilities, especially those in Level 3 facilities and below, to ensure storage requirements are met.
- In the short-term, improve cold chain monitoring of existing equipment by providing health facilities with SOPs, thermometers, and charts to record temperature. Other technology exists, such as temperature loggers, and bio-monitor stickers that are used with vaccines that change color over time with heat exposure that might be useful to consider, especially for the patient level. WHO has pre-qualified products that can be considered.
- Conduct a forecast of cold chain capacity needs for all purposes, including insulin, over the next 20 years and incorporate the capital investment into the Kenya National Health Supply Chain Strategy. The review of the cold chain could be led by MOH at the central level, leveraging the knowledge and technology of the Kenya EPI unit's recent efforts to upgrade and expand cold chain equipment including remote temperature monitoring.
- Conduct a feasibility assessment for introduction of bundled packing for consumables needed to support diabetes treatment. The assessment could look at policy and regulatory issues necessary to make this change across sectors as well as supply chain and costing implications.
- Sub-counties should also be incentivized to review each facility's digital order to ensure supplementary medical supplies are included, which would enhance patient compliance from an access and affordability perspective.

5.8 Conduct a costing assessment

As UHC scales up, the cost drivers are expected to change in the public sector. Nevertheless, it will be important to explore the impact of UHC on cost to patients seeking primary care services for NCDs and medicines in the public and private sectors.

- Conduct a costing assessment, focused on hypertension, diabetes, and hyperlipidemia to understand the cost drivers for NCD commodities reflected in the price markups captured in this report and explore how they can be mitigated.
- Use the cost assessment findings to inform policy recommendations to rationalize pricing, strengthen advocacy, plan for funding needs to address NCDs, and provide inputs to the Costed National NCD Strategy and Kenya Health Supply Chain Strategy.

Improved cost information is critical as Kenya scales up NCD programs and incorporates NCD management into the ongoing UHC rollout.

Results of the costing evaluation could also inform a possible future modeling study to assess options for improving efficiency of essential medicine and product delivery with the aim of achieving lower and more stable costs of accessing NCD medicines and products.

5.9 Engage PLWNCDs and stakeholders in developing an advocacy strategy to improve access and affordability of NCD commodities

In collaboration with the NCD Alliance of Kenya, build a critical mass of stakeholders—from patient associations, clinicians, community workers, nongovernmental organizations, and the private sector—who are informed of the evidence in Kenya regarding supply chain bottlenecks, unmet need, cost escalators, and other factors. Support them to develop an advocacy strategy to improve availability and affordability of NCD commodities.

To mobilize the NCD community in addressing access and affordability, recommendations are to:

- Provide evidenced-based advocacy training to support advocates and technical partners to identify advocacy issues and create actionable advocacy strategies aligned to PATH's 10-part process. A systematic approach to assessing advocacy options and making strategic decisions about policy goals and activities can help groups identify advocacy opportunities, risks, and partners—maintaining focus on moving the needle on key health strategic areas of interest and getting further with limited resources. This approach led to targeted advocacy efforts in Kenya and Senegal to address barriers to essential medicines and products for NCDs and improve their availability and affordability. The evidence generated from NES, coupled with targeted advocacy, contributed to inclusion of statins on the Kenya Essential Medicines List and continued advocacy efforts to influence policy change. See text box.
- Use the NCD Navigator along with local evidence to mobilize stakeholders and support NCD Alliance Kenya to build a grassroots movement targeting access to medicines and health products as a basic human right.
- Connect availability and affordability of NCD medicines and products to national goals such as UHC, primary health care—strengthening efforts, and the national NCD strategy. Couple this with heightening awareness of the need to build health system resiliency in the follow-on from COVID-19.

PATH's 10-part approach to strategic advocacy

The approach is based on proven advocacy principles designed to deliver results that improve quality or access to care; resources for health programs or actions; or commitments to health by global, national, or subnational leadership.

1. Identify the advocacy issue
2. State the advocacy goal
3. Identify decision-makers and influencers
4. Identify the key interests of decision-makers
5. Identify potential opposition or obstacles
6. Take an inventory of assets and gaps
7. Select strategic partners
8. Develop advocacy tactics
9. Create advocacy messages and select messengers
10. Measure success and progress

6. Conclusion

This assessment served to identify bottlenecks in the supply chain management of five NCD tracer drugs in Kenya and heighten awareness of the need to overcome barriers to financing in health delivery systems including the supply chain. As such, this work illuminated the priorities: improve NCD drug forecasting; improve data collection and ordering at the health facility level; develop a costing assessment to better understand cost drivers and price markups; strengthen capacity-building, including the development of a regional peer learning network; and engage a broad group of stakeholders to develop an advocacy strategy to improve access and affordability of medications for people who are suffering physically, emotionally, and financially from NCDs. Global engagement, government stewardship, multisectoral commitment, and innovative solutions are needed to ensure the supply of medicines and health products for PLWNCDs.

References

- ¹ World Health Organization (WHO). *Kenya: World Health Organization—Noncommunicable Diseases (NCD) Country Profiles, 2018*. Geneva: WHO; 2018.
https://www.who.int/nmh/countries/ken_en.pdf?ua=1.
- ² World Health Organization (WHO). *The World Medicines Situation*. Geneva: WHO; 2004.
- ³ World Health Organization (WHO). *Equitable Access to Essential Medicines: A Framework for Collective Action*. Geneva: WHO; 2004. <https://apps.who.int/iris/handle/10665/68571>.
- ⁴ Kenyan Ministry of Health (MOH), Division of Non-Communicable Diseases; Kenya National Bureau of Statistics, World Health Organization. *Kenya STEPwise Survey for Non Communicable Diseases: Risk Factors 2015 Report*. Nairobi: MOH; 2015.
https://www.who.int/ncds/surveillance/steps/Kenya_2015_STEPS_Report.pdf.
- ⁵ Institute for Health Metrics and Evaluation (IHME). *Development Assistance for Health Database 1990–2015*. Seattle: IHME; 2016. <http://ghdx.healthdata.org/record/ihme-data/development-assistance-health-database-1990-2015>. Accessed April 13, 2020.
- ⁶ World Health Organization (WHO). *Meeting Report: Technical Definition of Shortages and Stockouts of Medicines and Vaccines*. Geneva: WHO; 2017.
https://www.who.int/medicines/areas/access/Meeting_report_October_Shortages.pdf?ua=1.
- ⁷ Zimbulu V. *Organizational Practices Influencing Availability of Essential Medicines at Hospitals in Nairobi County*. Nairobi: University of Nairobi; 2016.
<https://pdfs.semanticscholar.org/b392/f0fcb5d6a11e19c34ae8445a5234d06dff26.pdf>.
- ⁸ Amref Health Africa. *Management and Control of NCDs in Kenya: Baseline Survey Report*. Nairobi: Amref Health Africa; 2016.

Appendix 1. Kenya national health system tiers

Level	Health Centre	Description	Approx. Population served	Tracer medicines that can be prescribed
1	Community health services	Primary health services provided to the community via public health sector only and staffed by community health volunteers	5,000	
2	Dispensaries/ clinics	Public and private primary health facilities providing an interface between the community and health system facilities. Engages with the community through curative, promotive, preventive, and rehabilitative care at basic levels. Staffed by clinical officers and nurses.	10,000 (rural); 15,000 (urban)	
3	Health centers	Public primary health centers and private maternity/ nursing homes providing services specified under L2 for its immediate catchment population (10,000-15,000) as well as additional services to support L2 facilities in its area, including: higher level health activities; referral services; logistical support to L2 facilities (e.g., cold chain support for KEPI); and coordinating information flow. Staffed by medical officers, clinical officers, lab technicians/ pharm technicians.	30,000-40,000	Amlodipine, Metformin, Hydrochlorothiazide
4	Primary hospital (sub-county hospital)	District referral hospitals providing curative services and principal referral level for all KEPH interventions from L1-3. Focuses on appropriate curative care through primary hospitals. These hospitals provide L2-3 functions for their surrounding areas and provide clinical supportive supervision to L2-3, higher level health activities, referrals, logistical support, and coordinating information flow from facilities in the catchment.	100,000 (rural); 200,000 (urban)	Insulin, Amlodipine, Metformin, Hydrochlorothiazide
5	Secondary hospital (county referral hospital) (18)	Consists of secondary hospitals and management functions supported by the PMOH and county partners. Hospitals offer a broader spectrum of curative services and serve as training facilities for nursing staff and clinical officers.	1,000,000	Tamoxifen, Insulin, Amlodipine, Metformin, Hydrochlorothiazide
6	Tertiary hospital (national/ teaching/ referral hospitals) (6)	Consists of national referral hospitals and management functions supported by MOMS. Provides all remaining specialized services at the national level, trains specialized cadres of health workers, and serves as a center for research.		

Appendix 2. List of health facilities and suppliers visited and interviewed in the public, public and FBO sectors

Table 3. Site visits in Nairobi County.

Sector	Name of site	Level
Public	Mama Lucy Kibaki (Embakasi) District Hospital	Level 4
Public	Mbagathi District Hospital	Level 4
Public	Mutuini Sub District Hospital (Dagoretti)	Level 4
Public	Kibera South Health Centre	Level 3
Public	Kibera Community Health Centre (Amref)	Level 3
Public	Mihang'o Community Dispensary	Level 2
Private wholesale	Dawa Pharmaceuticals/Medisel	Manufacturer
FBO	MEDS	Central-level wholesaler
Private wholesale	Philips Health Care	Wholesale/Distributor
Private retail	Nila Pharmaceuticals	Wholesale/Retail
Private retail	Goodlife	Retail outlet

Table 4. Site visits in Machakos County.

Sector	Name of site	Level
Public	Machakos Referral Hospital	Level 5
Public	Kangundo Sub County Hospital	Level 4
Public	Masinga Sub County Hospital	Level 4
FBO	Bishop Kioko Catholic Hospital	Level 4
Public	Mbiuni Health Centre	Level 3
Public	Ikombe Dispensary	Level 2
Private retail	Masaku Chemist	Wholesale/Retail
Private retail	Thwake Chemist	Wholesale/Retail

Table 5. Site visits in Kisumu County.

Sector	Name of site	Level
Public	Jaramogi Oginga Odinga Teaching and Referral Hospital	Level 5
Public	Maseno University Medical Clinic	Level 4
Public	Muhoroni Sub County Hospital	Level 4
FBO	St. Elizabeth Mission Hospital	Level 3
Public	Chemelil Sugar Factory Health Clinic	Level 2
Public	Riat Dispensary	Level 2
Public	Chiga Dispensary	Level 2
Private	Port Florence Hospital	Level 3
Private retail	Kentons Pharmacy	Wholesale/Retail
Private retail	Hodd's Pharmacy	Retail Pharmacy

Table 6. Site visits in Nakuru County.

Sector	Name of site	Level
Public	Nakuru County Referral Hospital	Level 5
Public	Mirugi Kariuki Sub County Hospital	Level 4
Public	Olunguruone Sub County Hospital	Level 4
Public	Molo Sub County Hospital	Level 4

Public	Naivasha Sub County Hospital	Level 4
Public	Keringet Sub County Hospital	Level 4
Private	Nakuru War Memorial Hospital	Level 4
Public	Arimi Dispensary	Level 2
FBO	Mother Kevin Hospital (Catholic)	Level 2
Private wholesale/retail	Nakuru Medical Stores	Former county supplier that suffered major financial losses
Private retail	Zen Pharmacy	Was undergoing a major KRA audit and hence was not available for the interview

Table 7. Site visits in Nyeri County.

Sector	Name of site	Level
Public	Nyeri Provincial General Hospital	Level 5
Public	Karatina District Hospital	Level 4
Public	Othaya Sub District Hospital	Level 4
Public	Mukurweini Sub District Hospital	Level 4
Public	Naromoru Health Centre	Level 3
Public	Wamagana Health Centre	Level 3
Private	Naromoru Medical Centre	Level 2
FBO	Naromoru Catholic Dispensary	Level 2
Private retailer	Othaya Chemist	Wholesale/Retail
Private retailer	Hallel Pharmacy	Wholesale/Retail (did not share data on products or prices)

Table 8. Site visits in Isiolo County.

Sector	Name of site	Level
Public	Isiolo County Hospital (Referral hospital)	Level 4
Private	Galaxy Hospital	Level 4
Public	Garbatulla Sub County Hospital	Level 4
Public	Merti Sub County Hospital	Level 3
Public	Kinna Health Centre	Level 3
Public	Tupendane Community Dispensary	Level 2
FBO	Catholic Dispensary (Isiolo)	Level 2
Private Retail	Sierra Chemist	Retail

Appendix 3. Point of care equipment for L1-4

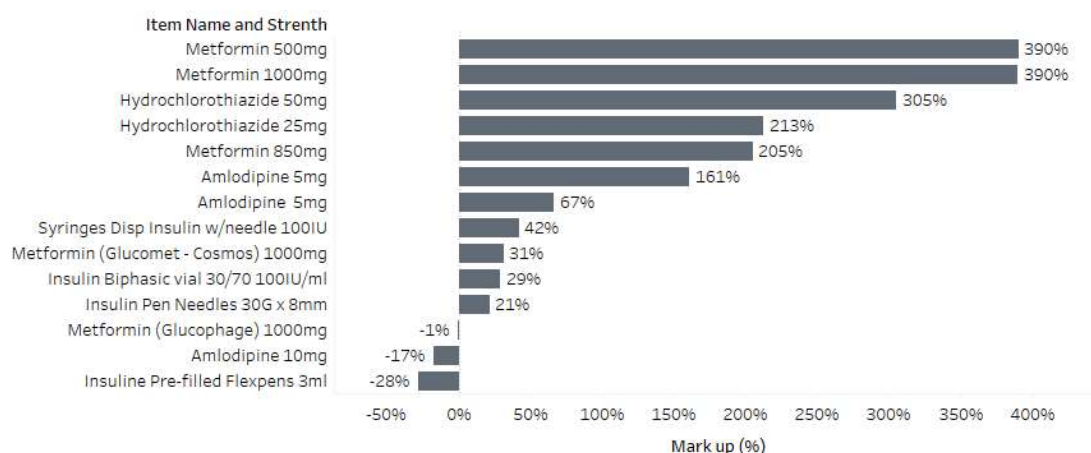
4.3 List of Identified basic medical equipment and estimated costs

No.	Equipment Name	Approximate cost
1.	Weighing scale (digital)	10 000
2.	Infant Weighing scale	4 500
3.	Drip stand	6 000
4.	Digital thermometer	300
5.	BP machine - digital	2 000
6.	Paediatric weighing scale	5 500
7.	KEPI Cool box	160 000
8.	MUAC tape	13 000
9.	Stethoscope	2 500
10.	Fetoscope-doppler (digital)	200
11.	standard wheelchair	20 000
12.	Nebulizer	5 000
13.	Sphygmomanometer.	4 000
14.	Emergency lamp	1 500
15.	Examination lamp-mobile	37 000
16.	Microscope	65 000
18.	Blood glucometer and strips	10 000
19.	Pulse oximeter	15 000
18.	Examination couch	15 000
19.	Adjustable chair	2 500
20.	Trolley	25 000
21.	Vaginal speculum/retractor	3 000
22.	Kidney dish	500
23.	Clock/Timer	1800
24.	Cryotherapy unit, gas and accessories	30 000
25.	Forceps	400
26.	Colposcopes	22 000
27.	Long needle holders	3 000
29.	Height and weight meter	15 000
30.	Basic trauma pack	25 000
31.	Bag-Valve mask	16 000
32.	Suction pump- manual	7 000
TOTAL		527,700
17	CHV Kits	30 000.00

Appendix 4. Percentage markups: Public, private, and faith-based sectors^b

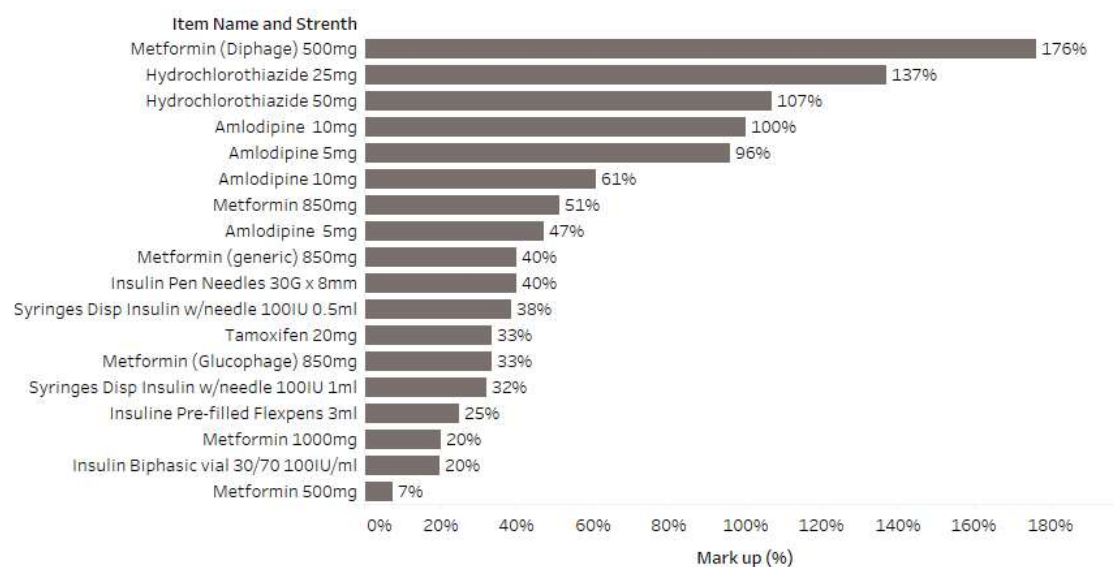
Public sector

Public facilities price markups



Private sector

Private facilities price markups

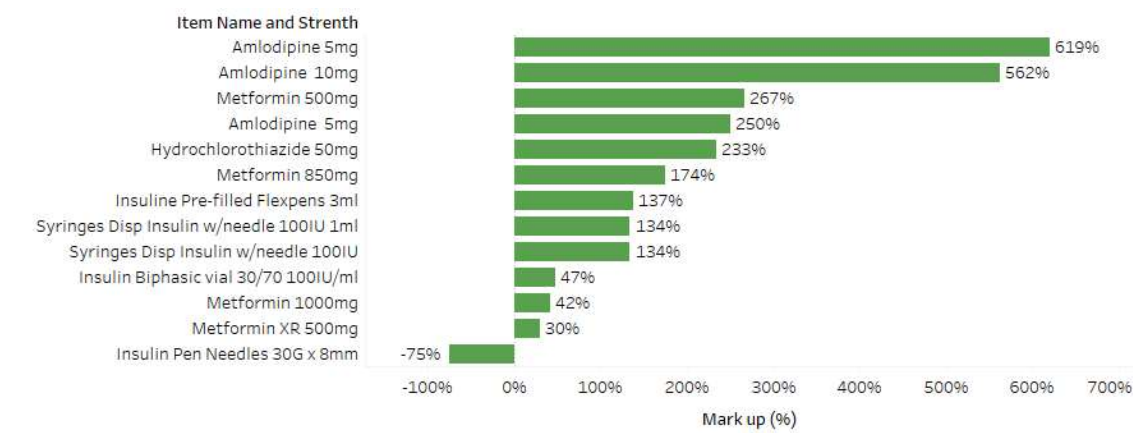


^b Note:

- Where the percentage is indicated as zero (0), the products are being sold to the patient at cost price.
- Negative percentages indicate subsidized costs within the public sector, as the charges to the patients are maintained at nominal charges for affordability.
- Although facilities may have procured supplies from the private sector, this was not evident during the assessment, as delivery notes/invoices from other suppliers were not easily available.

Faith-based sector

Faith-based sector price markups



Appendix 5. The Coalition for Access to NCD Medicines and Products' technical working group for demand forecasting and quantification of NCDs

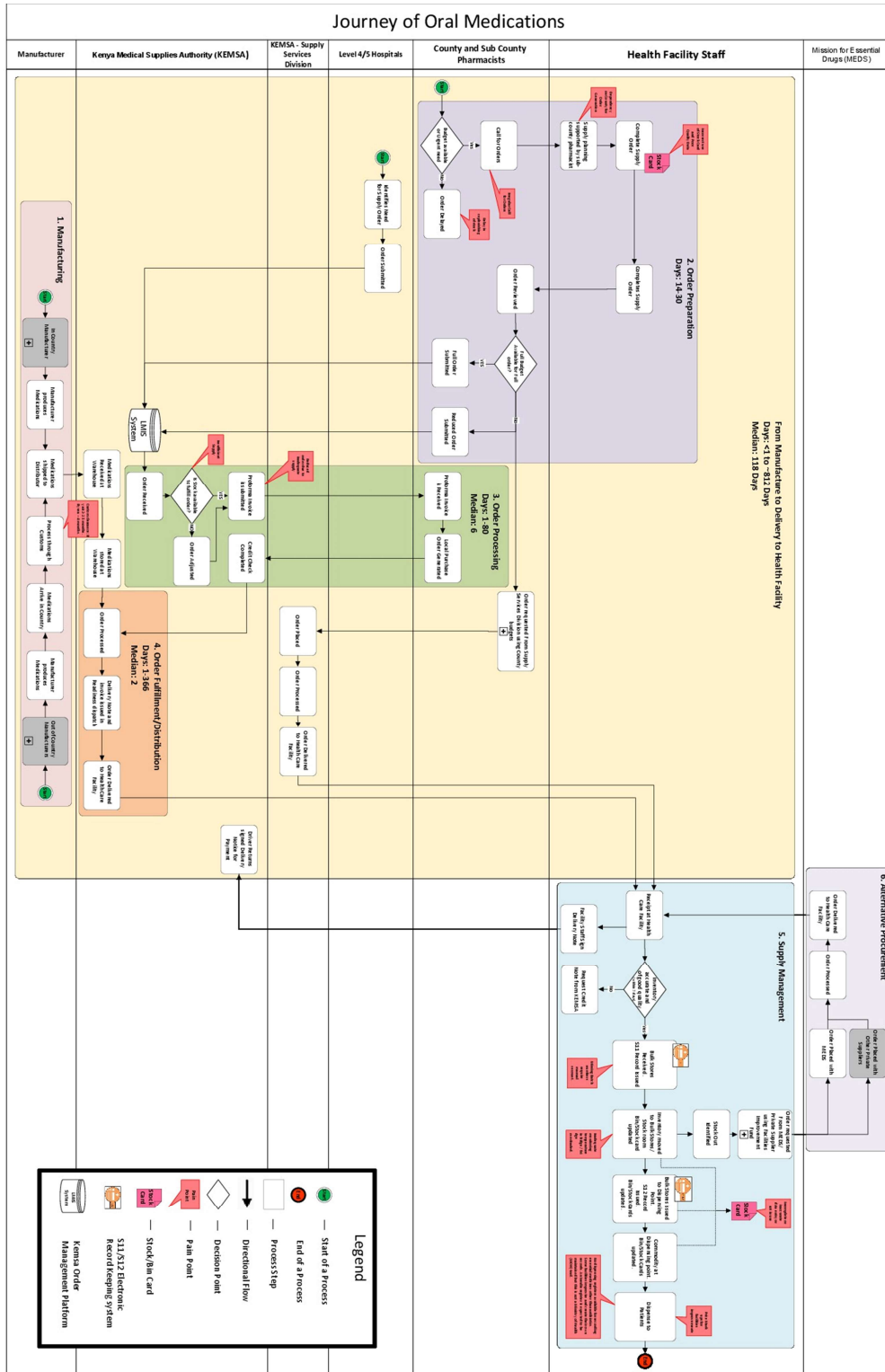
Membership roster

No	Name	Affiliation	Area of expertise
1	Dr. Irene Weru	Kenyatta National Hospital	Clinical pharmacist
2	Dr. Gerald Mutungi	Ministry of Health	Noncommunicable diseases lead
3	Mr. Daudi Msasi	Ministry of Health	Chief pharmacist
4	Dr. Prashant Yadav	INSEAD/Center for Global Development	Supply chain management, market dynamics
5	Mr. Hitesh Hurkchand	Interagency Supply Chain Group	Supply chain management, procurement
6	Dr. Laila Akhlaghi	John Snow, Inc.	Supply chain management, forecasting and quantification
7	Mr. Jean-Luc Hospital	Merck	Supply chain management, demand planning
8	Mr. Boniface Dongmo Nguimfack	World Health Organization	Supply chain management
9	Dr. Jeremy Schwartz	Yale University	Clinical, noncommunicable diseases
10	Dr. Ram Hariharan	macro-eyes	Machine learning, artificial intelligence

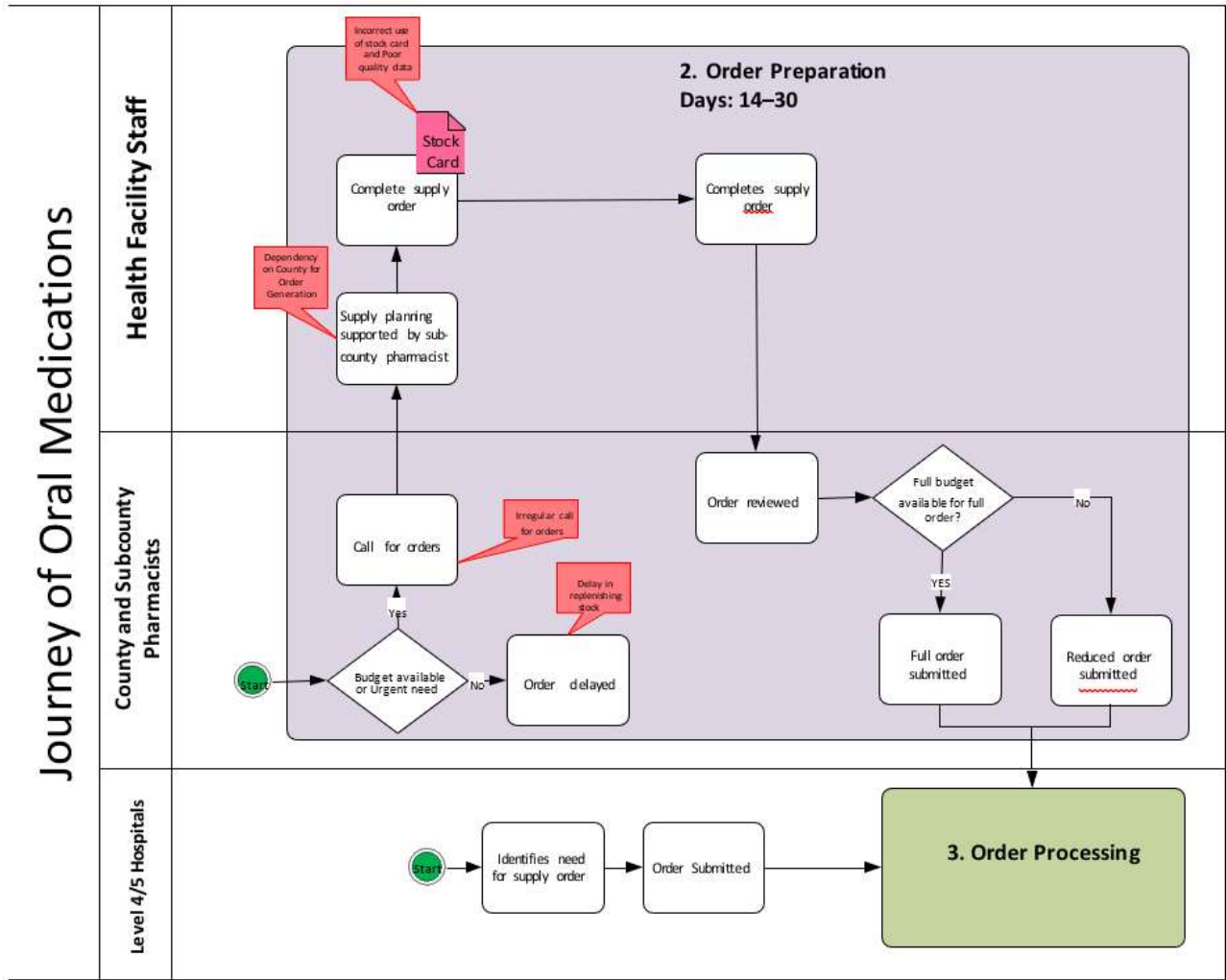
PATH Secretariat

Helen McGuire, Todd Dickens

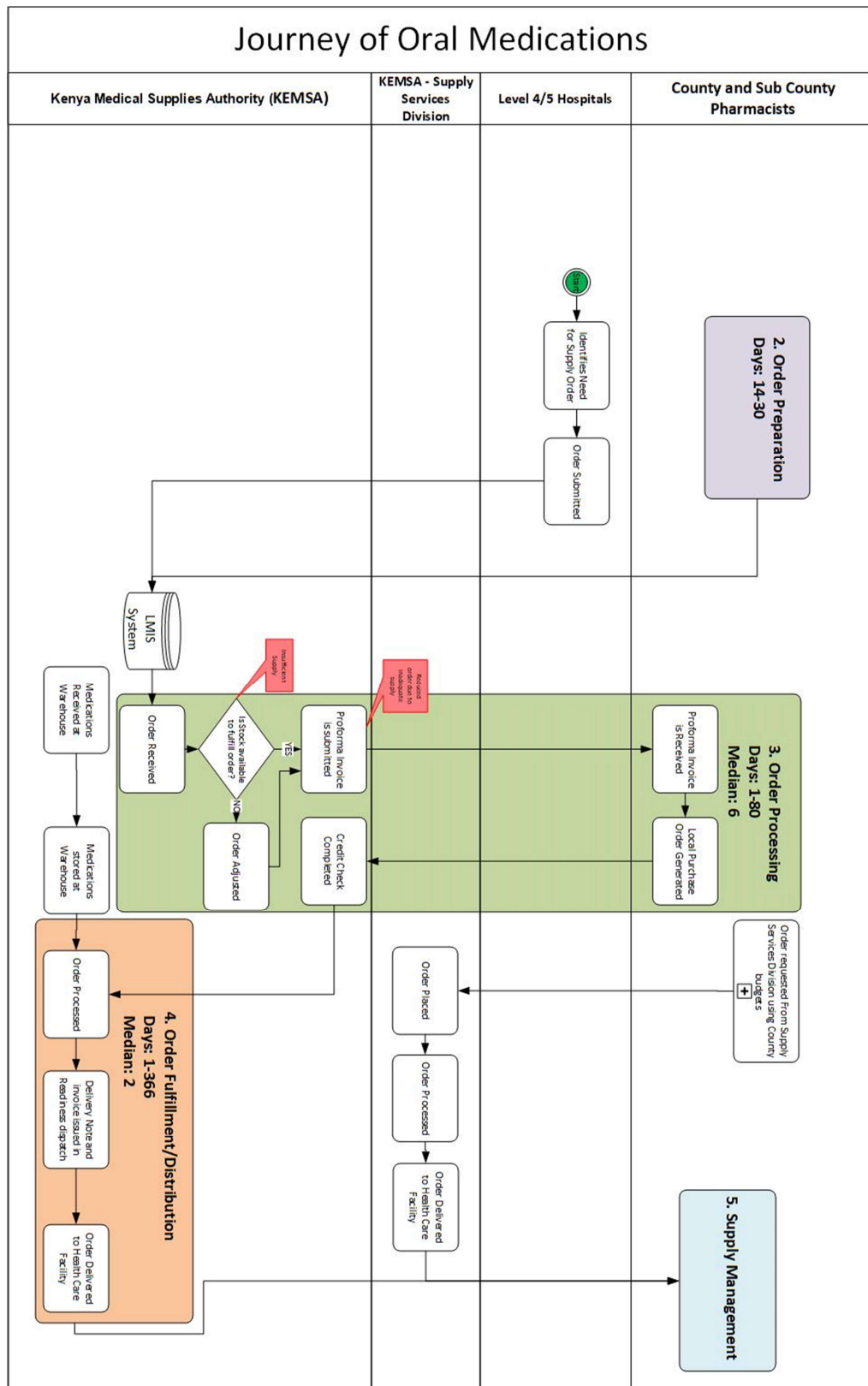
Journey of oral medicine: Overall process map



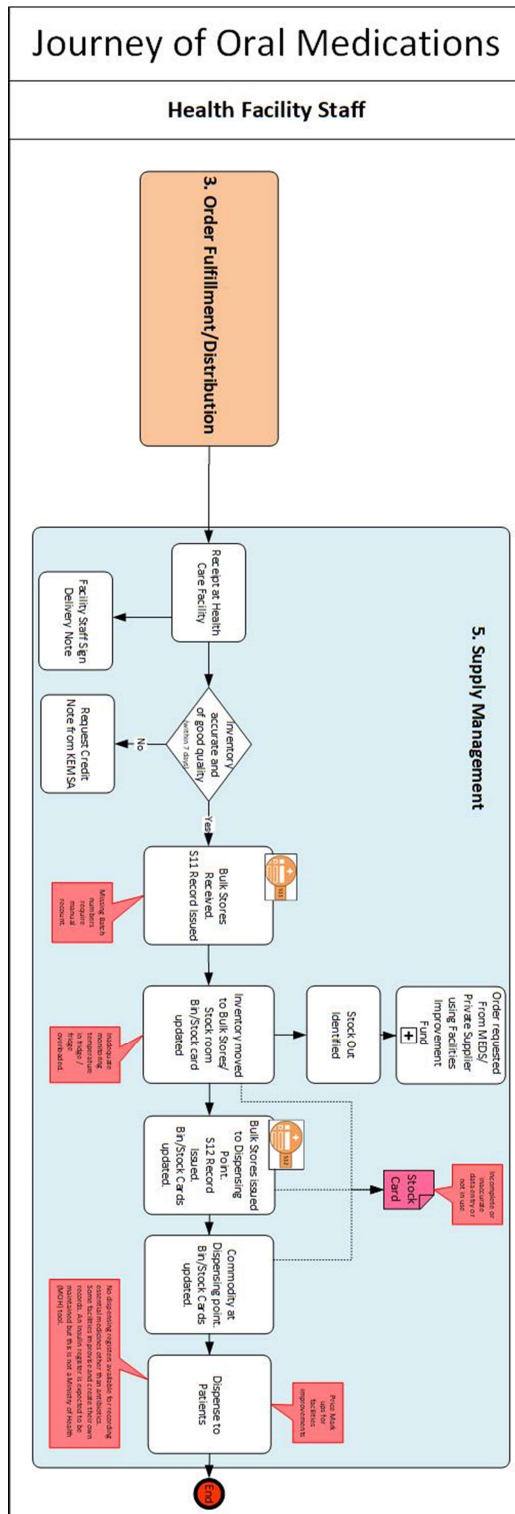
Order processing



Order preparation, order processing, and order fulfillment



Supply management



Process flow legend

