Landscape Assessment of Diabetes Mellitus in Ethiopia

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Table of Contents

Abbreviations and Acronyms

AHRI	Armauer Hansen Research Institute
ALP	Alkaline Phosphatase
BMI	Body Mass Index
BP	Blood Pressure
BUN	Blood Urea Nitrogen
CHAI	Clinton Health Access Initiative
CBC	Complete Blood Count
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Disease
DHIS	District Health Information System
DKA	Diabetic Ketoacidosis
DM	Diabetes Mellitus
DTC	Drug and Therapeutic Committee
ECG	Electrocardiography
EDA	Ethiopian Diabetes Association
EFDA	Ethiopia Food and Drug Administration
EFY	Ethiopian Fiscal Year
EML	Essential Medicines List
EPHI	Ethiopian Public Health Institute
EPSS	Ethiopian Pharmaceutical Supply Service
ETB	Ethiopian Birr
FIND	Foundation for Innovative New Diagnostics
HbA1c	Glycated Hemoglobin
HCW	Health care worker
HF	Health Facility
HHS	Hyperosmolar Hyperglycemic State
HMIS	Health Management Information System
IDF	International Diabetes Federation
IGT	Impaired Glucose Tolerance
IPLS	Integrated Pharmaceutical Logistics System
IRB	Institutional Review Board
KII	Key Informant Interview
KPI	Key Performance Indicator
LAAI	Long-Acting Analogue Insulin
LFT	Liver Function Tests

LIAT	Logistics Indicators Assessment Tool
LMICs	Low- and middle-income countries
LMIS	Logistic Management Information System
M&E	Monitoring and Evaluation
MNH	Maternal and Newborn Health
MOH	Ministry of Health
NCD	Non-communicable Disease
NPH	Neutral Protamine Hagedorn
OGTT	Oral Glucose Tolerance Test
OOP	Out of Pocket Expenditures
OPD	Outpatient Department
PEN	Package of Essential Noncommunicable Disease Interventions
PHC	Primary Health Care
PLWD	People Living with Diabetes
PMED	Pharmaceutical and Medical Equipment Directorate
PPL	Pharmaceuticals Procurement List
RDF	Revolving Drug Fund
RHBs	Regional Health Bureaus
SARA	Service Availability and Readiness Assessment
SCM	Supply Chain Management
SERC	Scientific and Ethical Review Committee
SGOT	Serum Glutamic-Oxaloacetic Transaminase
SGPT	Serum Glutamic Pyruvic Transaminase
SMBG	Self-Monitoring of Blood Glucose
SOP	Standard Operating Procedure
STG	Standard Treatment Guidelines
T1D	Type 1 Diabetes Mellitus
T2D	Type 2 Diabetes Mellitus
TOR	Terms of Reference
USAID	United Stated Agency for International Development
VEN	Vital, Essential, Non-Essential
WHO	World Health Organization

List of Tables

List of Figures

Executive Summary

Introduction

In Ethiopia, it is estimated that the prevalence of diabetes mellitus (DM) is between 3.3% [IDF, 2021] and 5.4% [EPHI and WHO, 2016], and that close to 70% of individuals living with DM, particularly in rural areas, remain undiagnosed. These rates imply that between 1.9 and 2.4 million people in Ethiopia live with diabetes. Among those who received treatment, a range of studies indicated that only 18-51% had glycemic control [Elfu BF *et al*, 2021; Alamirew GA, *et al*, 2021]. Further, non-communicable diseases (NCDs), including DM, drive high costs to the health system: The World Health Organization and United Nations Development Program (WHO and UNDP, 2019) estimated that NCDs cost Ethiopia at least 31.3 billion Ethiopian Birr per year (equivalent to 1.8% of the national gross domestic product), and according to the National Health Accounts 6th report, nearly 70% of NCD services in Ethiopia were financed by out of pocket expenditures from households [MOH, 2017].

Type 1 diabetes (T1D) is an urgently life-threatening NCD as a lack of access to insulin and/or continuity of care place patients at acute risk of death. At the same time, type 2 diabetes (T2D) is responsible for a significant burden of suffering and disability in low resource settings, as well as contributing substantially to cardiovascular disease related mortality. Together, they are a significant, fast-growing, and often under-estimated threat to global health [Sylvia and Lindsay, 2019]. This threat is amplified by the fact that access to appropriate care is a major problem for many people living with diabetes (PLWD) in low- and middle-income countries (LMICs) [Manne-Goehler *et al*, 2019]. Frequently cited reasons for limited access to DM care and commodities include: unaffordability of DM commodities in public and private sectors due to high market concentration and/or supply chain mark-ups; lack of product availability, partially due to limited procurement as a result of domestic and global financing constraints; poor financial protection; and lack of comprehensive service delivery [Beran D, Ewen M and Laing R, 2016; Beran *et al*, 2021].

There is an urgent need to ensure that PLWD in Ethiopia have better access to adequate diagnosis, treatment, and monitoring for their condition, both to increase life expectancy and quality of life (especially for people living with T1D), and to manage exorbitant health care costs for individuals and the government. To address these challenges, in 2020, the Ethiopia MOH published an updated national strategic plan for the prevention and control of major NCDs, including DM, to guide improvement of health service provision over the 2020/21-2024/25 period (MOH, 2020). The MOH is working alongside partners, including CHAI, to implement this strategy. This study was thus aimed at assessing the DM commodity supply chain landscape, and the availability and utilization for DM related services at public health facilities in Ethiopia.

Methods

A mixed methods study was conducted to collect data from October to December 2022. Data on supply chain management of DM commodities, and availability and utilization of DM services were collected from health facilities using a semi-structured questionnaire; data on procurement and import of DM commodities was abstracted from the Ethiopian Pharmaceutical Supply Service (EPSS) and Ethiopian Food and Drug Administration (EFDA) archives using data abstraction sheets; and additional qualitative data were collected through interview of key informants. A sample of 107 health facilities (covering a reported catchment population of at least 28 million people) was selected for inclusion in the study, distributed over two dominantly Agrarian regions (Oromia and Amhara), one City Administration (Addis Ababa), and one Agrarian and Pastoralist region (Somali). Descriptive analysis was conducted using Microsoft Excel across six thematic areas (commodity selection, quantification, procurement, stock management,

service delivery, and data management and monitoring and evaluation [M&E]) reflecting the objectives of the landscape assessment, followed by an inferential statistical analysis which examined data across multiple themes. The study protocol was reviewed by CHAI's Scientific and Ethical Review Committee (SERC) and in-country ethical approval was obtained from Armauer Hansen Research Institute (AHRI) ethics review committee. The data collection process was coordinated by zonal NCD focal persons and supervised by MOH and CHAI NCD teams to ensure compliance with the protocol throughout the data collection process.

Results and recommendations

Commodity selection

Drug and Therapeutics Committees (DTCs) were found to be established across all 107 surveyed facilities, however only 28% were functional. Without strengthened DTC functionality, facilities will be limited across a range of critical functions, including developing and executing appropriate facility-level medicines lists, and conducting adequate quantification, stock management, and procurement processes. DTCs should be strengthened, with an emphasis at lower levels of the health system, to perform functions critical to improving access to DM commodities.

Roughly 1 in 5 facilities (mostly health centers) had no facility-level medicines list in place, which may drive limited coordination of procurement and prescribing practices, contributing to high wastage and stockout rates of commodities patients need, driving poor patient outcomes and satisfaction. For those facilities with a list in place, 80% did not include the entire package of commodities required to support DM patients in achieving blood glucose control, with gaps most pronounced for insulin and at facilities at lower levels of the health system. To ensure improved access to commodities required for DM management, particularly at primary health care (PHC) facilities, facilities should be supported with the development and regular updating of facility-level medicines lists, based on the Ethiopian Essential Medicines List and the Vital, Essential and Non-essential (VEN) framework which informs commodity prioritization for procurement.

Quantification

While all facilities are expected to conduct quantification for DM commodities, various findings indicate barriers to ensuring procurement based on need, including the low percentage of surveyed facilities conducting quantification (43%), low availability of forecasting guidance documents among those that do (30%), and expressed need among interviewed stakeholders for increased capacity building. The Pharmaceutical and Medical Equipment Directorate (PMED)- and EPSS-led capacity building exercise on quantification should be expanded to more health facilities, especially at the lower levels, alongside improved dissemination of guidance documents, such as the written guide/manual for facility-level quantification, to these facilities.

Procurement

Analysis of EPSS-procured volumes of DM commodities showed, with the exception of EFY 2012, a continual and significant increase in procurement of all three types of human insulin over the past five years (EFY 2010-2014): It is estimated that the volumes of insulin (regular, NPH and premixed) procured in EFY 2014 may be sufficient to provide approximately between 146,561 and 201,431 patients with the insulin they need. However, procured volumes in EFY 2014 were low compared to estimated need: assuming approximately 315,553 adults living with DM in Ethiopia require insulin, the procured volumes

in 2014 may be sufficient to meet the needs of approximately 46 to 64% of PLWD who require insulin. Similarly, Ethiopian Fiscal Year (EFY) 2014 procurement of syringes and HbA1c reagent seems to fall short of actual need, and EPSS only reported procurement of glucometers and strips for in-facility use, indicating a major barrier to self-monitoring of blood glucose (SMBG), an essential part of DM management instrumental in achieving glycemic control. Given budget constraints noted at the EPSS and facility levels, it is recommended to explore how improved procurement efficiency and additional funding can allow increased volumes of DM commodities to be procured, thereby supporting decreased morbidity and mortality from DM and its complications, unlocking further savings for the government.

Stock management

Inventory turnover rates and line fill rates below the government targets for Revolving Drug Fund (RDF) commodities over the past five years (2017—2021) indicate a need for further investigation into commodity-specific inventory turnover and line fill rates, and a qualitative investigation into the drivers of inaccurate order fulfillment. In addition, opportunities to improve inventory turnover and line fill rates should be explored.

Only 30% of health facilities with any of regular, premix or NPH insulin available at the time of survey met the MOH criteria for acceptable storage conditions. Further investigation into specific drivers of poor storage conditions including associated costs, especially at lower-level health facilities, is highly recommended. Further, interventions to address identified barriers should be explored and implemented, including consideration of integrated solutions across biologics requiring cold chain storage (e.g., vaccines).

Critically, this assessment identified gaps in the availability of DM commodities at the health facility level, presenting an important barrier to improving health outcomes for PLWD. For example, less than three-quarters of facilities that listed a DM commodity on their facility-level medicines lists actually received stock of those commodities in the past year, with availability notably low for insulin syringes (only 26% of facilities that included syringes on their drug list received stock) and insulin (only 25%-56% of facilities that included each type of insulin on their drug lists received stock). Strategies to improve availability of stock at the health facility level are recommended, for example improving use of facility-level medicines lists based on the VEN framework across facilities, accurate quantification of required DM commodities at EPSS and health facilities, and procurement of required quantities of DM commodities especially by EPSS central hub.

Service delivery

Availability of clinical guidelines/protocols, manuals and job aids for DM service delivery

The assessment found low availability of guidelines, protocols, manuals and other job aids across surveyed facilities, especially at less central levels (less than 30% of health centers had any of these documents) of the health system and for more detailed documents that guide clinical practice (i.e., treatment guidelines and training participant manual). These findings present a barrier to the decentralization of critical components of diabetes management as routine clinical practice. The National NCD Management Protocols and National Standard Treatment Guidelines (STGs) may be particularly important at lower-level health facilities, especially for cadres of healthcare workers (HCWs) that are unlikely to have received advanced NCD training as part of their professional education (e.g., nurses and health officers). Awareness creation on the national NCDs strategy, and ensuring availability of these documents, especially the National NCD Management Protocols and National STGs at lower level of the health care system, is important to ensure access to decentralized and quality care to DM patients.

Screening, diagnosis, and treatment initiation and maintenance

With 83% of diabetes patients across all surveyed facilities seen by referral and general hospitals, it is recommended to prioritize developing and implementing a comprehensive decentralization plan, as noted in the NCD strategy., This could help to reduce the burden of care at higher levels of the health system and reduce the proportion of patients experiencing complications that require treatment at higher levels of the health system). This study demonstrated a substantial gap in in-service training on diabetes management for HCWs – across all levels, but particularly at the health center level: in-service training was provided to general practitioners, health officers and nurses in only 2%, 24% and 9% of facilities respectively. It is recommended to strengthen in-service training for HCWs at lower-level health facilities and task shifting for more effective management in facilities with staff shortage (noting the large gap in availability of physicians at lower-level health facilities (16%), which is a notable barrier to care delivery at the PHC level). Strengthening of referral pathways and mentorship for down-referral of patients with controlled DM is also recommended.

Based on the availability of screening services across health facilities (64% of facilities, and screening only targeting either symptomatic patients or patients with other chronic conditions), it is recommended to increase availability of diabetes screening at lower levels of health system alongside required diagnostic commodities.

Only 11% (9/85) of health centers reported initiating patients on insulin—consistent with insulin initiation being a common reason for referral to general and referral hospitals, and with the lower proportion (less than 20%) of health centers with at least one physician reported to be available per service rotation. To support the MOH's objective of insulin initiation and treatment at lower levels of the health system, additional physicians at primary hospitals and health centers will be needed, alongside appropriate task shifting (e.g., via introduction of widespread capacity building for nurses). Given protocols for insulin initiation were found to be largely driven by physicians' expertise (consistent with the low availability of a treatment algorithm and job aids), this should be complemented by establishing and disseminating a clear DM treatment algorithm including for insulin initiation and titration.

Self-Monitoring of Blood Glucose

Low levels of counselling patients on SMBG (40% of health facilities) were reported, likely in part explained by lack of availability and affordability of glucometers and strips for at-home use. Efforts to expand provision of counselling on self-monitoring of blood glucose for people using insulin will be important to overcome patient-side barriers to achieving blood glucose control. These must be complemented by interventions to increase access to insulin and particularly glucometers and strips.

Availability of commodities for screening, diagnosis and management of complications

Availability of commodities and laboratory tests for DM service delivery tended to fall into two categories, with availability generally lower at lower levels of the health system. Commodities with relatively high availability (more than half of facilities) across facilities included: glucose-lowering drugs, equipment for diabetes screening, laboratory tests used for confirmatory diagnosis of diabetes and monitoring in diabetic ketoacidosis management, commodities used in the supportive management of diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS), and commodities used in the definitive management of DKA (except potassium chloride) and severe hypoglycemia. Contrastingly, facilities reported relatively low (less than half of facilities) availability of insulin, HbA1c test, commodities used in diagnosis and monitoring of chronic complications of diabetes, and commodities critical in the diagnosis of DKA and monitoring its response to treatment, and potassium chloride. Efforts to improve access to diabetes commodities, as recommended elsewhere in the report, should be

targeted, taking into account the package of diabetes services expected to be provided at each level of care, for example at the PHC level focusing on improving access to insulin and commodities required to stabilize patients in emergency.

Data management and M&E

While use of the cohort register across surveyed facilities appears relatively high (80%), interview responses suggested the approach to register and document diabetes patients is not well-standardized, and use of the various data management tools observed across facilities is inconsistent. Strengthening data management and M&E for diabetes at health facilities will be critical to ensure future progress – and any barriers to success – are well-understood. Strengthening already existing platforms for data management—through the integration of missing relevant diabetes indicators in these platforms and DHIS2, and as part of health facilities' key performance indicators, and looking into alternative, more efficient data management options such as electronic platforms, as outlined in priority area 4 of the National Strategic Plan for the Prevention and Control of NCDs–will be a crucial step to drive data use for clinical decision-making.

Implications and next steps

Taking place at mid-point in the NCD strategy timeline, these findings shed light on successes so far and areas to seek improvement in by 2024/25. The findings from this study highlight important opportunities for regional health bureaus (RHBs) and health facilities to work together to improve forecasting and distribution of DM commodities to better meet patient needs. Findings on the current readiness level of lower-level health facilities to provide DM services provide a reference guide to inform MOH-led development of a framework for the decentralization and integration of DM services at the primary health care level. This is especially important as no health center met a set of generic minimum criteria (staff availability per service rotation, less than 90 days of stockout of basic package of DM commodities, and availability of basic screening tools and equipment at the time of survey) used to assess overall capacity to provide DM services at this level of the system. The results also inform recommendations on how forecasting and procurement of DM commodities at the central level can be strengthened to enable procurement of higher volumes that better reflect patient need, improving facility access to affordable, publicly procured commodities, and ultimately improving access to life-saving DM commodities for all those in need.

The results of this analysis, and the corresponding recommendations, intend to inform MOH, EPSS, RHBs, and health facilities, as well as health professionals and development partners working on DM on the status of the management of the supply chain of DM commodities, and the availability and utilization of DM services at each level of the health system. In line with this, the findings will be used to advocate for policy level interventions and improved planning of activities for decentralization and integration of DM services at PHC level. As there is limited evidence on the status of DM in developing countries, this study is also expected to inform the global scientific community about the landscape of DM in Ethiopia.

1. Introduction

1.1. Background and Justification

DM is defined by the World Health Organization (WHO) as a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces [WHO, 2023]. It is accompanied by a marked propensity to develop relatively specific forms of renal, ocular, neurologic, and premature cardiovascular diseases [WHO, 1999]. DM is one of the largest global health emergencies of the 21st century; a global epidemic affecting every country, every age group, and every economy across the world [IDF, 2021].

According to the 2021 International Diabetes Federation (IDF) report, 567 million adults worldwide are currently living with DM, of which approximately 75% live in low- and middle-income countries (LMICs). While over 40% of this 567 million people are unaware of their diagnosis, another half a billion people have impaired glucose tolerance which places them at a higher risk of a type 2 diabetes. In the 20-79 age group, 12.2% of all mortalities worldwide in 2021 were attributed to diabetes. In Africa, 416,000 deaths were attributed to diabetes, and this number is expected to rise with the predicted 129% rise in the number of cases in this region by 2045 [IDF, 2021].

In Ethiopia, the prevalence of DM is 3.3% with approximately 57.6% of cases undiagnosed (IDF, 2021). The National STEPS survey (2015) puts the prevalence of diabetes in Ethiopia at 5.4% [EPHI and WHO, 2016]. Other community-based studies on population prevalence of diabetes indicate different figures: a study with urban and rural sampled population in the Southern region estimated the prevalence of diabetes mellitus (type 1 and 2) to be 4.9% among adults aged 18 years and above [Giday and Tadesse, 2011]; another study with urban sampled population in the Oromia region, estimated the prevalence of type 2 diabetes mellitus to be 5.3% among adults aged 40 years and above [Yemane *et al*, 2007]. These rates imply that between 1.9 and 2.4 million people in Ethiopia live with diabetes[1].

Only a minority of people living with diabetes are diagnosed, receive appropriate treatment, and achieve glycemic control. In LMICs approximately 23% of people living with diabetes receive treatment, and among those, those who are diagnosed and have access to treatment, glycemic control is low [Manne-Goehler et al, 2019]. In Ethiopia, it is estimated that close to 70% of individuals living with diabetes, particularly in rural areas, remain undiagnosed. And, among those who had received treatment, a range of studies indicated that only 18-51% had glycemic control [Elfu BF et al, 2021; Alamirew GA, et al, 2021].

T1D is an urgently life-threatening NCD, since a lack of access to insulin and/or continuity of care place people living with diabetes at acute risk of death. At the same time, type 2 diabetes is responsible for a significant burden of suffering and disability in low resource settings, as well as contributing substantially to cardiovascular disease related mortality. Together, they are a significant, fast-growing, and often under-estimated threat to global health [Sylvia and Lindsay, 2019]. This threat is amplified by the fact that access to appropriate care is a major problem for many people living with diabetes in LMICs, in particular for those who require insulin.

There is an urgent need to ensure that people living with diabetes (PLWD) in LMICs have better access to adequate diagnosis, treatment, and monitoring for their condition. This urgency is driven by life expectancy in people living with type 1 diabetes: in LMICs this is under one year, in contrast to being nearly equal to that of the general population in high-income countries [Beran D and Yudkin JS, 2006].

[1] This was calculated using the figures from the 2015 National STEPS survey (diabetes prevalence of 5.4%) and the population pyramid from https://www.populationpyramid.net/ethiopia/2015/.

Second, the urgency is driven by the high levels of health expenditure, both for individuals paying out-of-pocket and for governments, driven by high commodity prices and the costs of treating complications due to late or inadequate treatment of diabetes and its complications. At the current growth rate, these costs can severely overwhelm resources in LMIC health systems as a whole [Moucheraud C *et al*, 2019; Stedman *et al*, 2020].

WHO and UNDP (2019) estimated that NCDs, including diabetes cost Ethiopia at least 31.3 billion Ethiopian Birr per year, equivalent to 1.8% of the national gross domestic product. According to the National Health Accounts 6th report, nearly 70% of NCD services in Ethiopia were financed by out of pocket (OOP) expenditures from households and NCDs account for 23% of OOP expenditure in Ethiopia [MOH, 2017].

Research findings indicate that there is general alignment on the reasons why access to adequate treatment is limited, including: unaffordability of diabetes commodities in public and private sectors due to high market concentration and/or supply chain mark-ups; a lack of product availability, partially due to limited procurement as a result of domestic and global financing constraints; poor financial protection; and a lack of comprehensive service delivery [Beran D, Ewen M and Laing R ,2016; Beran *et al*, 2021]. These challenges span both the public sector – where service delivery and availability are limited, and the private sector – where affordability and quality challenges face those who are able to pay [Mutyambizi, C, 2019]. Access challenges are most severe and most impactful for people who require insulin, given the complexity and cost of treatment. Because of this, a relatively large share of people requiring insulin will often face catastrophic expenditures [Ewin *et al*, 2019].

Health systems need to provide PLWD, particularly those requiring insulin, with a high-quality and cost-effective package of commodities. In 2020, the Ethiopian MOH published an updated national strategic plan for the prevention and control of major NCDs, including diabetes, to guide improvement of NCD service provision over the 2020/21-2024/25 period (MOH, 2020). The MOH is working alongside partners, including CHAI, to implement this strategy. Taking place at mid-point in the strategy timeline, these findings shed important light on successes so far and areas to seek improvement by 2024/25. The results of this analysis will inform MOH, EPSS, regional health bureaus, and health facilities as well as health professionals and development partners working on DM on the status of the management of the supply chain of DM commodities, and on the availability and utilization of DM services at each level of the health facility. In line with this, the findings are intended to inform policy level interventions and improve planning of activities for decentralization and integration of DM services at primary health care level. As there is limited evidence on the status of DM in developing countries, this study is also expected to inform the global scientific community about the landscape of DM in Ethiopia.

1.2. Objectives

The main objective of the study is to assess the supply chain landscape of DM commodities, and the availability and utilization for DM related services at public health facilities in Ethiopia. Specific objectives are:

1) To assess how diabetes commodities are selected, forecasted and procured at national and facility levels.
2) To assess diabetes commodities stock management practices at national and facility levels.
3) To assess the availability of diabetes commodities at health facilities.
4) To assess the extent to which appropriate storage conditions are maintained for temperature-sensitive diabetic commodities, including insulin.
5) To assess the availability of diabetes service at each level of the health care system.

6) To determine the extent of utilization of DM diagnosis and treatment services at each level of health facilities.
7) To identify key challenges in the availability and utilization of diabetes services at health facilities

2. Methods

2.1. Study Design

A mixed methods study was conducted to collect data from October to December 2022. Data on supply chain management of DM commodities, and availability and utilization of DM services were collected from health facilities using a semi-structured questionnaire; data on procurement and import of diabetes commodities was abstracted from EPSS and EFDA archives using data abstraction sheets; and additional qualitative data was collected through interview of key informants.

2.2. Sample Size Determination

According to data from MOH Health Facility Registry (MOH, 2022), there are 3,851 public health facilities in Ethiopia, excluding those in conflict-prone regions of Tigray and Afar: 23 referral hospitals, 94 general hospitals, 240 primary hospitals and 3,494 health centers. The national 2018 Service Availability and Readiness Assessment (SARA) reports indicates that 36% of health facilities (excluding health posts) provide DM service in Ethiopia.

Thus, the sample size of health facilities for quantitative data was calculated with the assumption that the proportion of public health facilities providing DM services in the country is 36%, at 95% level of confidence and 10% margin of error. A design effect of 1.2 was considered since cluster sampling was used to select health facilities. Based on these assumptions, sample size calculation using OpenEpi (Open source for Epidemiologic Statistics for Public Health), and considering 5% non-response rate, yielded an adjusted sample of 110 health facilities for the assessment. The Cochran formula (Cochran, 1977) was used to calculate the sample size:

$$\mathrm{n} = \frac{\mathrm{z}^2\mathrm{P}(1-\mathrm{P})\mathrm{DeFF}}{\mathrm{e}^2}; \qquad n = \frac{n_0 N}{(n_0+N-1)}$$

Where:

Z = the standard score at 95% CI, (which is 1.96 critical value)

P= Availability of diabetes service at health facilities (36%)

Deff= Design effect value 1.2

e = the margin of error to be tolerated (5%)

no = the minimum unadjusted sample size,

n = the adjusted sample size and

N= estimated target population

Qualitative data was collected through interview of key informants through purposive sampling of 31 key informants from the sample health facilities, regional health bureaus, Ministry of Health, and Ethiopia Pharmaceutical Supply Service and Ethiopian Diabetes Association.

2.3. Selection of Study Facilities and Participants

Ethiopia has 13 administrative units, including seven dominantly Agrarian regions, four Agrarian and Pastoralist regions, and two city administrations. To facilitate data collection within the available budget, as well as geographic and socioeconomic diversity of Ethiopia, two dominantly Agrarian regions (Oromia and Amhara), one City Administration (Addis Ababa), and one Agrarian and Pastoralist region (Somali) were selected by purposive sampling and included in the assessment.

The estimated number of health facilities (110 health facilities) was distributed over the selected regions and city administration in proportion to the total number of health facilities in each region and city administration, as indicated in table 1. In each region and city administration, proportional allocation was also used to assign the sample to each type of health facility. List of primary hospitals from MOH Health was used as sampling frame for primary hospitals, and an updated list of health centers, obtained from respective zones, was used for sampling health centers. Before sampling, those zones inaccessible due to security issues were excluded. In addition, health centers that were newly constructed and recently became operational (in 2022), and those that do not provide DM service, were excluded, in consultation with Zonal health offices.

Table 1: Distribution of total and sample health facilities by region.

Region	Total Number of health facilities					Number of sampled health facilities				
	Referral Hospitals	General Hospitals	Primary hospitals	Health Centers	Total	Referral Hospitals	General Hospitals	Primary hospitals	Health Centers	Total
Amhara	8	17	70	860	955	2	2	4	29	37
Oromia	7	49	82	1502	1640	1	3	5	50	59
Addis Ababa	3	3	2	105	113	1	1	-	4	5
Somali	1	4	4	189	198	-	1	1	6	8
Total	**19**	**73**	**158**	**2656**	**2906**	**4**	**7**	**10**	**89**	**110**

A two-stage cluster sampling was used, with health facilities considered as the primary sampling unit within sampled zones that were considered as clusters in each of the selected regions. First, zones were randomly sampled from each of the purposively selected regions. Next, health centres and primary hospitals were selected by simple random sampling, and all general and referral hospitals in the selected zones were included. Because there was no general hospital in one of the sampled zones of Amhara region, a nearby general hospital was taken from an adjacent zone. In regions where more than two zones were selected (Amhara and Oromia), the number of selected health facilities was proportionate to the total number of health facilities in each zone per region. The described sampling approach was taken to ensure representativeness of the data in the country and to reduce sampling error. Key informants were selected purposively from the sampled health facilities and higher levels of the healthcare system (e.g., MOH, RHBs and EPSS hubs).

Table 2: Number of zones/Sub-city selected per region.

Region	Total no. of zones/sub-cities	No. of zones/Sub-city selected
Addis Ababa	10	1
Amhara	11	2
Oromia	20	3
Somali	9	1

For qualitative interviews, key informants were selected purposively from the MOH, EFDA, EPSS (central hub and two additional hubs found in the sampled regions), RHBs and sampled health facilities depending on their experience on the issues identified.

Secondary data on quantification, procurement and import of DM commodities from the last 5 years (2017-2021) were extracted from EPSS and EFDA archives using excel-based data abstraction templates.

2.4. Ethical Review and Considerations

This protocol was reviewed by CHAI's Scientific and Ethical Review Committee (SERC) and determined as non-human subjects research. In-country ethical approval was also obtained from AHRI ethics review committee. Before data collection, data collectors and coordinators were trained on basic ethical issues of research, and on the methods and tools of data collection.

MOH wrote an official support letter to the selected regions, which in turn wrote to the sampled zones and hospitals. At each zone, a letter of support was written to the sampled health facilities. On arrival at the selected health facilities, the data collection team used support letters to introduce the study and request permission from facility heads. Then, the data collectors approached respondents selected for the study to provide detailed description of the study and obtain verbal consent for participation.

A consent script (annex II), developed by the study team in English and translated into the regional working languages (Amharic, Afaan Oromo and Somali), was used to obtain oral consent of key informants. Written consent was waived as this was the only identifier that could link the data with the respondents, and since the study was identified as non-human subjects research. Even though key informants were involved in the study, data were only collected about the facility, systems, and processes, not about the respondent or his/her experiences. Moreover, personal identifiable information, like names and facility addresses of respondents, were not collected. The collected data was analyzed and results reported as aggregate findings. Further, due attention was given to maintaining the privacy and autonomy of respondents throughout the data collection process.

The Ethiopian MOH COVID-19 protocol [MOH, 2020] was followed throughout the study process to ensure safety of respondents, data collectors and researchers.

The data collection process was coordinated by zonal NCD focal persons and supervised by MOH and CHAI NCD teams to ensure compliance with the protocol throughout the data collection process.

2.5. Data Collection

Three different data collection methods were used: (1) semi-structured questionnaire (2) key informant interviews and (3) data abstraction templates. Details on how data were collected and managed for each of these three methods are as follows:

(1) **Semi-structured questionnaire:** The questionnaire (annex III) was developed and programmed into SurveyCTO to collect quantitative information from the **health facilities**. This electronic data collection technique helped support high data quality and minimized time needed for data entry and cleaning. Questions on supply chain management were adapted from United States Agency for International Development (USAID) Logistics Indicators Assessment Tool (LIAT) [USAID, 2011], and the national Supply Chain monitoring and evaluation framework [MOH, 2019]. Questions related to availability and utilization of diabetes service were adapted from the WHO SARA implementation guide [WHO,2015], and the WHO PEN-Plus toolkits. The tool was drafted by the study team and reviewed by experts from the MOH, EPSS, CHAI Ethiopia M&E team and CHAI Global NCD team.

(2) **Key informant interviews:** Qualitative data regarding the policy environment and detailed processes for each component of supply chain management and diabetes service delivery were collected using an interview guide (annex IV), which was drafted by the research team and subsequently reviewed by experts from MOH, EPSS, CHAI Ethiopia M&E team, and the CHAI Global NCD team.

(3) **Data abstraction templates:** Secondary data on national quantification, procurement and import of diabetic commodities was abstracted from EPSS and EFDA records/archives using a data abstraction template in Microsoft Excel (annex V).

Data was collected by clinical pharmacists with demonstrated experience in supply chain management and health facility-level pharmacy services, and clinicians (physicians, public health officers, nurses) with demonstrated experience on provision of diabetes service at health facilities, with additional experience in qualitative and quantitative data collection techniques. A total of 12 data collectors (6 pharmacists, and 6 clinicians) were deployed, and 6 Zonal NCD focal persons coordinated the data collection at facilities, with supervision provided by MOH NCD team and CHAI NCD staff. The data collectors were independent contractors recruited by CHAI Ethiopia. The data collection team (supervisors, coordinators and data collectors) were trained on the study design, data collection methodology and associated tools, and ethical issues in data collection and handling.

2.6. Data Analysis

The electronically collected health facility data was exported to Microsoft Excel for cleaning. Each data element of all the health facilities was reviewed for completeness, consistency, and any other data quality issues, and any data issues identified were communicated to data collectors for rectification. After completion of data collection, each data element of all health facilities was validated against the data collected in hardcopies. CHAI's NCD team reviewed and cleaned the data, for example clarifying any mismatches between the two sets of data and investigating and clarifying any identified data quality issues.

Descriptive analysis was conducted using Microsoft Excel across six thematic areas (commodity selection, quantification, procurement, stock management, service delivery, and data management and M&E) reflecting the objectives of the landscape assessment, followed by an inferential statistical analysis which examined data across multiple themes. The findings were presented in tables and graphs.

Considering the sampling approach and sample size, inferential statistics were conducted for data collected from health centers. A subset of variables was identified to explore potential significant association between independent and outcome variables, and differences by region. Addis Ababa and Somali region were excluded as neither included at least two zones required to account for the cluster sampling of health centers for the analysis of survey data. Sampling weights were calculated to adjust for the unequal probability of sampling of health centers across zones in the two regions. No variables were identified as potential confounders in each of the proposed analyses. Variables in the cleaned data were recoded and data imported into STATA SE version 15.1 for analysis. Results of hypothetical test of

associations were summarized and interpreted with the corresponding p-values, while those of test of difference by region were presented as difference in proportions with the corresponding standard errors, 95% confidence intervals and p-values.

Interviews were transcribed by a subset of five data collectors who had prior experience in qualitative data transcription and were able to speak the regional languages (as some interviews were conducted in regional languages). Thematic codes were developed in alignment with the overarching themes and piloted with sample transcriptions (including all three interview templates) for revisions. The updated coding key was validated by a second team member, who also piloted the codes and suggested revisions. The two analysts aligned on the final coding key based on this process. Data were analyzed in Dedoose-9.0.86 using this coding key, and then sub-coding was conducted in Microsoft Word to identify sub-themes emerging under each major theme, for example considering chronology, people, processes, and issues. Findings were triangulated with data from the semi-structured interviews as appropriate.

Data collected from EPSS and EFDA records were consolidated, reviewed and cleaned before analysis and reporting.

2.7. Limitations of the Assessment

The study's findings are limited by quality of documentation at health facilities, EPSS and EFDA, and are limited to public sector experiences only, thereby not commenting on complementary diabetes services which are currently available in the private sector. Purposive sampling was used to select an appropriate mix of regions, and a limited number of zones within each region were selected. Given the resources available for this study, this was deemed the most appropriate approach to capture a range of data relevant to inform MOH and other stakeholders on diabetes landscape in Ethiopia. Further, the sampling method excluded conflict-affected areas, which may introduce some bias. Thus, the assessment results should be interpreted taking the above stated limitations into consideration. Importantly, despite the limitations stated, the data sheds important light onto the state of diabetes care across facilities with a reported catchment of at least 28 million people, representing an estimated 25% of Ethiopia's population.

3. Results and Discussion

3.1. Characteristics of Surveyed Health Facilities and Respondents

As indicated in table 3 below, a total of 107 health facilities (85 health centers, 10 primary hospitals, 6 general hospitals and 6 referral hospitals) from 3 regions and one city administration were surveyed for the assessment. Three health centers sampled from Somali region were dropped because of inadequate data availability.

Table 3: Summary of Surveyed Health Facilities by Level and Region

Type of Health facility	Oromia	Amhara	Addis Ababa	Somali	Total
Health Centers	49	30	4	2	**85**
Primary Hospitals	5	4	0	1	**10**
General Hospitals	3	2	0	1	**6**
Referral Hospitals	2	2	2	0	**6**
Total	**59**	**38**	**6**	**4**	**107**

A total of 31 key informant interviews were conducted, with interviewees selected based on their experience and expertise in diabetes service delivery and supply chain management of diabetes commodities. Interviewees included: one representative from each of MOH and EDA, one representative from each RHB from the four regions included in the study, four EPSS representatives (one from the main hub plus one from each of Addis, Bahirdar and Jimma), and 21 representatives from hospitals and health centers across the four regions (three from referral hospitals, six from general hospitals, three from primary hospitals, and eight from health centers). Respondents' professions included pharmacists, pharmacy technicians, nurses, general practitioners, and health officers, with work experience ranging from 2 to 30 years, and the number of years of experience in NCDs service delivery or supply chain management ranging from 1 to 13 years.

3.2. Commodity selection

3.2.1. Drug and Therapeutics Committee

A Drug and Therapeutics Committee (DTC) is a platform for coordination of professionals at health facilities aimed to improve access to and rational use of essential medicines. The role of the DTC includes determining what medicines will be available, at what cost, and how they will be used. As such, DTCs are involved in product selection, quantification and stock management of diabetes commodities.

All 107 facilities surveyed have a DTC in place. About three-quarters of facilities had assigned members by official letter and approved terms of reference in place. Less than a third reported performance management, conducted supply and medicine use problem studies and took action based on those studies (see Table 4).

Table 4: Proportion of Health Facilities with a DTC Conducting DTC Functions (N=107).

DTC Functions	Proportion
Assigned members by official letter	76%
Approved terms of reference	78%
Documented minutes of monthly meeting	44%

Developed action plan	52%
Supply and medicine use problem studies (2014 EFY)	27%
Took action based on studies	21%
Reported performance Management	30%

Based on MOH parameters for DTC functionality (MOH, 2019), only 28% of these DTCs were determined to be functional. Across health facility levels, primary hospitals and health centers had the lowest proportion of functional DTCs (see Figure 1). Interview respondents cited several challenges with DTCs, including inability to gather DTC members due to workload, and DTCs only meeting once in the previous year.

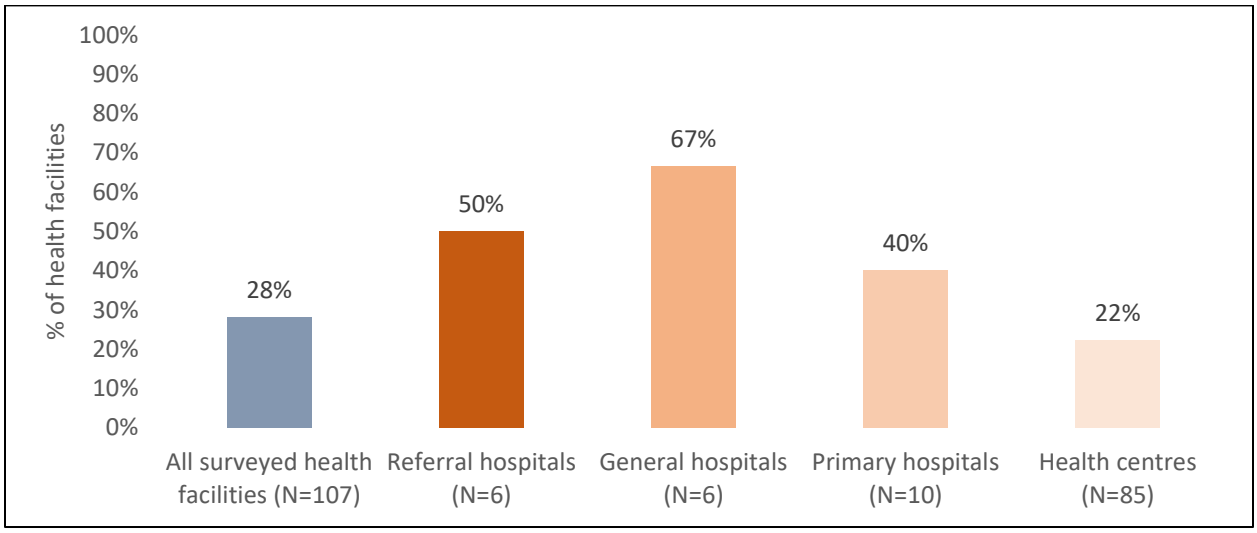

Figure 1: Proportion of all surveyed health facilities, overall and by level, with a functional DTC.

While DTCs were established across all surveyed facilities, without strengthened functionality, facilities will be limited across a range of critical functions, including developing and executing appropriate medicines lists, and conducting adequate quantification, stock management, and procurement processes, as demonstrated by findings across the remaining sections of this report.

3.2.2. Commodity list

Commodity lists are developed to inform which commodities should be forecasted for, procured, and to guide prescribing practices at both the national level (Ethiopian Essential Medicines List [EML] and EPSS Pharmaceuticals Procurement List [PPL]) and the health facility level. The facility-level medicines lists, meant to be updated annually, are developed and adapted based on the Ethiopian EML, which is revised every 3-5 years, and includes medicines that are expected to be available at all times, where needed, in the country. The decision by facilities to include supplies and equipment (e.g., glucometers, strips) in their medicines lists is informed by unpublished MOH documents. At the facility level, medicines lists are also shaped by the facility's scope of service delivery, including availability of qualified health personnel, and morbidity patterns among its catchment population. As such, referral and general hospitals may also include medicines beyond those included in the Ethiopian EML, depending on the scope of services. As

part of the annual review of medicines lists, facilities use the VEN framework for commodity procurement priority setting.

This section reports on the extent to which the EPSS PPL and health facility-level medicines lists include DM commodities. This is analyzed considering the 2nd edition of the EPSS PPL (January 2021), which includes regular insulin, NPH insulin and premixed (biphasic) insulin, metformin and glibenclamide, as well as insulin syringe and glucometers with test strips.

Survey results showed 81% of all surveyed health facilities (N=107) had a medicines list in place, and almost all the facilities without a medicines list in place were PHC facilities. Ninety-three percent (or 76% of the 107 surveyed health facilities) of the lists were based on the VEN framework (see Figure 2).

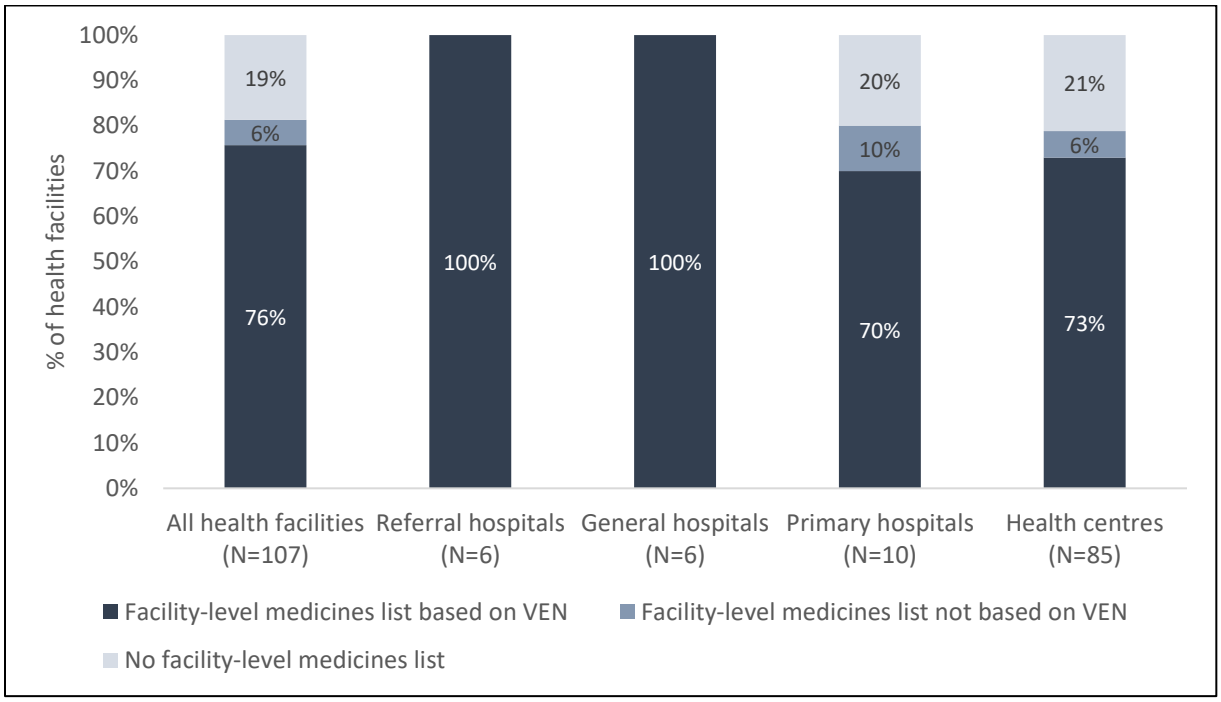

Figure 2: Proportion of health facilities, overall and by level, with medicines lists based on the VEN framework.

As indicated in Figure 3, of those facilities with a medicines list in place (N=87), 20% of facilities had a medicines list that included all diabetes commodities on the Ethiopian EML, 6th edition; and glucometers, insulin syringes, lancets and strips (the package of commodities required to support insulin use). Of these commodities, the three types of human insulin (regular, NPH and premixed) were most often excluded from facility-level medicines lists at lower-level facilities.

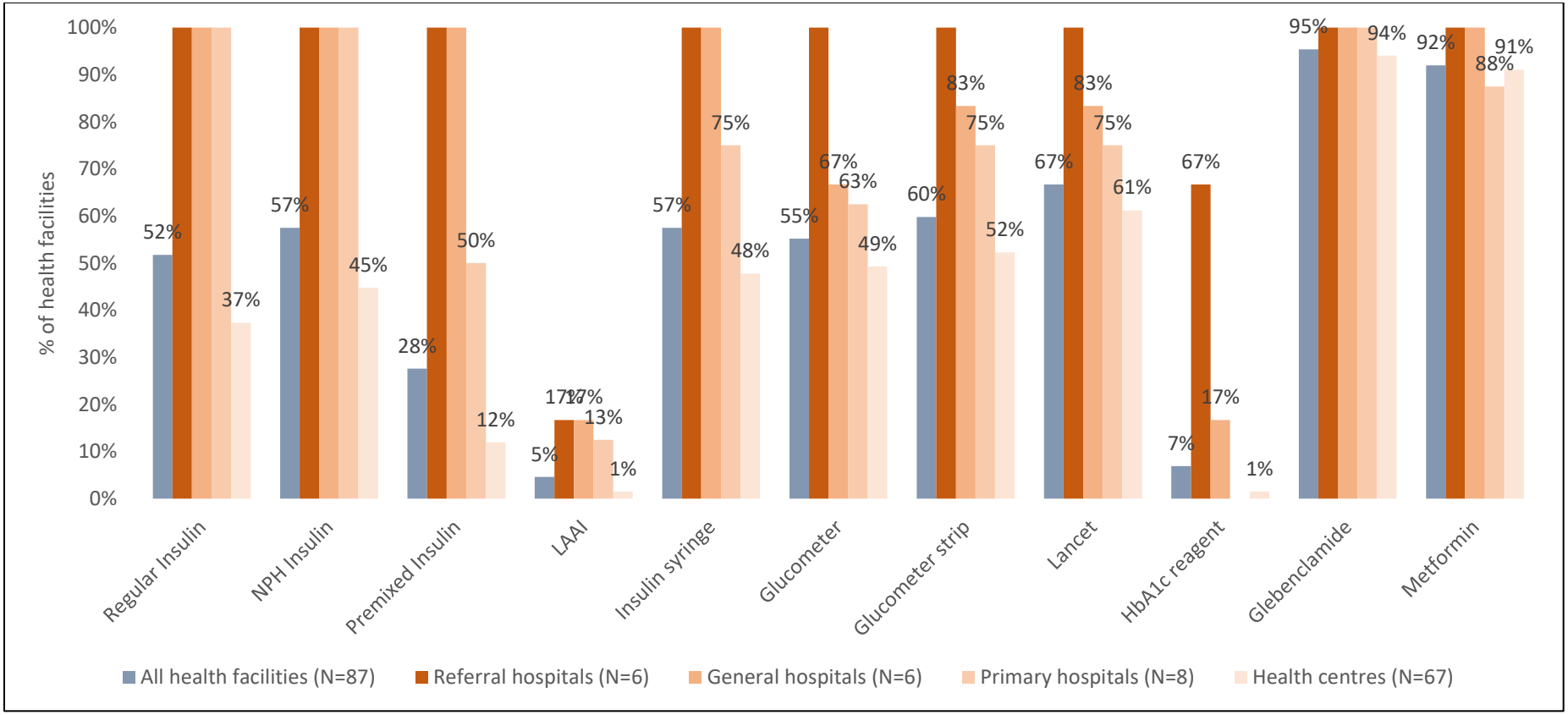

Figure 3: Proportion of surveyed health facilities, overall and by level, with a medicines list including each assessed diabetes commodity (N=87, representing the number of health facilities with a medicines list).

Roughly 1 in 5 facilities (mostly health centers) had no facility-level medicines list in place, which may drive poor coordination of procurement and prescribing practices, contributing to poor alignment between patient needs and facility procurement, high wastage and stockout rates of commodities patients need, driving poor patient outcomes and satisfaction. For facilities with a list in place, 80% of them did not include the entire package of commodities required to support DM patients in achieving blood glucose control, with gaps most pronounced for insulin and for facilities at lower levels of the health system.[2] Further, while most facilities with a medicines list in place reported using the VEN prioritization framework, poor availability of insulin on these lists suggests room for improvement in the use of the framework, as a life-saving medicine is not being adequately prioritized for procurement.

3.3. Quantification

3.3.1 Process

Limited data were reported during interviews on the specific quantification process each facility follows, however several respondents reported similarly on the overall quantification process. Quantification for DM commodities occurs annually, as part of the RDF quantification and procurement process. The process is led by the RDF quantification team under Quantification and Market Shaping Directorate. Each July, an excel-based quantification tool is distributed by EPSS via regional hubs to health facilities. Health facilities complete quantification using this tool, which includes a complete list of RDF products required for the year to follow with their prices. Over a 1–2-month period, EPSS regional hubs then compile the data from the facilities that consumed 80% of the hubs' commodities from the past year, validate it (i.e., by comparing with national consumption data from the previous two years), extrapolate to cover needs across facilities in the hub's entire catchment area, and add 20%, to come to the overall quantity required. The aggregated quantification is presented to the hub-level Technical Working Group for validation, approved by the EPSS hub manager, and by the end of February is sent on to EPSS for further analysis and to eventually inform central procurement.

3.3.2. Commodities forecasted

Survey data (Table 5) showed that 43% of the facilities conducted quantification of medicines and medical devices for the past fiscal year (July 2021 to June 2022); across facility levels, only 40% of primary hospitals and of health centers[3] reported conducting quantification.

Table 5: Proportion of surveyed health facilities, overall and by level, that conducted quantification of medicines and medical devices for 2014 EFY.

Health facility type	Proportion
All health facilities (N=107)	43%
Referral hospitals (N=6)	83%
General hospitals (N=6)	50%

[2] According to the decentralization strategy for diabetes, for all levels of the health system, a non-specialist physician should be available who are trained on the initiation of insulin for newly diagnosed cases of insulin-dependent diabetes.

[3] While all facilities are expected to conduct quantification, only those with larger patient populations are selected to conduct annual forecasting with EPSS support. The higher numbers of facilities conducting quantification at higher levels of the health system are likely partially driven by higher clinic throughput and larger catchment areas, and corresponding support from EPSS to conduct quantification.

Primary hospitals (N=10)	40%
Health centers (N=85)	40%

Based on available data, for each DM commodity, only about one quarter to one third of facilities that included the commodity on its facility-level medicines list reported actually forecasting for that commodity in the past fiscal year. (See Table 6 below).

Table 6: Proportion of health facilities with a medicines list including each DM commodity and forecasting for each commodity.

Commodity	Surveyed health facilities with a medicines list (N=87)		Proportion
	Number of health facilities that included the commodity on its medicines list…	…and forecasted for the commodity	
Regular Insulin	45	14	31%
NPH Insulin	50	17	34%
Premixed Insulin	24	7	29%
Long-acting analogue insulin	4	1	25%
Insulin syringe	50	16	32%
Glucometer	48	12	25%
Glucometer strips	52	14	27%
Lancet	58	17	29%
HbA1c reagent	6	2	33%
Glibenclamide	83	20	24%
Metformin	80	21	26%

3.3.3. Manual, Standard Operating Procedures and capacity building

The Essential Pharmaceuticals Quantification Manual for Health Facilities (updated May 2021) was developed to guide health facilities on the quantification of essential pharmaceuticals products (medicines, medical supplies, laboratory chemicals and reagents, and medical devices). However, only 30% of facilities that reported conducting quantification of medicines and medical devices for the past fiscal year had a written guide/manual for facility-level quantification (25% of referral hospitals, 67% of general hospitals, 50% of primary hospitals and 26% of health centers).

Despite EPSS hosting orientation sessions for those facilities procuring 80% of products, the most common challenge with forecasting reported by health facility interview respondents was a lack of capacity building activities, including standard operating procedures and job aids, largely driven by limited budget.

While all facilities are expected to conduct quantification, the low percentage of surveyed facilities conducting quantification, in combination with the low availability of guidance documents among those that do, likely creates a major barrier to ensuring procurement based on need (this is further reflected

by the high stockout rates and low availability of commodities reported in subsequent sessions on stock management and service delivery).

3.4. Procurement

3.4.1. Process: National Level

While limited data were reported during interviews on the procurement process, the following picture emerged. Like for quantification, procurement of DM commodities is integrated with other RDF commodities. The process is led by the Procurement Contracts and Tender Management Directorate at EPSS, with a range of stakeholders involved. Procurement is expected to take place annually, but practically, additional procurement can take place as required following the tender. Decisions on how much to purchase are influenced by current stock, pipeline products, and buffer/safety stock[4]. The most common and preferred procurement option is the open national competitive bid, however various procurement methods are used (e.g., international competitive bid, framework agreement[5], direct purchase [for products with sole importer], and restricted tender [for products with limited suppliers]). Framework agreements are currently used to procure insulin, and HbA1c reagent is purchased directly.

Supplier selection for RDF products including diabetes commodities is the responsibility of EPSS main office. Under the framework agreement model used for diabetes commodities, three preliminary, technical and financial evaluations are used to select suppliers, with the main requirement being their history regarding product quality. While framework agreements are in place, there is an annual review to determine actual quantities to procure. One respondent highlighted the need for better diversification of suppliers at the central level, citing that EPSS has developed a strategy which is being implemented, including for DM medications.

3.4.2. Process: Health facilities

At the facility level, respondents reported different procurement processes, so the process reported describes the overarching, common elements of the procurement process facilities undertake.

Most interview respondents reported that procurement is conducted quarterly, as per the national operating guidelines. However, respondents frequently mentioned that when stockouts occur, and due to problems getting supply from EPSS, procurement may be more frequent (e.g., six times per year, monthly or even biweekly; one referral hospital and one primary hospital even reported weekly procurement).

To begin the procurement process, the pharmacy department coordinates preparation of a list of commodities, in accordance with the facility-based medicine list and stock availability, to be procured, including via consultation with clinicians and lab professionals. The Drug Supply Management (DSM) officer, a new role focused on leading the logistic and supply team, is involved and some facilities reported they are the lead. This list is then presented to the DTC, which discusses it and provides feedback and suggestions.

[4] National safety stock is expected to cover 6-12 months, depending on the product.

[5] Under a framework agreement, EPSS signs a 3-year agreement with a given supplier for a specified commodity; during this period, EPSS will not announce a tender for the product.

Respondents reported making procurement decisions most often based on available budget, VEN analysis[6], consumption data, and epidemiologic data (e.g., top 10 diseases in catchment area, disease outbreaks)[7]. If budget is insufficient to procure the full requested amount, facilities reported taking different approaches, including a few respondents referencing making allocation decisions based on VEN or ABC analysis. Final decisions were most often cited as being made by the facility head, and the DTC was frequently cited as playing an advisory role in budget approval.

As per government guidelines, EPSS was found to be the major supplier across facilities for all 11 of the assessed DM commodities (see Figure 4). However, the proportion of health facilities EPSS was the main supplier for was much lower at the health center levels compared to the higher levels of care. One respondent stated appreciating the flexibility on payments, saying "It is better because…it allows us to take on a credit for a maximum of two times."

In the event of stockout, EPSS issues a stockout letter, valid for 15 days, to allow facilities to purchase from private vendors. Most facilities interviewed reported using a proforma invoice in this case, which is distributed to a number of suppliers (reported in the range of 3-10 suppliers). This is a competitive process where the lowest priced commodity is selected for direct purchase by the procurement committee. A few respondents in Oromia Region reported that before using a proforma invoice they go to *Biftu Adugna* (a private importer) as a second option, and some also mentioned that there has been a shift recently away from proforma invoice towards the use of open tenders. A few facilities mentioned getting supply from the Ethiopian Diabetes Association, by donation. During EPSS stockouts, facilities are required to procure from private suppliers, and to procure more often, which may further strain limited budgets and lengthen facility stockouts (e.g., due to additional time required to procure, longer lead times, and higher prices). The observed reliance on private suppliers appears higher at less centralized health facilities, placing increased burden on those facilities and threatening success of MOH's decentralization strategy.

[6] One facility that reporting using VEN included DM medications on its vital list, while another included DM drugs on its essential drug list, but glucometer on the vital list. Further investigation is required to understand how DM medications are prioritized when using the VEN and ABC frameworks.

[7] Here, total annual quantification is typically broken down into quarters to guide procurement. For facilities that do not conduct quantification, DTC typically proposes what to procure and in what quantities for approval by facility leadership.

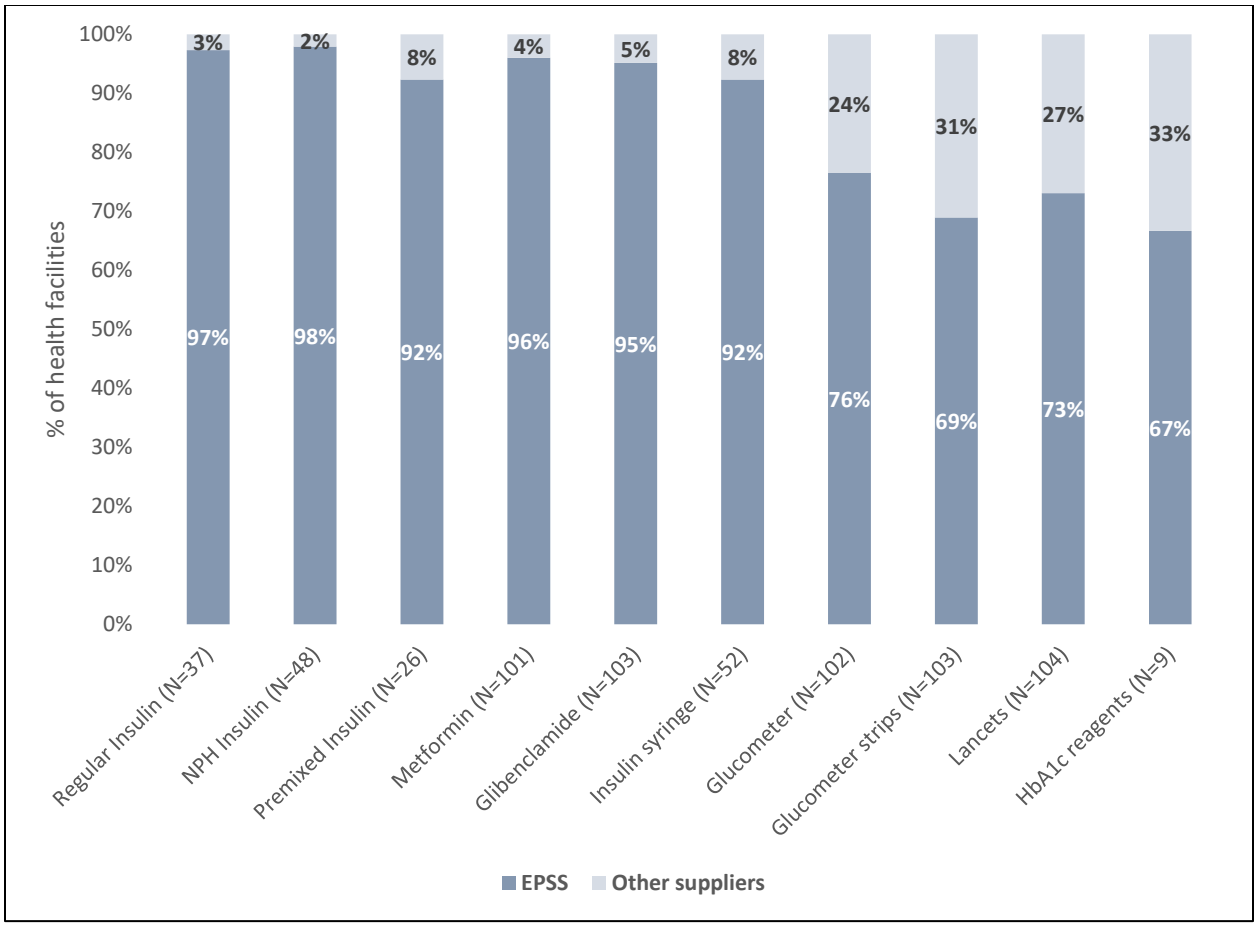

Figure 4: Proportion of surveyed health facilities with EPSS as the main supplier per diabetes commodity (N is the number of health facilities with data on commodity suppliers).

3.4.3. Procurement Lead times

EPSS reported lead times have been decreasing over time; while still above the 160-day target, this progress is notable (see Figure 5).

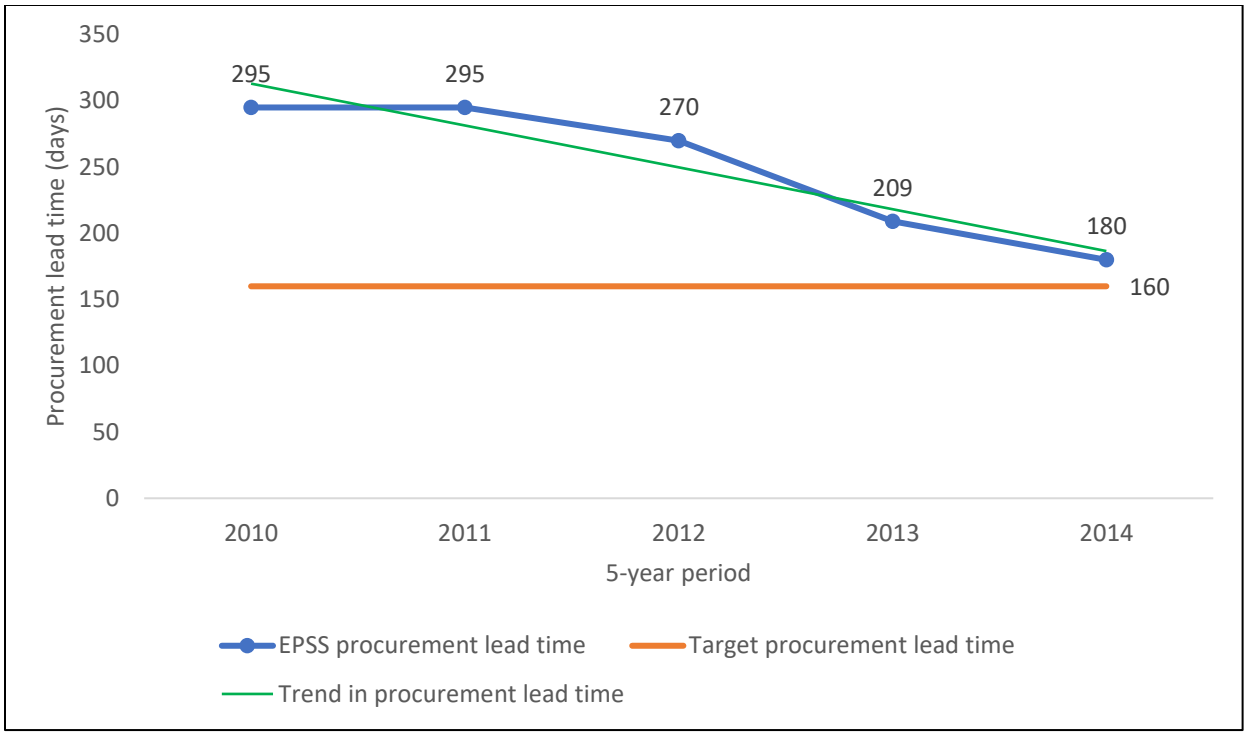

Figure 5: Lead times per year for EPSS procurement, EFY 2010-2014.

Survey responses showed that procurement lead times vary across facilities. Overall, 77% of facilities received deliveries of commodities procured from EPSS within 7 days of requisition (this number was 79% for private suppliers) (see Figures 6 and 7). Interview responses affirmed that lead times for private suppliers tended to be longer.

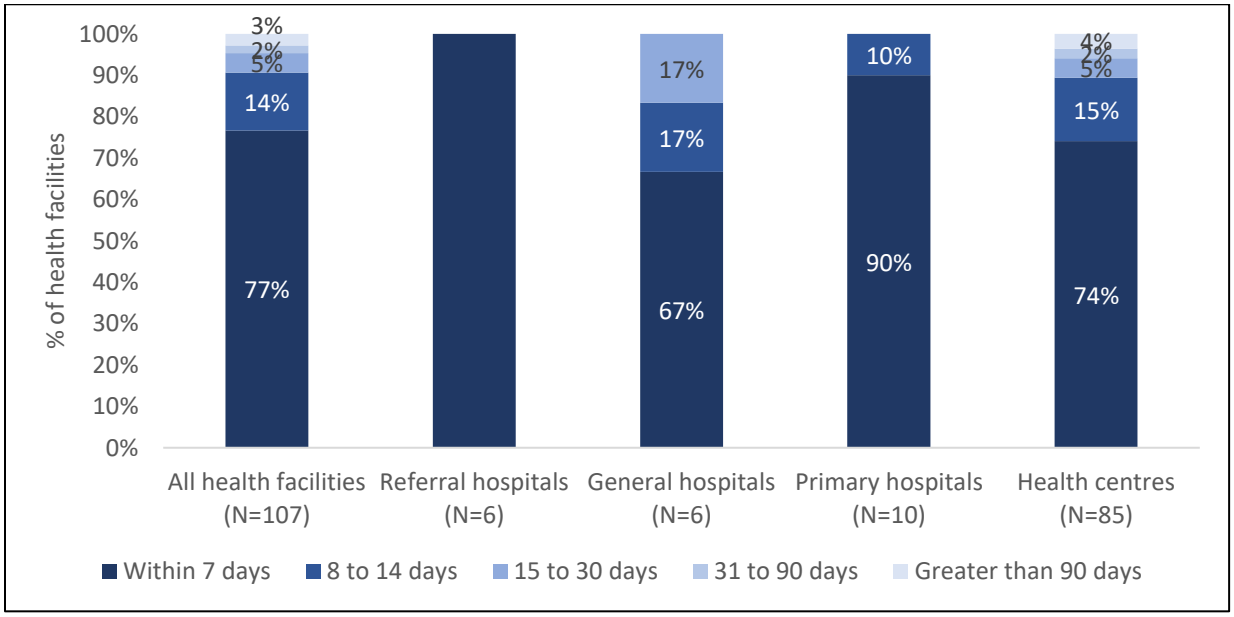

Figure 6: Average lead time for diabetes commodities procured from EPSS by surveyed health facilities overall and by level.

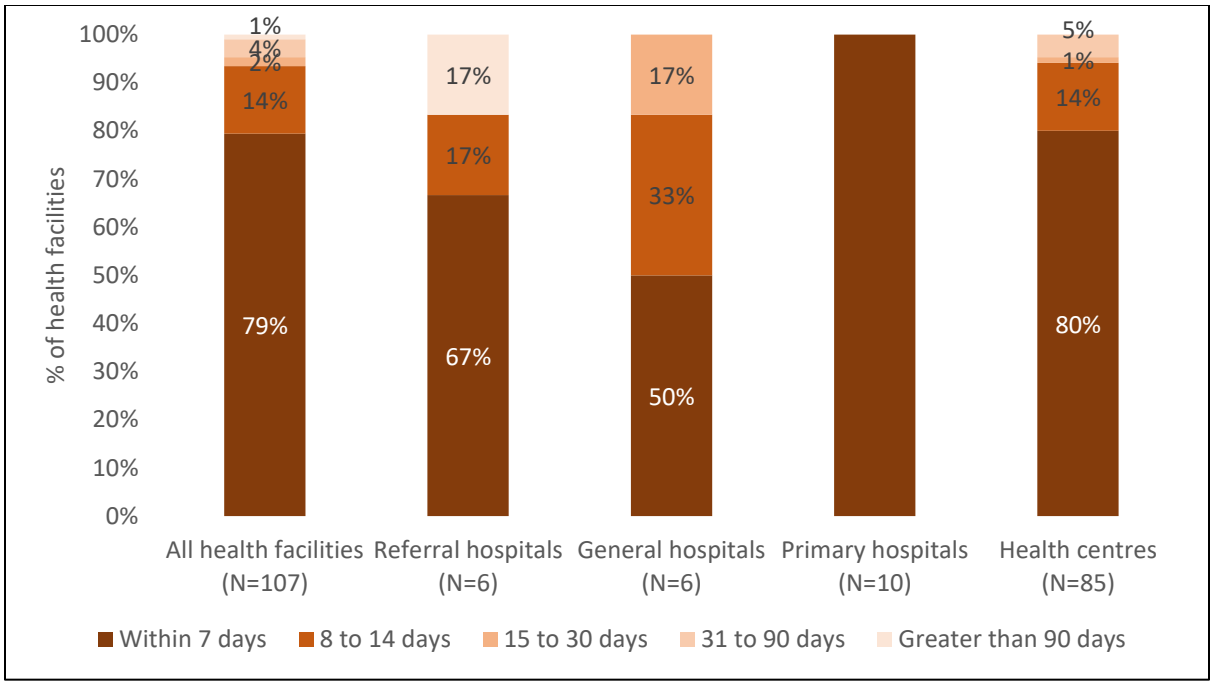

Figure 7: Average lead time for diabetes commodities procured from other suppliers by surveyed health facilities overall and by level.

3.4.4. Volumes procured

Over the past five years (EFY 2010-2014), EPSS has procured the following package of commodities to support people living with diabetes who require insulin: regular insulin (100IU/ml in 10ml vial), NPH insulin (100IU/ml in 10ml vial), premixed insulin ([30+70]IU/ml in 10ml vial), syringes (100 per pack), glucometers, test strips (50 per pack), lancets (200 per pack) and HbA1c reagent (20 per pack). This section provides an analysis of trends in procurement of these commodities by EPSS from EFY 2010-2014 (noting data on volumes procured were not collected at the facility level). It should be noted that EFY 2012 can be considered an exceptional year – the peak year of the COVID-19 pandemic - during which procurement for almost all diabetes commodities dropped versus the previous year. EPSS' ability to procure was severely affected by the COVID crisis.

With the exception of EFY 2012, during this 5-year period, there was a continual and significant increase in procurement of all three types of human insulin: volumes of regular insulin procured tripled, NPH insulin volumes almost doubled, and premixed insulin volumes increased by 75% (noting though premixed insulin volumes fluctuated quite starkly across the years). For other diabetes commodities, this picture is more mixed (see Table 2).

It is estimated that the volumes of insulin (regular, NPH and premixed) procured in EFY 2014 may be sufficient to provide approximately between 146,561 and 201,431 patients with the insulin they need.[8] However, procured volumes in EFY 2014 were low compared to estimated need: assuming approximately **315,553** adults living with DM in Ethiopia require insulin, the procured volumes in 2014 may be sufficient

[8] Based on estimated 1.98M adults in Ethiopia living with diabetes, 1,940,400 of whom have T2D and 39,600 of whom have T1D (World Diabetes Atlas, 2021, accessed via web tool 2023-07; Green, A., Hede, S.M., Patterson, C.C. et al. Type 1 diabetes in 2017: global estimates of incident and prevalent cases in children and adults. *Diabetologia* **64**, 2741–2750 (2021).

to meet the needs of approximately 46 to 64% of PLWD who require insulin. It should be noted this is an approximation based on a variety of assumptions made in lieu of accurate data on patient profiles and prescriber behavior in Ethiopia (see footnotes 8 and 9).

Other commodities: While procurement volumes of syringes, HbA1c reagent, glucometers and strips varied over the past five years, based on volumes procured in the most recent year (EFY 2014):

- Assuming insulin-users require 183 syringes per year (assuming re-use and replacement every other day), the EFY 2014 amount procured (115,360 packs of 100 syringes) would be able to provide for approximately 63,000 insulin-users. This seems to fall short of the actual need.
- With just over 13,100 units of HbA1c reagent procured in EFY 2014, this only covers diagnostic requirements for a small share of the people in need. With a recommended monitoring frequency of 4 HbA1c tests/year, as well as recommended use of HbA1c testing for diagnosis of diabetes, the current procured volumes only provide for a small share of the population in need. While forecasted volumes were higher, these would also not meet needs as per HbA1c testing recommendations.
- Given glucometers and strips may be used for in-facility screening and testing, at-home blood glucose monitoring, and large-scale community testing, it is difficult to interpret how the volumes procured in EFY 2014 compared to population needs. However, the values reported represent EPSS-procured volumes for in-facility use. Given self-monitoring of blood glucose is an essential part of diabetes management and instrumental in achieving glycemic control, expansion of central procurement of these commodities for these purposes is critical.

Table 7: DM commodity volumes procured by EPSS per year, EFY 2010-2014.

Commodity	2010	2011	2012	2013	2014
Regular Insulin (vial)	103,587	107,801	78,194	186,950	327,441
NPH Insulin (vial)	940,426	1,246,219	290,598	1,545,508	1,823,355
Premixed Insulin (vial)	135,409	102,377	89,877	341,325	234,224
Insulin syringe (pack of 100)	20,999	28,793	120,214	173,351	115,360
Glucometer (1 device)	15,495	1,333	2,002	3,000	2,150
Glucometer strips (pack of 50)	25,495	32,546	227,011	153,000	122,515
Lancet (pack of 200)	5,593	6,326	41,760	16,372	941
HbA1c reagent (pack of 20)	Not procured	Not procured	1,279	1,336	655

3.4.5. Forecast Accuracy

3.4.5.1. EPSS

EPSS forecasting and procurement data from the past five years (EFY 2018 to 2022) were analyzed across eight commodities. The analysis showed, in line with the increasing burden of disease, forecasted volumes have mostly increased over this period of time. However, forecasting accuracy (shown in Figure

8 as forecast accordance[9]) appears low, with EPSS tending to procure less than nationally forecasted volumes (see Figure 8).

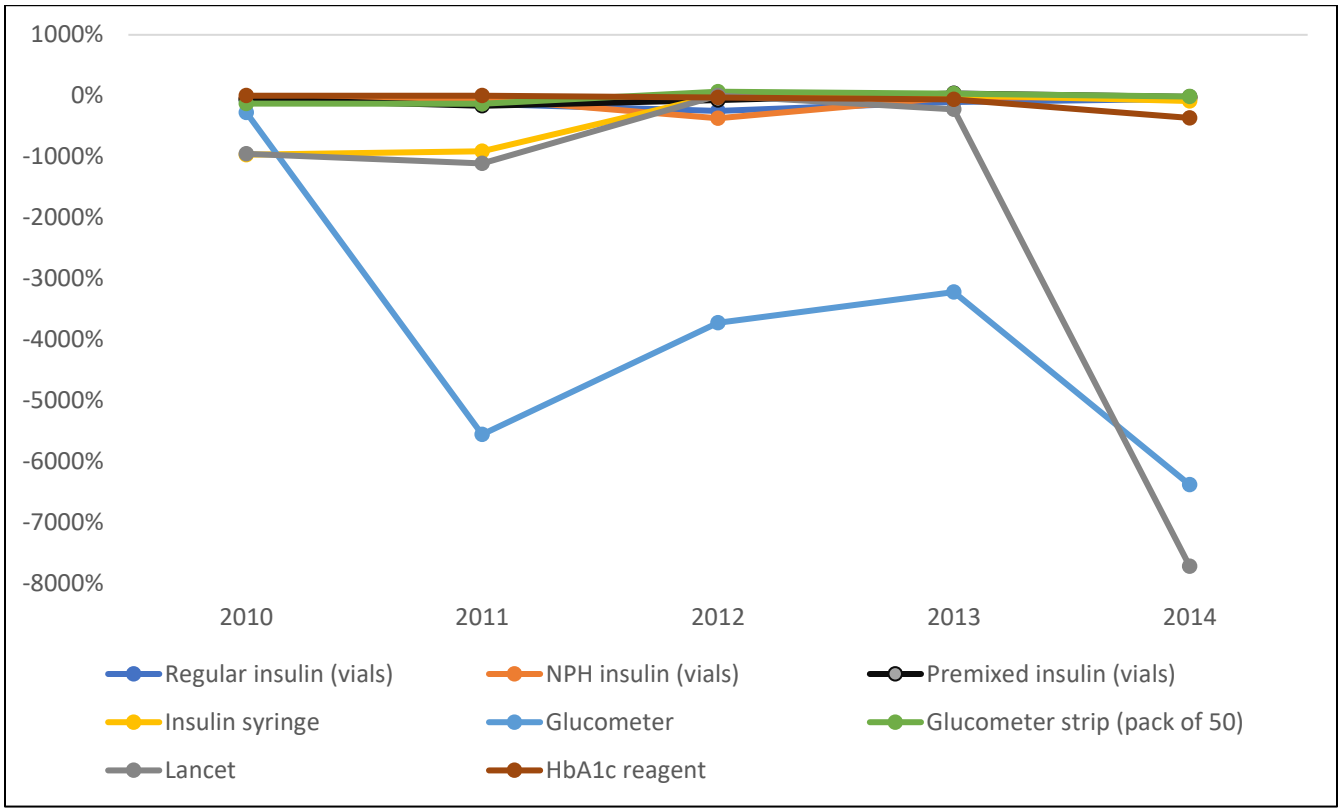

Figure 8: EPSS's forecast accuracy (measured as forecast accordance) of 8 diabetes commodities over 5 years, 2010—2014 EFY.

3.4.5.2. Health facilities

Forecast accuracy at the health facility level was measured per commodity across all facilities, based on data availability (only between one and 33 health facilities had complete data available [forecast and consumption[10] data] per commodity). Based on available data, the forecast accuracy target[11] was met for insulin (regular, NPH and premixed). For the other four assessed DM commodities, facilities tended to over-forecast; these numbers were the most dramatic for glucometer strips, metformin and glibenclamide, with forecasts up to five times greater than consumed volumes (see Figure 9 below).

[9] Forecast accordance (also known as mean absolute percentage error (MAPE)) of a forecast is the ratio of the difference between the volume of a commodity consumed/procured and the volume forecasted to the volume of the commodity consumed/procured. MAPE of <=25% is defined as acceptable by EPSS; MAPE of >25% (forecast underestimated consumption/procurement need) or < -25% (forecast overestimated consumption/procurement need) signifies poor forecast accuracy

[10] Consumption data reported represents commodities procured and consumed within the facility (not inclusive of volumes patients buy from outside sources). During the consumption-based quantification exercise, facilities adjust for stockout periods (by calculating average monthly consumption volumes that reflect only the number of days each commodity was in stock) and for service expansion (e.g., if more outreach activities are planned for the coming year).

[11] Defined as a mean absolute percentage error of the forecasted volume relative to the consumed volume of 25% or less:Essential Pharmaceuticals Quantification Manual for Health Facilities (2021) (p.29).

Forecast accuracy for glucometer strips, glibenclamide and metformin was substantially poorer (greater volumes forecasted versus consumed) at the health center level compared to the higher levels of the health system.

Low forecast accuracy could undermine confidence in forecasted volumes and is likely a driver of low procurement volumes observed. While this may be driven partially by issues reported by interview respondents, such as low data availability and quality and lack of ownership/coordination of roles and responsibilities at each level, given the tendency for EPSS to under-procure versus forecasted quantities, budget constraints are likely a major driving factor.

Commodity	Forecast Accuracy
Insulin regular (N=14)	-10%
Insulin NPH (N=19)	-7%
Insulin mixed (N=7)	15%
Insulin syringe (N=18)	-43%
Glucometer strip (N=23)	-442%
Metformin tablets (N=33)	-272%
Glibenclamide tablets (N=33)	-358%

Figure 9: Summary of diabetes commodities forecast accuracy across all surveyed health facilities, based on available data (July 2021 to June 2022) (N is the number of health facilities with complete data).

Accurate forecast Forecast > procurement Forecast < procurement

Commodity	Forecast Accordance			
	Referral hospital	General hospital	Primary hospital	Health centre
Regular Insulin (N=14)	-0.19%	-9.17%	28%	-50%
NPH Insulin (N=19)	38.92%	2.05%	24%	-41%
Premixed Insulin (N=7)	57.51%	-63.98%	No data	0%
Insulin syringe (N=18)	-2.02%	-141.97%	-78%	-9%
Glucometer strip (N=23)	42.87%	2.87%	-161%	-705%
Metformin tablets (N=33)	56.29%	-27.37%	32%	-401%
Glibenclamide tablets (N=33)	-42.40%	-50.49%	-4%	-500%

Figure 10: Summary of diabetes commodities forecast accuracy by facility level (July 2021 to June 2022) N is the number of health facilities with available data.

3.4.5.3. Challenges in procurement

At the central level, insufficient budget was reported by several respondents as a key challenge in procurement. At the facility level, budget constraints and unavailability of supply from EPSS were very

commonly and consistently listed as the biggest challenges in facility-level procurement. In Oromia, this included challenges with budget distribution (as RHB allocates a fixed budget for medication procurement of about 300,000 ETB, regardless of service and patient loads). Other challenges reported at the facility level included low capacity of DTC, lack of capacity building support, poor data systems/lack of digitization, price increases, and transportation issues (since for RDF commodities, facilities are responsible for covering the costs of transporting orders from EPSS hubs to the ordering facility). One respondent noted being affected by a whole range of issues:

> "From the facility side transport is the most important factor that affect[s] the process. The demand and the budget are not inline, currently the price of the drug is alarmingly increasing, and we cannot satisfy the demand of the facility. We cannot get what we plan from EPSS and also there is stockout from private wholesale[r]s. We go to Addis Ababa to buy the stock[ed-]out drugs and [are] exposed to unintended cost[s]. Generally, nationally there is lack of supply (availability of drugs)."

The most common forecasting challenge reported by interview respondents across all levels was low data availability and quality, particularly at health facilities. Forecasting challenges reported included lack of access to actual consumption data, lack of epidemiologic data to validate forecasts, and poor-patient level data (e.g., lack of patient registry, difficulty determining T1D vs. T2D patient numbers). Other reported challenges which may drive low forecast accuracy at EPSS and by facilities included lack of ownership/coordination of roles and responsibilities at each level, and a poor accountability scheme for validation.

3.5. Stock management

3.5.1 Inventory management

While not yet implemented for RDF Products, EPSS employs a Forced Ordering Maximum/Minimum inventory control system as per the Integrated Pharmaceutical Logistics System (IPLS). Based on this system, health facilities send their request using appropriate RDF Purchase request formats to get supplies from EPSS. Then EPSS hubs supply them fully or ration the volume when a supply shortage is encountered.

Inventory management systems in place across the commodity supply chain vary, with facilities at different levels of the health system using various digital tools, manual tools, or both. Some hospitals and health centers reported using both manual and electronic inventory management systems, including having implemented IPLS. Other systems in place included counting manually and then on DAGU-2 (a computerized inventory system similar to bin cards), use of the auditable pharmaceutical transaction and services (APTS) system.

Health facilities at all levels are meant to use bin cards for inventory management, an essential tool used to manage expiry dates and stock balance of commodities. Bin cards should be updated every time an item moves in or out of the medical store to ensure the store manager has full information about available and expired stock and can therefore prevent over- and under-stock. Survey results showed bin cards for DM commodities were available in 75% of all surveyed health facilities, and 79% of these had their bin cards updated, with similar proportions seen across all facility levels (see Figure 11).

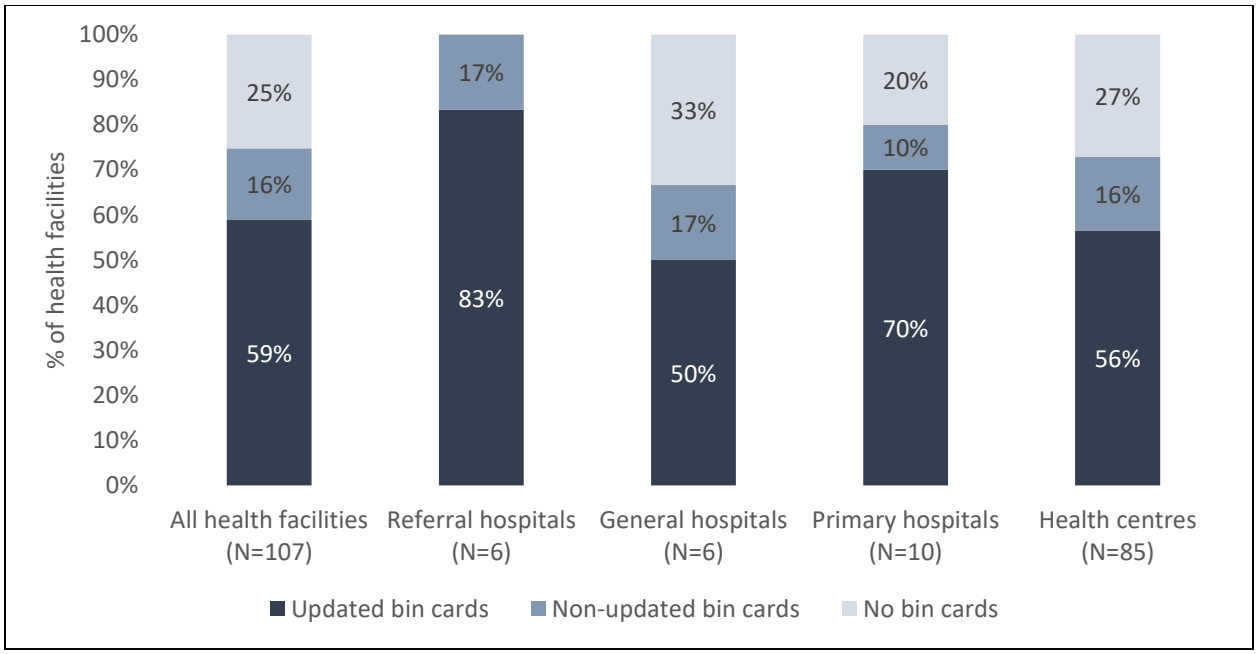

Figure 11: Proportion of all surveyed health facilities, overall and by level, with updated bin cards for diabetes commodities.

3.5.2 Physical inventory

Facilities reported conducting physical inventory at different frequencies. One EPSS hub reported performing a daily stock count, monthly stock status analysis, and periodical inventory analyses to improve its inventory management system. Referral and general hospitals most often reported conducting quarterly store inventory, with one hospital reporting different frequency by category (every month for Outpatient Department [OPD]pharmacy, every quarter for drug and supply store, every year for equipment store). Several health centers reported conducting annual inventory, though sentiments were shared that it would be preferable to do it more often:

> "Since we are not implementing APTS site, we don't do inventory every quarter. It would be good if we [did] it every quarter."

> "In reality it should be done biannually, but due to high burden we do it once per year."

3.5.3 M&E

Systems for M&E stock management also differed across health system levels and facilities within each level. EPSS reported developing and using a supply chain management (SCM) M&E manual with clearly defined key performance indicators (KPIs) for each operation and process to monitor and evaluate its SCM operation. In addition, it reported that quarterly performance review meetings are also deployed as an M&E system. KPIs at EPSS include lead time, inventory turnover ratio and line filling rate. Based on

data from the past five years for RDF products, EPSS reported inventory turnover ratios[12] and line fill rates[13] below the set targets of >70% and 1.8 respectively (see Figures 12 and 13).

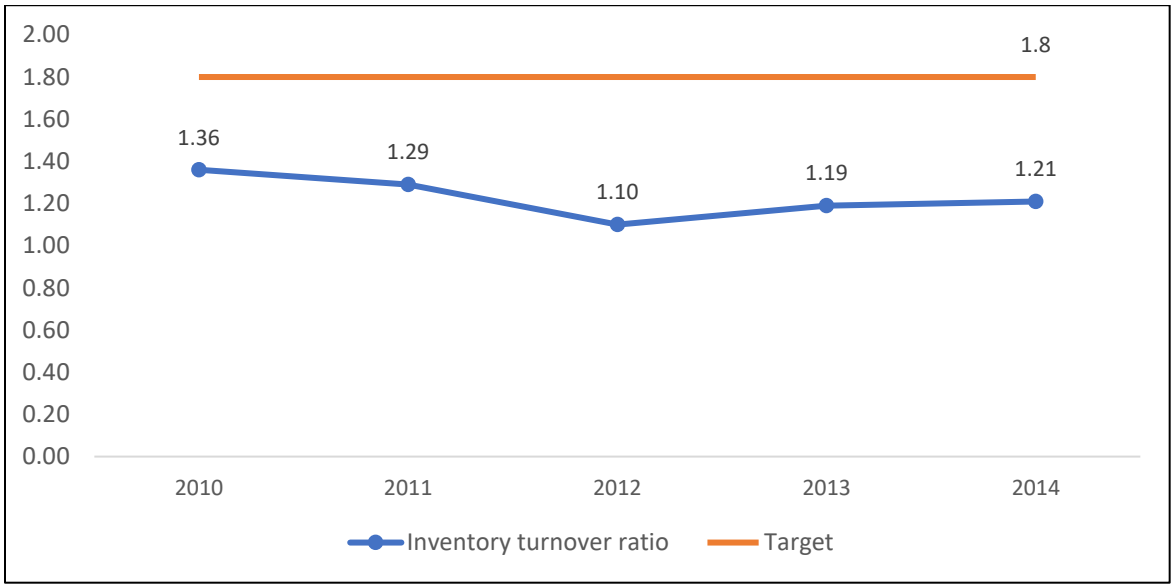

Figure 12: EPSS inventory turnover ratios over 5 years, 2010—2014 EFY.

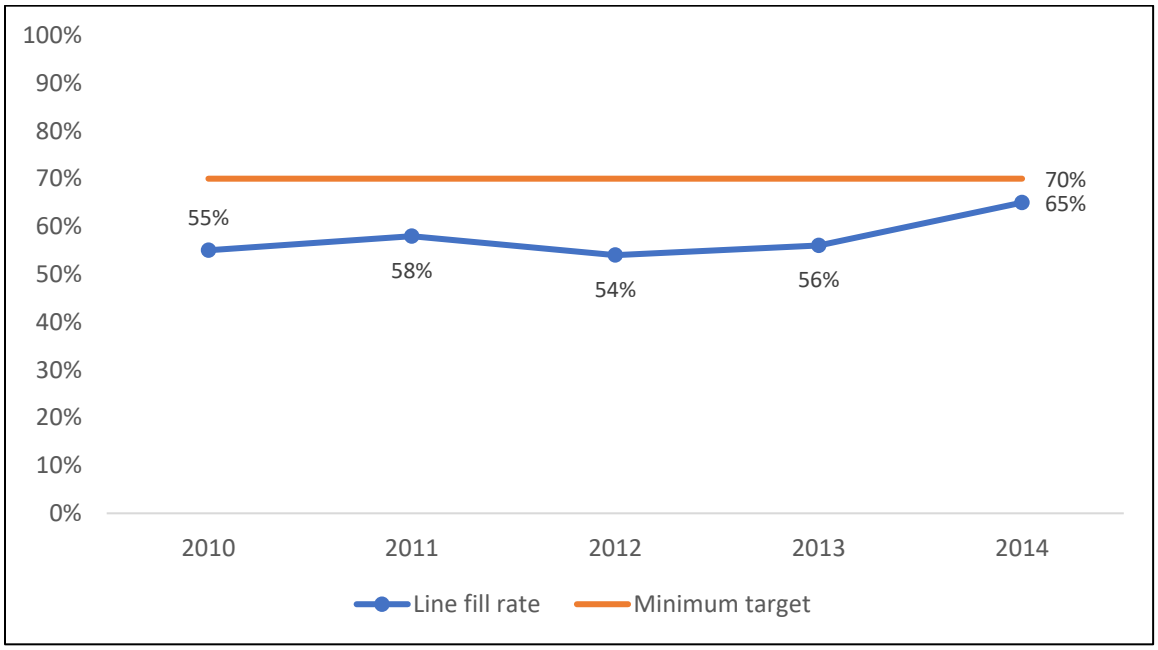

Figure 13: EPSS line fill rates over 5 years, 2010—2014 EFY.

[12] The inventory turnover ratio is calculated by dividing the cost of commodities sold by the average inventory over the same period. See "Monitoring and Evaluation Framework for Ethiopia Pharmaceuticals Supply Agency", 2019, for further information.

[13] Line fill rate measures the percentage line items refilled correctly in terms of items and quantities requested by health facilities from the total items requested or ordered.

All respondents from hospitals reported that SCM is monitored and evaluated by the RHB: referral and general hospitals reported using a monthly and quarterly KPI-based performance monitoring system which is then reported to the RHB.

Low inventory turnover ratios and line fill rates for RDF commodities over the past five years, versus the government targets, indicate a need for further investigation into the ratio per commodity is required to understand the extent to which diabetes commodities – and which ones – drive the low ratio. With regards to the observed line fill rates, despite small increases in the past three years, there is still room for EPSS to improve its ability to fulfill health facilities requests.

3.5.4 Storage conditions

As indicated in Figure 14, only 30% of health facilities with any of regular, premix or NPH insulin available at the time of survey met the MOH criteria for acceptable storage conditions14 (MOH, 2019). However, every facility with any of the three insulin products available at the time of survey reported storing insulin and other biologics in a refrigerator.

The very low rate of health facilities that met the criteria for acceptable storage conditions is concerning, especially at lower levels of the health system.

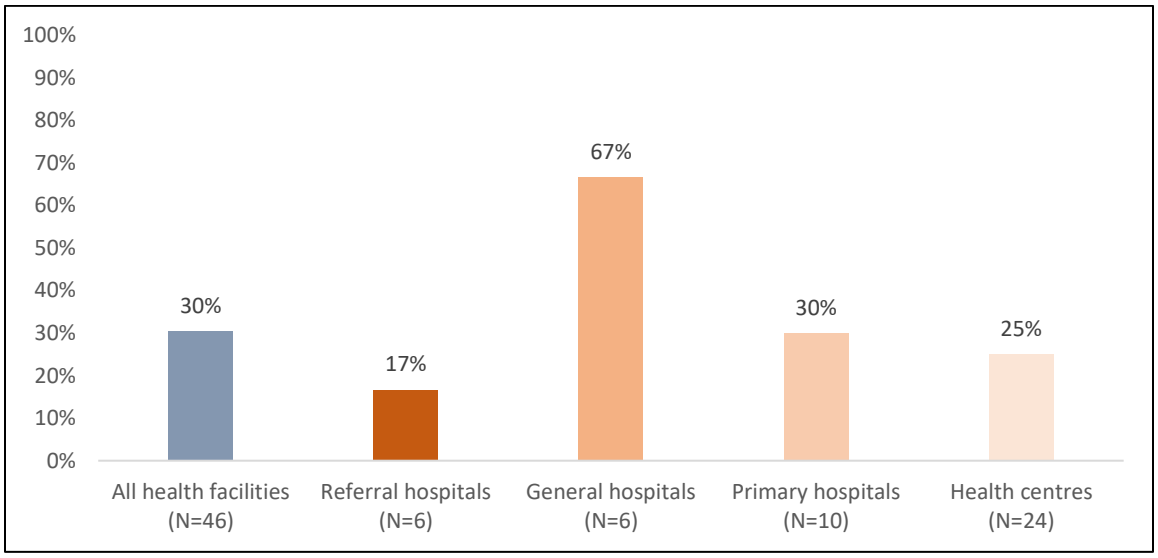

Figure 14: Proportion of surveyed health facilities with insulin available at the time of survey, overall, and by level, that maintain appropriate storage conditions. N=46, representing facilities with any of the three insulin products at the time of survey.

3.5.5 Stock availability

For most commodities, over half of facilities that included the commodity in its medicines list reported having received stock in EFY 2014, with the highest rates of availability for metformin and glibenclamide (74% and 70% respectively) (See Table 8). The findings on stock received and extent of stockouts indicate significant barriers to accessing diabetes commodities across facilities. While the majority of facilities

[14] Maintenance of acceptable storage conditions: facilities comply with at least 80% of the recommended storage practices (at least 11 of the 13 recommended storage practices)

listing DM commodities on their medicines lists received stock of those commodities in the past year (except for insulin syringes and LAAI), many facilities that listed insulin on their medicines lists did not receive any stock; this could be driven by low prioritization of procurement of these commodities when allocating limited budgets or stockouts at EPSS or from private suppliers.

Table 8: Health facilities receiving stock of commodities included on their medicines lists.

Commodity	Proportion of health facilities reporting received stock in 2014 of the commodities included on their medicines lists
Regular insulin	56% (25/45)
NPH insulin	54% (27/50)
Pre-mixed insulin	50% (12/24)
LAAI	25% (1/4)
Metformin	74% (59/80)
Glibenclamide	70% (58/83)
Insulin syringe	26% (13/50)
Glucometer strips	71% (37/52)
Lancets	67% (39/58)
HbA1C reagent	67% (4/6)

The majority of facilities with total received stock >0 in EFY 2014 reported no stockouts in the same year of glibenclamide, Metformin, glucometer strip, lancet, insulin syringe and human insulin (regular and NPH) (see Table 9). Among those facilities reporting stockouts of up to 364 days in EFY 2014, the mostly commonly stocked out commodities were metformin (18 facilities), lancets (16 facilities), and glucometers (15 facilities), and across facilities and commodities, stockouts were most often <180 days (see Table 9). Data on facilities reporting stockouts for the entire year are not reported due to low data quality.

Table 9: Stockout durations per commodity. N represents number of facilities reporting >0 total received stock in EFY 2014 per commodity.

Commodity	No stockout	1-30 days	31-90 days	91-180 days	180-364 days
Regular Insulin (N=28)	19 (68%)	3 (11%)	2 (7%)	2 (7%)	0 (0%)
NPH Insulin (N=30)	19 (63%)	3 (10%)	4 (13%)	2 (7%)	0 (0%)
Premixed Insulin (N=15)	7 (47%)	4 (27%)	2 (13%)	1 (7%)	0 (0%)
Metformin (N=74)	56 (76%)	1 (1%)	9 (12%)	7 (9%)	1 (1%)
Glibenclamide (N=70)	64 (91%)	1 (1%)	2 (3%)	2 (3%)	0 (0%)

Insulin Syringe (N=27)	19 (70%)	1 (4%)	3 (11%)	2 (7%)	0 (0%)
Glucometer Strips (N=63)	46 (73%)	6 (10%)	5 (8%)	3 (5%)	1 (2%)
Lancets (N=57)	41 (72%)	6 (11%)	7 (12%)	3 (5%)	0 (0%)

Across all facilities levels, the most common reported factors affecting stockouts were budget constraints and unavailability of supply from EPSS and private suppliers. Several facility respondents also reported prices and inflation as a challenge, as well as poor quality data making it difficult to predict demand, and problems with stock management.

At EPSS hubs, a wide range of challenges were reported, with the most common being long lead times, inflation and demand (high demand, variation in supply and demand, growing population density). One respondent noted that the high number of medications on the PPL (n=262) affects availability. The most common stockout drivers reported across facility levels were inadequate supply, budget shortage (e.g., due to same budget being allocated every year, low internal revenue) and inflation. One general hospital reported that it can be difficult to get enough supply from EPSS or alternative suppliers because EPSS will not report a stockout even when only small amounts are available (e.g., one pack). At the health center level, inadequate supply emerged as a particularly common challenge.

3.5.5.1. Wastage

Generally, unusable stock of any of the diabetes commodities was very low across all surveyed health facilities (reported by 12% or less of facilities). Unusable stock was reported for only four DM commodities (see Figure 16). Across facility level, health centers were the facilities with an unusable stock of NPH insulin and accounted for the majority of facilities with unusable stock of glibenclamide (3/4 of facilities) and metformin (3/5 of facilities), while referral and general hospitals accounted for all facilities that had unusable stock of regular insulin.

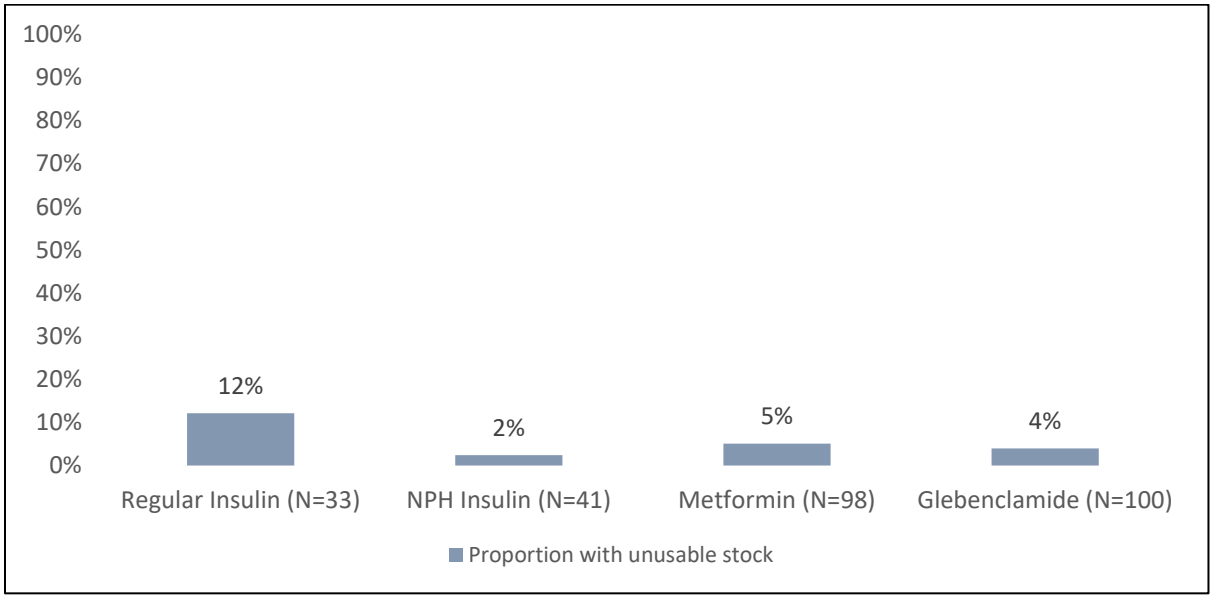

Figure 15: Proportion of surveyed health facilities reporting unusable stock per DM commodities.

Data availability on wastage for diabetes commodities was low across all 10 commodities measured, with data availability highest for metformin, glibenclamide, strips and lancets (see Figure 19). For each commodity, over 80% of facilities with data available recorded no wastage in EFY 2014, except LAAI (for which 2/3 facilities reported wastage). Of those facilities that did report wastage, health centers had higher wastage rates for the greatest number of commodities (see Table 10).

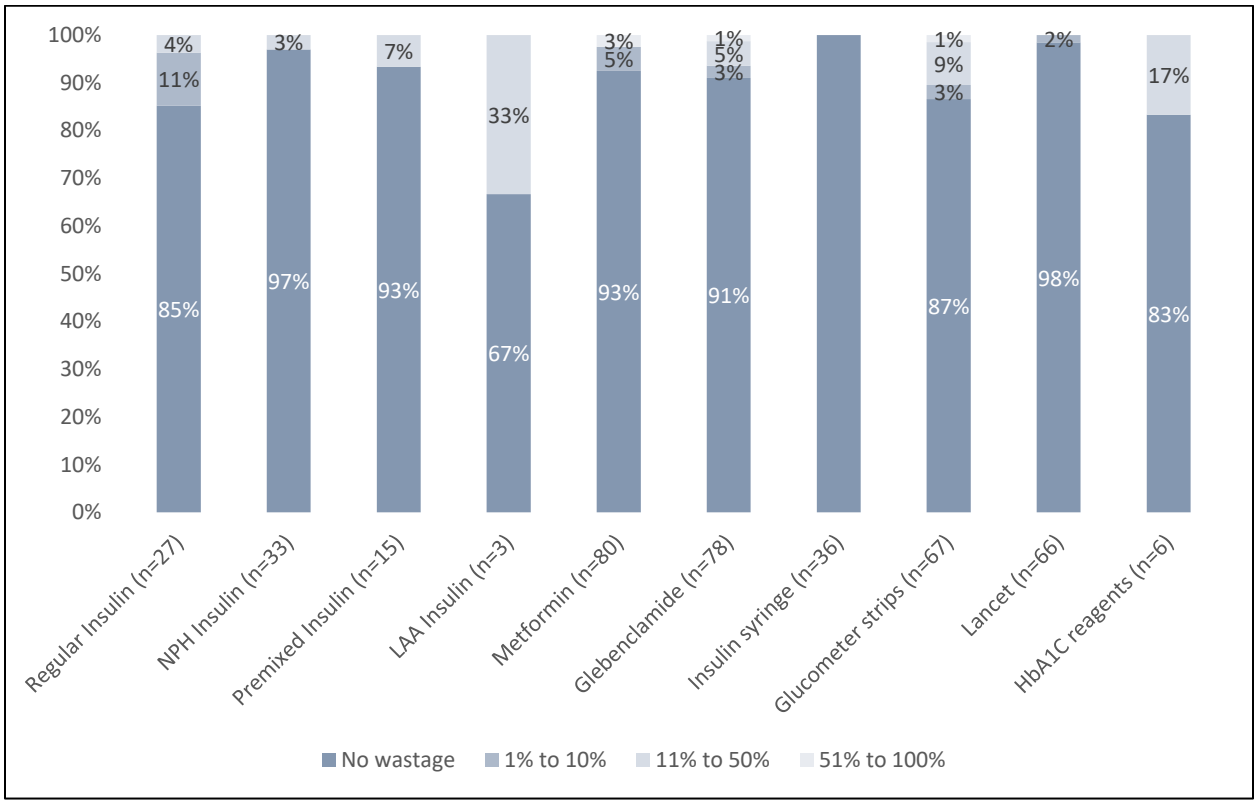

Figure 16: Wastage rates across surveyed health facilities, EFY 2014 (N represents the number of facilities with available data).

Table 10: Wastage rates across surveyed health centers, EFY 2014 (N represents the number of surveyed health centers with complete accurate inventory data for wastage rate calculation).

Diabetes commodities	No wastage	1% to 10%	11% to 50%	51% to 100%
Regular Insulin (n=11)	10	0	1	0
NPH Insulin (n=16)	15	0	1	0
Premixed Insulin (n=3)	2	0	1	0
LAA Insulin (n=2)	1	0	1	0
Metformin (n=63)	58	3	0	2
Glibenclamide (n=61)	55	1	4	1
Insulin syringe (n=18)	18	0	0	0
Glucometer strips (n=51)	42	2	6	1
Lancet (n=51)	50	1	0	0

HbA1C reagents (n=1)	0	0	1	0

EPSS reported <1% wastage rate, within the national target of <2%, at the central level over the past five years (see Figure 17).

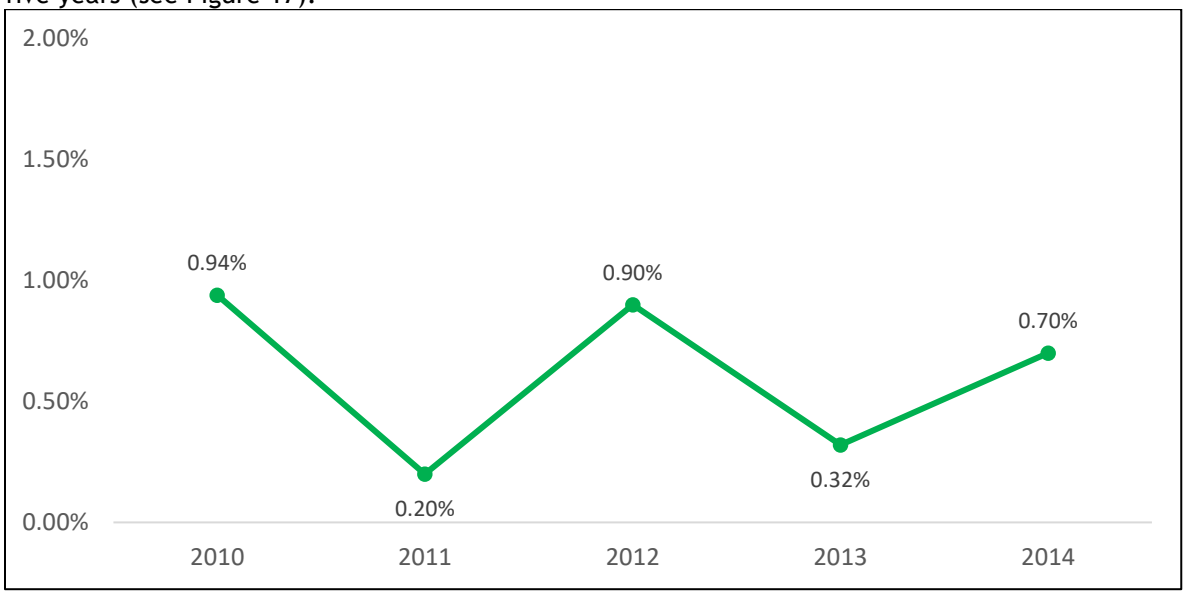

Figure 17: EPSS overall product wastage rate over 5 years, 2010—2014 EFY (2018—2022).

The very low wastage rates reported by EPSS and health facilities, and very low rate of unusable stock across health facilities is likely driven by high usage rates of these commodities; since facilities tend to have less stock on hand than they require, it is likely those commodities that are available are used up quickly with limited wastage.

3.6. Association between selected SCM variables

In light of the country's decentralization strategy, inferential statistical analysis was conducted to explore associations between select diabetes service availability indicators at the health center level. Accordingly, two indicators, DTC functionality and availability of a medicines list, considered as independent/exposure variables, were analyzed for their association with a number of other indicators considered as outcome variables.

Availability of medicines lists based on VEN: A lower proportion of health centers with a functional DTC had a medicines list based on VEN (25.93%) relative to those without a functional DTC (66.23%); however, this negative association was not statistically significant (p-value = 0.839).

Conduct of annual quantification of medicines and medical devices: A lower proportion of health centers with a functional DTC conduct annual quantification of medicines and medical devices (6.07%) compared to those without a functional DTC (30.32%); however, this negative association was not statistically significant (p-value = 0.2658).

Availability of selected diabetes commodities[15]: A lower proportion of health centers with a functional DTC reported a stockout duration of less than 90 days for the selected diabetes commodities (3.15%)

[15] Defined as stockout duration of <90 days for human insulin, Metformin, Glibenclamide, glucometer strip and syringes in the past fiscal year.

relative to health centers without a functional DTC (18.15%); however, this negative association was not statistically significant (p-value = 0.0980).

Availability of select diabetes commodities: A higher proportion of health centers with a facility-level medicines list reported a stockout duration of less than 90 days for the selected diabetes commodities (20%) compared to health centers without a medicines list (1.36%); however, this association was not statistically significant (p-value = 0.0576).

While the presence of a functional DTC in a health facility is expected to positively influence product selection, quantification and stock management practices, the negative statistically non-significant associations observed between the presence of a functional DTC and the selected outcomes indicators may be due to limitations in the sampling approach for the survey and smaller sample size of selected health centers. Though the association is not statistically significant, the observed negative relationship may be an indicator for a need for an MOH-led evaluation of the current status of implementation of DTC functions, especially at the lower levels of the health system, to identify and review supply chain management practices, status of service delivery, and DM-related health outcomes to enable development of targeted interventions to address them.

3.7. Service Delivery

3.7.1. Implementation of the national NCD Strategy

In 2020, the Ethiopian MOH published an updated National Strategic Plan for the Prevention and Control of Major Non-Communicable Diseases, including diabetes, to guide improvement of health service provision over the 2020/21-2024/25 period. According to the national strategy, all general and primary hospitals should provide DM services, which implies that DM services should currently be accessible at least half of the country's health centers.

In practice, respondents reported varying implementation of this strategy: for example, a respondent from one RHB reported only 30% (of roughly 1500 health facilities) provide diabetes services, one from another RHB reported 80% of health centers provide such services. The major reported drivers of facilities not providing diabetes services included lack of human resources (particularly physicians); a limited budget; supply unavailability (e.g., insulin, HbA1c reagent); limited distribution of guidelines, protocols and job aids; and lack of confidence among HCWs in diabetes care, including the belief that nurses and health officers cannot provide DM care.

3.7.2. Service Availability

3.7.2.1 Availability of Guidelines, Protocols, Manuals and Other Job Aids

Several key documents have been developed to guide diabetes service delivery across Ethiopia:

(1) The **National NCD Management Protocol was** developed to standardize the management of major NCDs including diabetes, to ensure quality of management, consistency in recording and reporting of treatment outcomes across sites.
(2) The **National Standard Treatment Guidelines** (STGs) were developed and adapted for the different levels of the Ethiopian health system to provide clear guidance and recommendations about the treatment and management of clinical conditions through the promotion of therapeutically effective and economic use of medicines. Additionally, at the tertiary level (referral hospitals), facility-specific treatment guidelines may be prepared for higher levels of care for more complicated cases that cannot be treated at lower level.

(3) The **Diabetes Participant Training Manual** was developed to deliver the diabetes training component of the National Major NCD training curriculum to physicians, health officers, nurses, and NCD focal persons at the national and regional levels.
(4) The **Ethiopian PHC Clinical Guidelines (expected at Health centers only)** is an integrated symptom-based algorithm/guide for the care of children and adults presenting with common symptoms and priority chronic conditions at the health center level.
(5) **Diabetes treatment algorithms** and **job aids** are used to provide health care workers a step-by-step guide on the management of diabetes, and education/counseling of diabetic patients. These include flyers, audios and videos, posters and algorithms.

The availability of the National NCD Management Protocol, National Standard Treatment Guidelines and the Diabetes Training Participant Manual was substantially low (less than 30%) in health centers compared to primary and general hospitals (see Figure 20). This aligns with the perceptions of survey respondents at the central and regional levels, who expressed that awareness and implementation becomes more challenging at more decentralized levels of the health system. Some surveyed RHBs reported that budget challenges prevent full implementation of the policies. Only one of the six referral hospitals had a facility-level treatment guideline. Availability of the Ethiopian PHC Clinical Guideline was very high at health centers (94% of health centres).

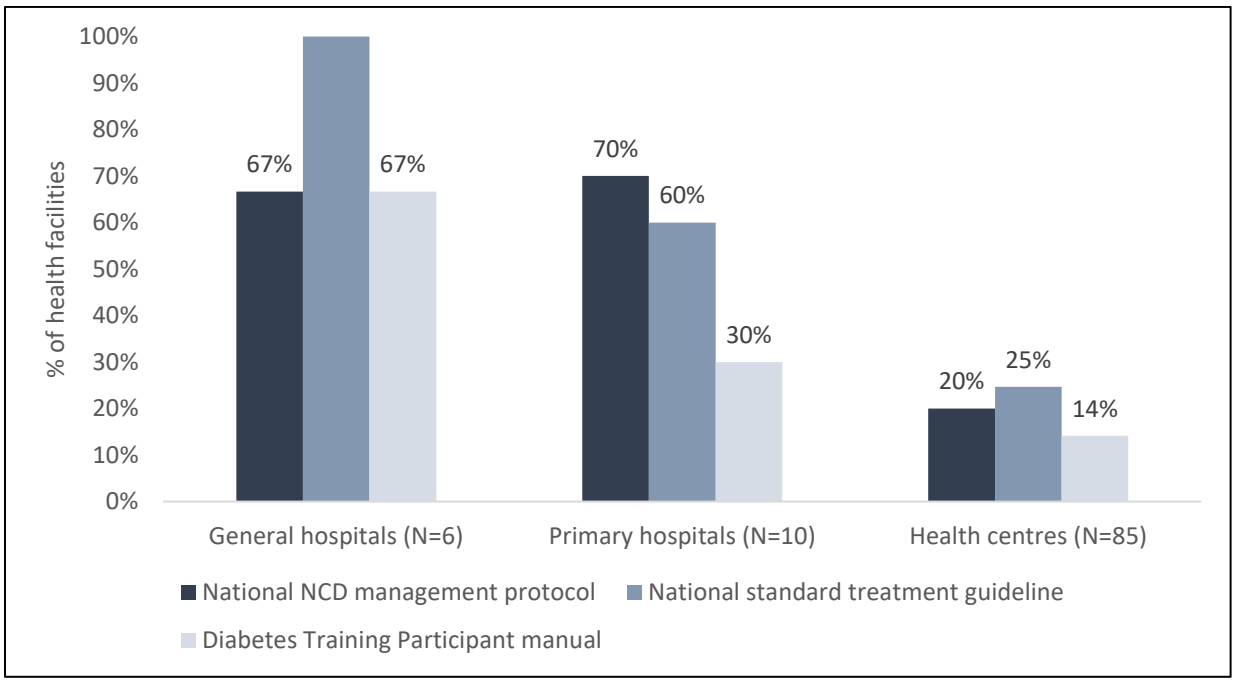

Figure 18: Availability of the National NCD management protocols, National Standard Treatment Guideline and Diabetes Training Participant Manual at surveyed health facilities.

Availability of algorithms and job aids was very low at levels of the health system where these tools are recommended to guide the scope of service delivery; 12% or less of health centers had each of the treatment algorithm and job aids in place, and none of the six general hospitals had any of the job aids (see Figure 19).

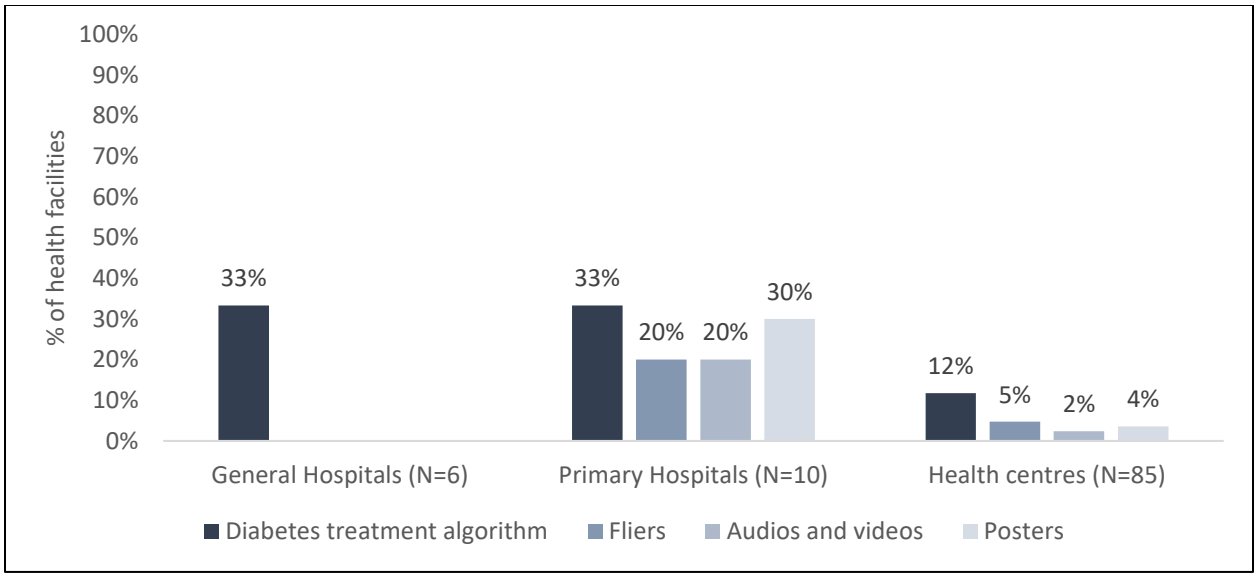

Figure 19: Availability of algorithms and other job aids for diabetes service provision at surveyed health facilities.

The low availability of these key documents across surveyed facilities, especially at less central levels in the health system and for more detailed guidance that guides clinical practice (i.e., treatment guidelines and training participant manual), presents a barrier to the decentralization of critical components of diabetes management as routine clinical practice. The National NCD Management Protocols and National STGs may be particularly important at lower-level health facilities, especially for cadres of HCWs that are unlikely to have received NCD training as part of their professional education (e.g., nurses and health officers).

3.7.2.2. Staffing

Respondents reported that at MOH, there is a Program wing led by the state minister, with one of its branches being the Disease Prevention and Control Directorate (DPCD). DPCD is responsible for NCDs and has four main programs: cancer (breast and cervical cancer), chronic obstructive pulmonary disease (COPD), DM, and cardiovascular disease (CVD). Each disease type has a focal person who is in charge of monitoring the overall activities. At the RHB level, an NCD team, composed of NCD coordinators and experts, is responsible for monitoring DM service provision. All NCD programs are managed as "Common NCDs" at the Zonal, Woreda, and Health facility levels by assigned NCD focal persons. While some MOH respondents reported no issues filling these positions, others noted inadequate budget limits the ability to fill the roles with qualified personnel, and that NCD focal persons may be stretched between multiple roles.

Given the complex nature of diabetes management, availability of specialists that can provide comprehensive care, including for acute and chronic complications, at higher levels of the health system (referral and general hospitals) is critical. In the majority of surveyed referral and general hospitals, no such specialists were available: 1/6 referral hospitals had an endocrinologist, 2/6 general hospitals had at least one cardiologist, 2/6 referral hospitals each had a neurologist and a nephrologist, while 1/6 and 2/6 of general hospitals had one of each of these two specialists respectively. 4/6 referral hospitals and 2/6 general hospitals had at least one ophthalmologist (a specialist that manages the eye complications of diabetes) available per service rotation.

According to the decentralization strategy for diabetes, for all levels of the health system, a non-specialist physician (at least one of: an internist, general practitioner or family physician) should be

available who are trained on the initiation of insulin for newly diagnosed cases of insulin-dependent diabetes (noting though that it is expected that initiation of insulin use for complex cases is expected to continue to be provided at higher-level health facilities). Overall, a low number of health facilities had at least one internist (11%), general practitioner (32%) or family physician (3%) per service rotation, with most of these physicians in referral or general hospitals (see Figure 20). Only 16% (14/85) of health centers had at least one physician (in all cases, a general practitioner) available per service rotation. Availability of nurses, pharmacy and lab professionals was high across all facilities, and availability of health officers was high at health center level (see Figure 20).

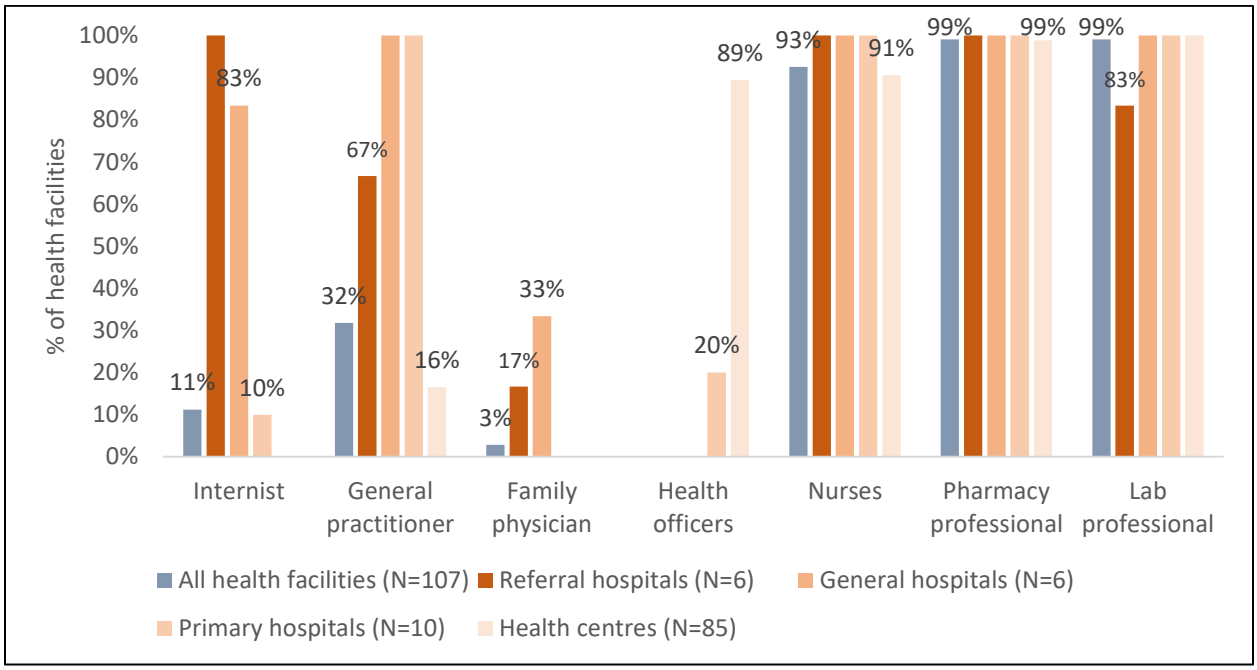

Figure 20: Proportion of health facilities, overall and by level, with at least one health care worker by cadre per diabetes service rotation.

The number of health facilities with non-specialist staff who received in-service training on diabetes management was low overall. Across facility levels, health centers had the least number of trained staff. Health officers and pharmacy and lab professionals were the least trained health professionals on diabetes management (see Figure 21).

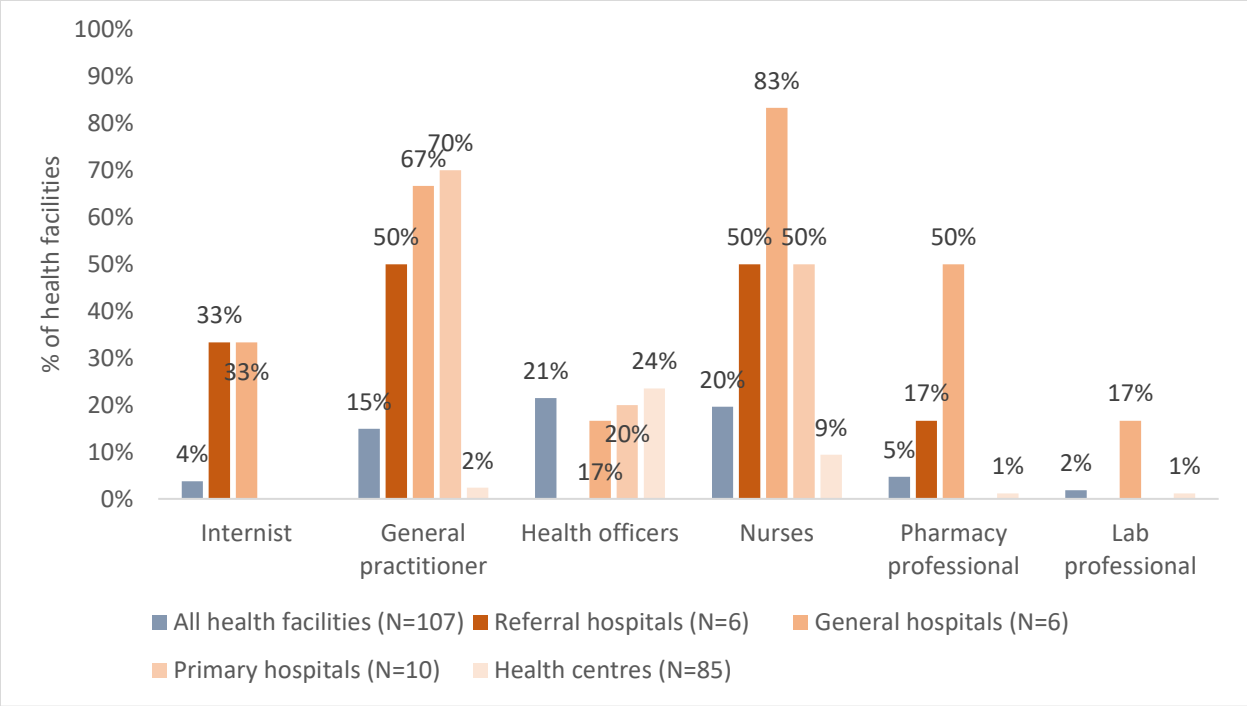

Figure 21: Proportion of health facilities, overall and by level, with at least a staff by cadre trained on diabetes or NCD management by cadre.

Very limited availability of specialists for comprehensive diabetes care across surveyed higher-level health facilities indicates a resourcing gap which is likely further exacerbated by the number of patients seen by these facilities (noting 83% of diabetes patients across all surveyed facilities were seen by referral and general hospitals). Further, the large gap in availability of physicians at lower-level health facilities is a significant barrier to decentralizing diabetes service delivery, particularly when it comes to insulin initiation and maintenance. For those HCWs that are available, the large gap in in-service training on diabetes management for HCWs – across all levels but particularly large at the health center level – likely drives limitations in the ability of facilities to support catchment populations in timely and effective prevention, diagnosis, and ongoing treatment of diabetes.

3.7.2.3. Insulin and Oral DM Medications

While section 3.5 on Stock Management provides insights into availability of a subset of high-priority diabetes commodities across surveyed facilities, including on stock received and extent of stockouts, this section sheds light on the availability of a broader range of diabetes commodities and laboratory tests, which are required to enable diabetes service delivery, at the time of the survey.

Oral DM medications (metformin and glibenclamide) were available in over 90% of the facilities, however less than 40% of facilities had at least one type of insulin at the time of survey. Across facility level, insulin availability was lowest in health centres, (see Figure 22), which is consistent with the low availability of physicians who can initiate insulin treatment for PLWD requiring insulin.

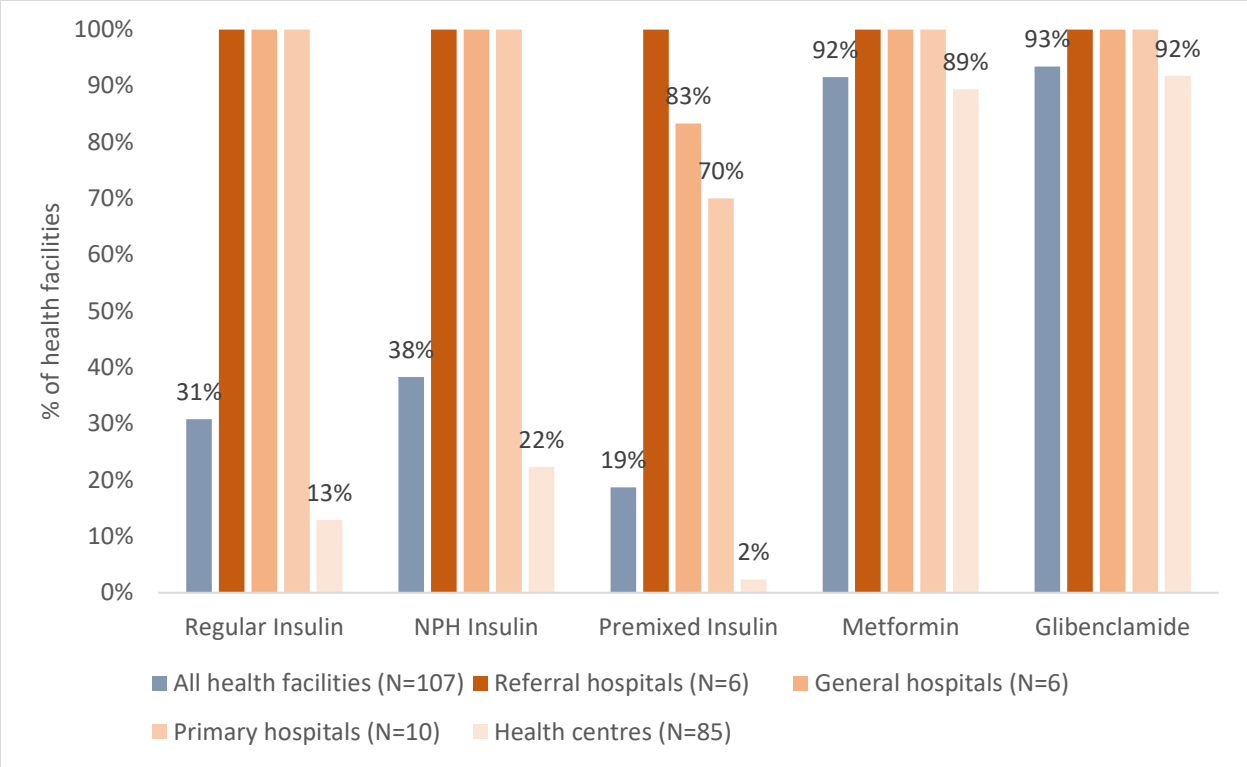

Figure 22: Availability of DM medications at the time of survey at health facilities, overall and by level.

3.7.2.4. Diagnostic tools and equipment

While the majority of health facilities had equipment used for screening (adult weight and height scales, BP apparatus, stethoscope and glucometer) (between 66% and 98%, depending on the commodity), less than 30% had any of the equipment used in diagnosis and monitoring of chronic complications of diabetes (ECG machine, ophthalmoscope, fundus camera, reflex hammer and monofilament). This trend was consistent across health facility types, though availability of both categories of equipment was higher in referral, general and primary hospitals than in health centers. (See Figure 23)

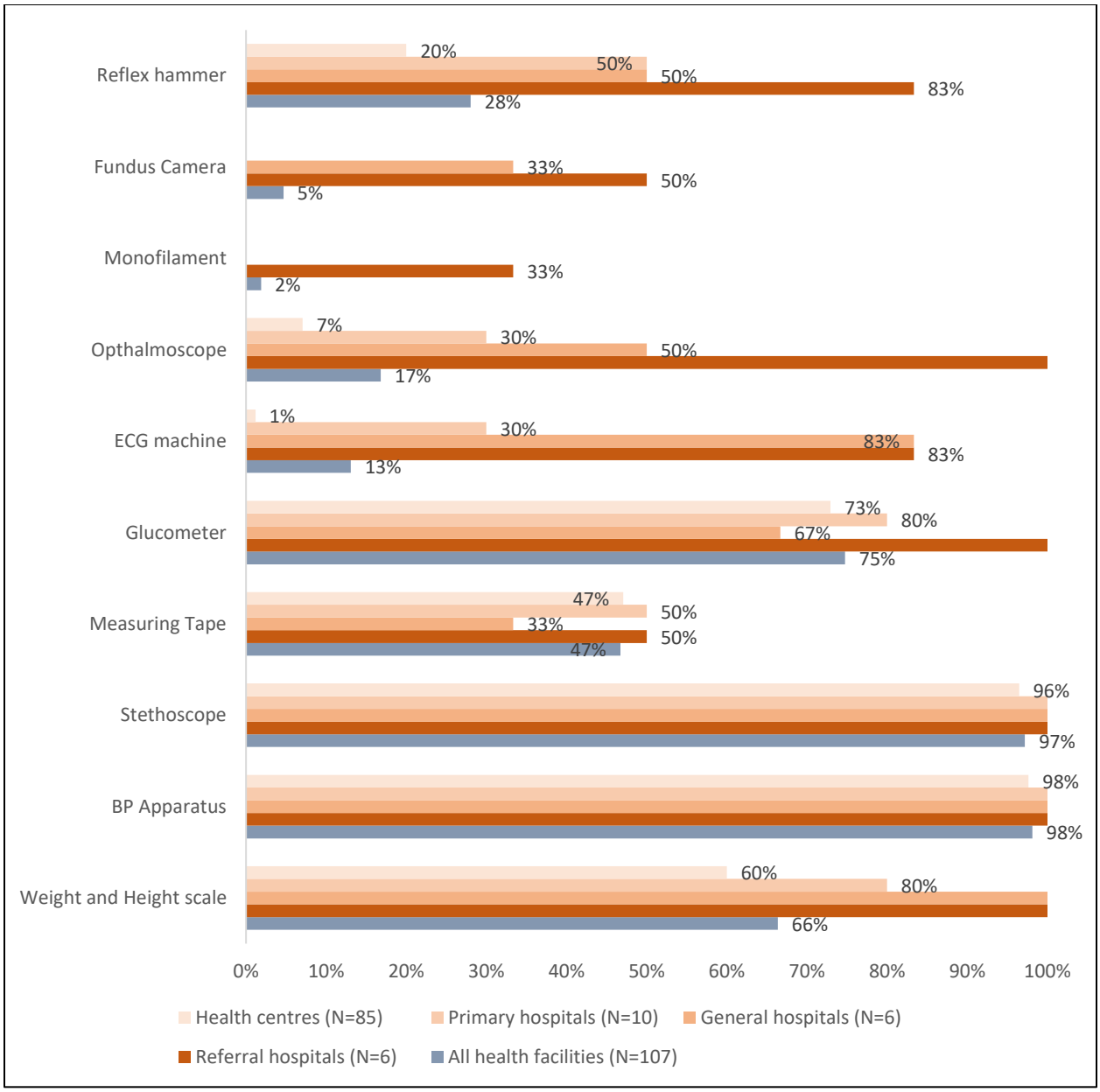

Figure 23: Proportion of all surveyed health facilities, overall and by level, with diagnostic tools, apparatus, and equipment at the time of survey.

3.7.2.5. Laboratory tests

As indicated in Figure 24, while most facilities (over 90%) had blood glucose and urine analysis tests available, HbA1c and renal function and electrolyte (K+) tests availability was very low, especially at health centers. HbA1c was available at 3 referral hospitals and 1 general hospital only. Similarly, while laboratory tests used for confirmatory diagnosis of diabetes and monitoring in DKA management (urine dipstick and urinalysis) were available in the majority of health facilities, electrolyte (K+) and renal functional tests - crucial in the management of diabetic ketoacidosis and monitoring its response to treatment - were less available. These trends were consistent across facility types, except in referral

hospitals where availability of all of the above tests was high (all six referral hospitals had blood glucose test, urine dipstick, urinalysis, electrolyte and renal functional tests; and 5/6 had HbA1c test).

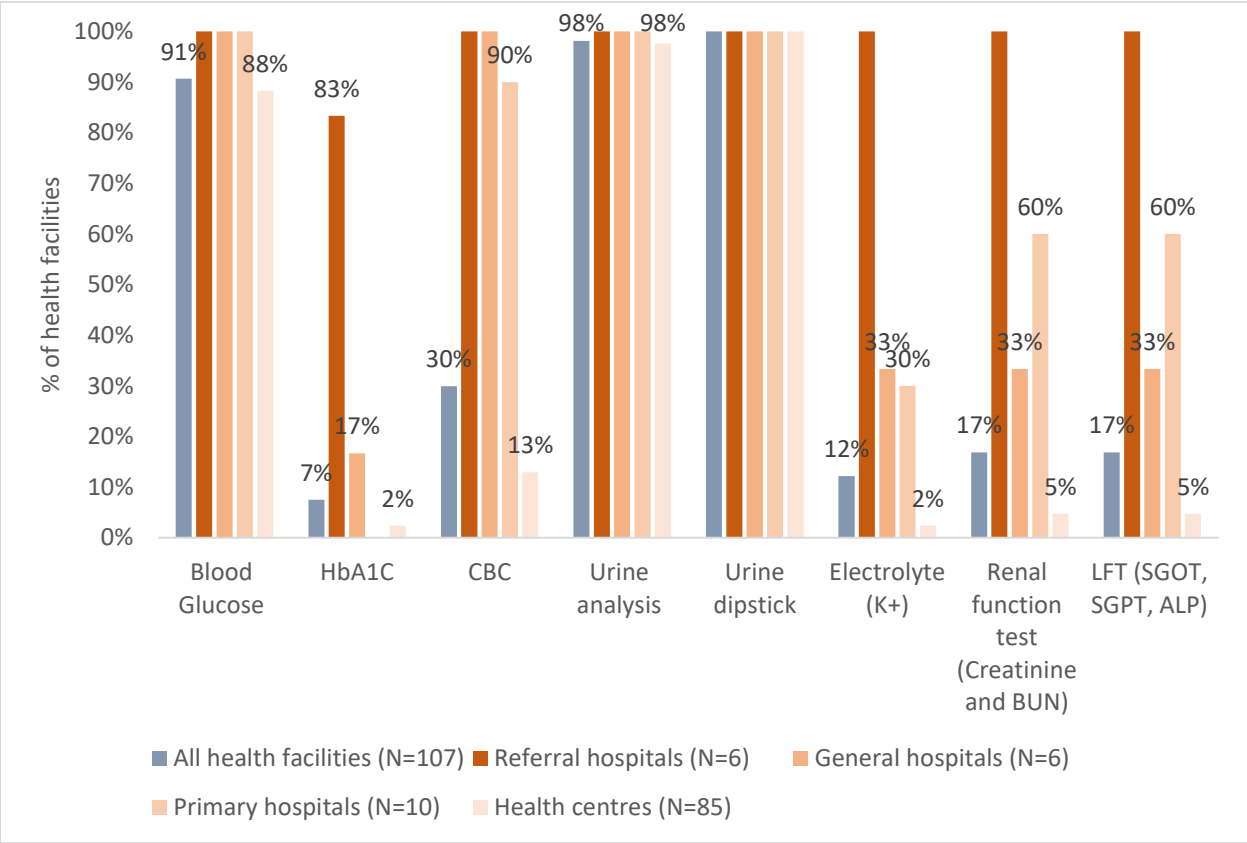

Figure 24: Availability of diagnostic tests at the time of survey across all surveyed health facilities overall and by level.

3.7.2.6. Medications for management of Acute Complications of DM

Over 80% of all levels of health facilities had normal saline and 40% glucose and multivitamin at the time of survey (see Figure 25). Potassium chloride was available at one-fifth of the health facilities, with low availability in health centres.

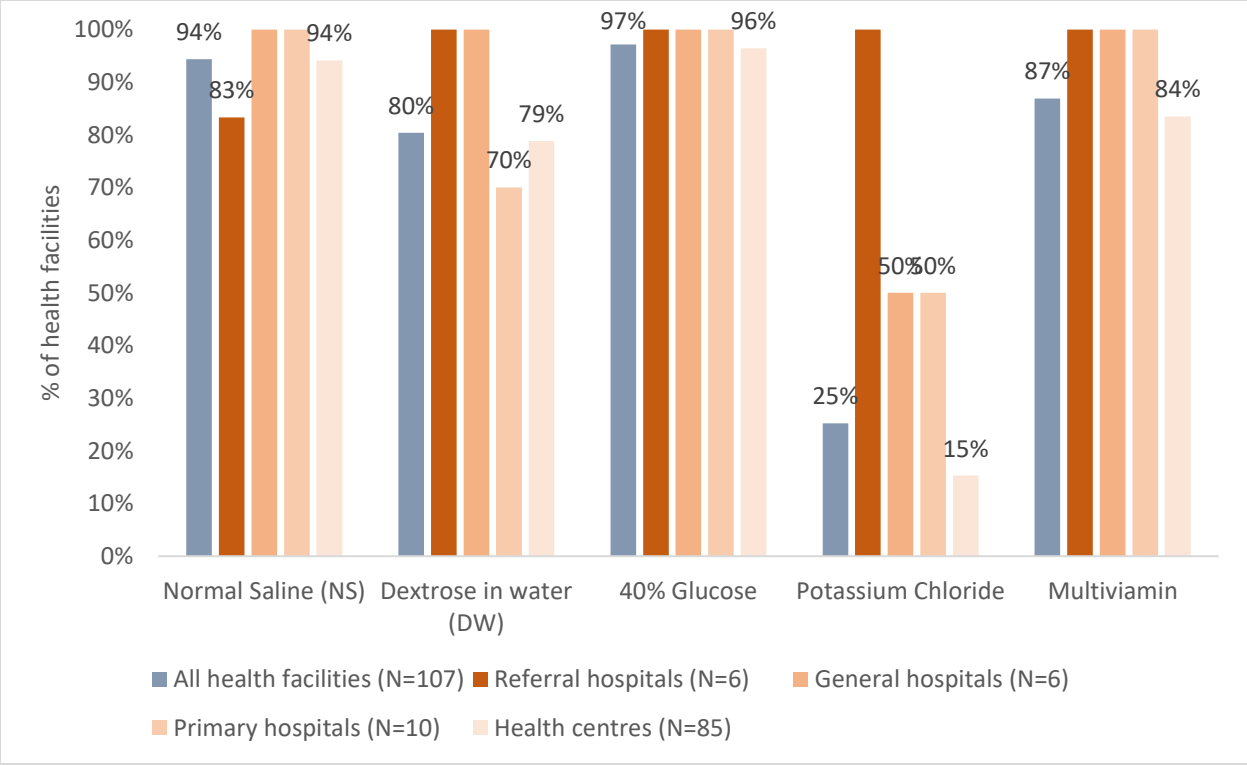

Figure 25: Availability of medications for management of acute complications of DM at the time of, overall and by level of health facilities.

3.7.2.7. Overall health center capacity

As a preliminary assessment of the capacity of health centers to carry out DM services, the extent to which health centers met a range of criteria – across multiple thematic areas – was analyzed. No health facilities met the following criteria:

- **Availability of at least one of each of:** general practitioner, health officer, nurse, pharmacy professional, lab professional per service rotation
- **Less than 90 days of stockout in the past year of:** human insulin, metformin, glibenclamide, glucometer, strips, syringes
- **Availability at time of survey of:** adult weight and height scale, BP apparatus, Stethoscope, tape measure

Of these facilities, 71/85 had no general practitioner available per service rotation.[16] When removing the criterion for a general practitioner to be available per service rotation, still only 4/85 facilities met the defined requirements.

[16] As noted under insulin initiation in the Service Utilization sub-section (3.7.3.5), only nine health centres (11%; 9/85) reported initiating newly diagnosed cases of diabetes on insulin. While all of these nine facilities reported at least one patient on insulin, five also reported having no physicians available per rotation. Further investigation is required to understand if lower-level health professionals initiate insulin in these facilities, if there is a functional down referral mechanism once patients are initiated on insulin at higher level facilities, or if there is an underlying data reporting issue.

The lack of any health centers surveyed meeting a basic set of criteria for diabetes service delivery indicates a potentially significant gap in the implementation of MOH's decentralization goals, under the NCD strategy. This gap is particularly pronounced when looking at the availability of physicians, posing a significant barrier to enabling initiation of insulin use at health center level.

3.7.3. Service Utilization

3.7.3.1. Patient population

From the surveyed health facilities, 104 reported having DM patients. Of these, 6 were excluded due to incomplete data and data from 98 facilities was analyzed. A total of 25,299 patients with DM received care, with referral and general hospitals providing care to 64% and 19% of these patients respectively, and 17% of patients receiving care at the PHC level (5% at primary hospitals and 12% at health centers). About 72% patients with diabetes had T2D, and among patients with T1D, 25% were children. Almost all T2D patients (99%) were adults (see Table 11). However, given the lack of clear standards for classifying DM cases, as reported by an interview respondent, there may be inaccuracies in the data.

Table 11: T1D versus T2D patients across 98 health facilities, disaggregated by age category.

	Type 1	Type 2
Adults	3,918 (75%)	13,126 (99%)
Children	1,307 (25%)	87 (1%)
Total	5,225 (100%)	13,213 (100%)

Of the 98 facilities with data available on DM patients, 45 facilities (46%) met the MOH's target of having at least 60% of patients on treatment with blood glucose levels controlled in the 6 months before the survey (60% to 99% of patients in 22/98 facilities achieved blood glucose control, 23/98 facilities reported 100% of patients achieving blood glucose control); 18/98 facilities did not report any patients with blood glucose controlled, and less than 60% of patients receiving treatment at 35/98 facilities achieved blood glucose control. Control of blood glucose in patients with diabetes is vital for preventing life-threatening acute complications such as DKA and HHS, and debilitating chronic complications such as stroke, diabetic retinopathy and diabetic nephropathy, all of which require resource-intensive management at the higher levels of the health system.

Across interviews, respondents reported the main activities undertaken to achieve blood glucose control for patients include providing health education on medication adherence, self-monitoring of blood glucose (e.g., at least daily), lifestyle modifications and nutrition. Respondents from health facilities very often cited poor medication compliance and lack of lifestyle modifications – as patient-side drivers of poor blood glucose control. Though less often, barriers to accessing drugs and clinics (e.g., financial, geographic and transportation) and challenges storing insulin were also cited as barriers to achieving blood glucose control. On the provider side, poor counselling and shortage of trained healthcare workers were cited each a few times as potential drivers of poor blood glucose control, as well as incorrect dose adjustments. One respondent explained that often providers need to make decisions about medication provision without necessary evidence, due to lack of supplies like diagnostics. The low blood glucose control rates across many facilities are likely driven by barriers mentioned by interview respondents (e.g., poor medication compliance, lack of lifestyle modifications, poor counselling, shortage of trained HCWs) and discussed in other sections of the report (e.g., gaps in commodity availability, lack of guidelines and training to support staff).

3.7.3.2. DM Service Packages

Based on interview responses at the facility level, it is unclear if a standard written/oral guide regarding the package of services provided at each level of health system exists. Respondents from all health facility levels reported provision of a basic service package for diabetes, including awareness creation and patient education, and screening including lab investigations and diagnosis. Hospitals reported initiating patients on insulin and management of diabetes complications, whereas lower-level health facilities reported referring those cases up to hospital level (at the primary hospital level approaches differed).

3.7.3.3. DM Service Delivery Sites

As summarized in Figure 26, across facilities, DM services were reported to be most often provided at the outpatient department (51% of facilities), followed by NCD clinics. While general and primary hospitals use chronic OPD as the main site, health centers use the general OPD for DM service provision. DM clinics are available only at referral hospitals. This indicates that, typically, diabetes services are provided in a way that is integrated with the delivery of other services; while some interview respondents suggested this is desirable, others noted that lack of dedicated rooms for diabetes service delivery is a barrier to success.

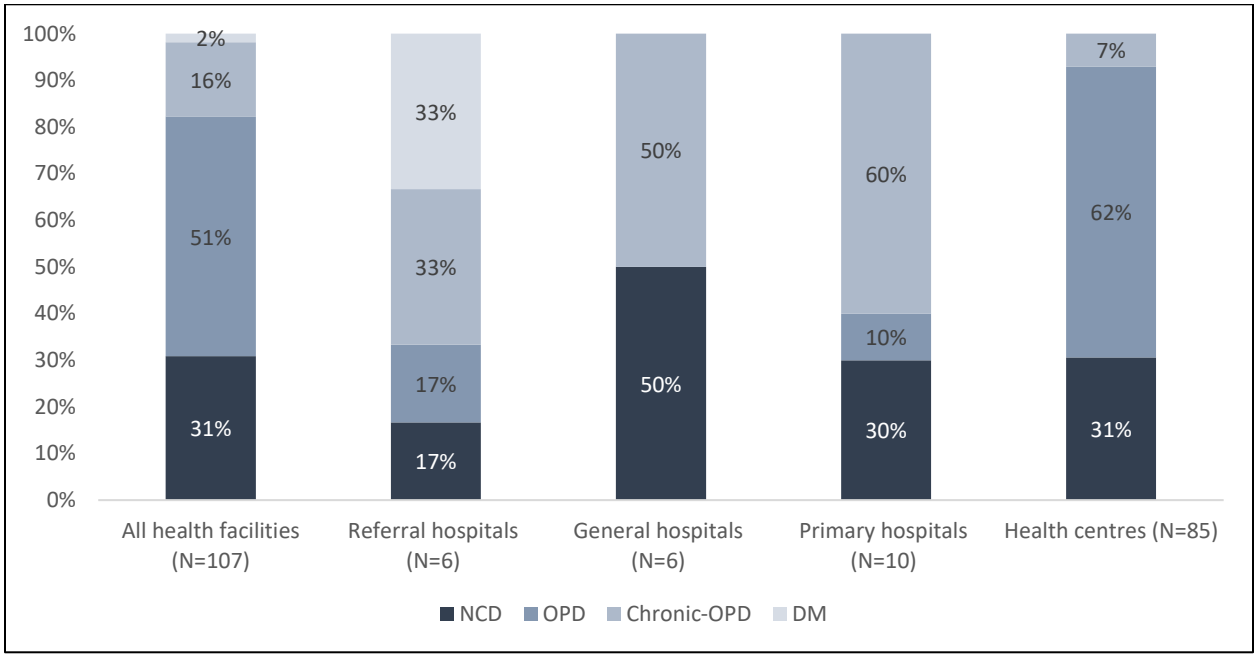

Figure 26: Proportion of surveyed health facilities, overall and by level, by their sites for DM service provision

3.7.3.4. In-facility screening, education and awareness

Sixty-four percent (69/107) of surveyed health facilities reported providing diabetes screening services; across facility levels, with the proportion was lowest in health centers (52/85). However, a majority of interview respondents described screening clients that are symptomatic. Targeting only symptomatic patients excludes other population segments who may be at risk of developing diabetes, and this is below the expectation that "all health facilities will be in charge of delivering screening, diagnostic, treatment and care services for NCDs and risk factors" according to the national NCD strategy. Overall, diabetes

screening service is provided majorly in adult OPD (84%), followed by emergency and pediatric OPDs. Triage and wards were less utilized for DM screening. About 50% of the health facilities [55/106] provided diabetes screening in two or more sites. Adult OPD was the most common site for diabetes screening across the facility levels; at the health center level, pediatric and emergency OPDs and MNH Clinic were also common sites for diabetes screening (see Figure 27). While diabetes screening is provided at pediatric OPDs in some facilities (33/69), the number is still almost 50% less than the number (58/69) of facilities screening for diabetes in the adult OPD.

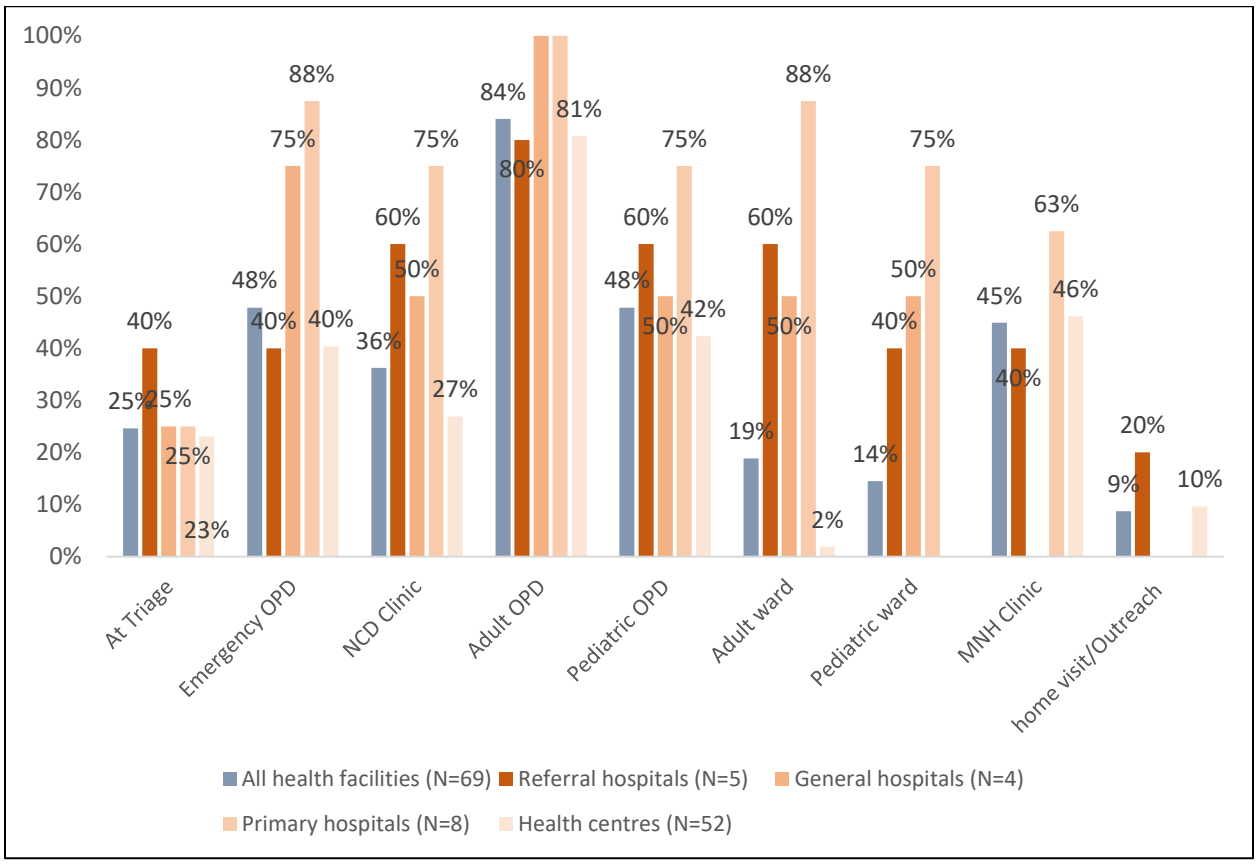

Figure 27: Proportion of surveyed health facilities by their diabetes screening sites. (N= 69, representing facilities that reported providing diabetes screening service).

As indicated in Figure 28, the majority of facilities that conduct DM screening target patients with other chronic illnesses (hypertension, CVD and HIV) and those mothers with a history of gestational diabetes mellitus. This finding also indicates that there is a gap in clearly understanding the national criteria for DM screening as some facilities reported screening all adults, and those with high BMI regardless of age range, a trend that was similar across health facility types, but different from the account of the majority of interview respondents who reported screening only symptomatic patients.

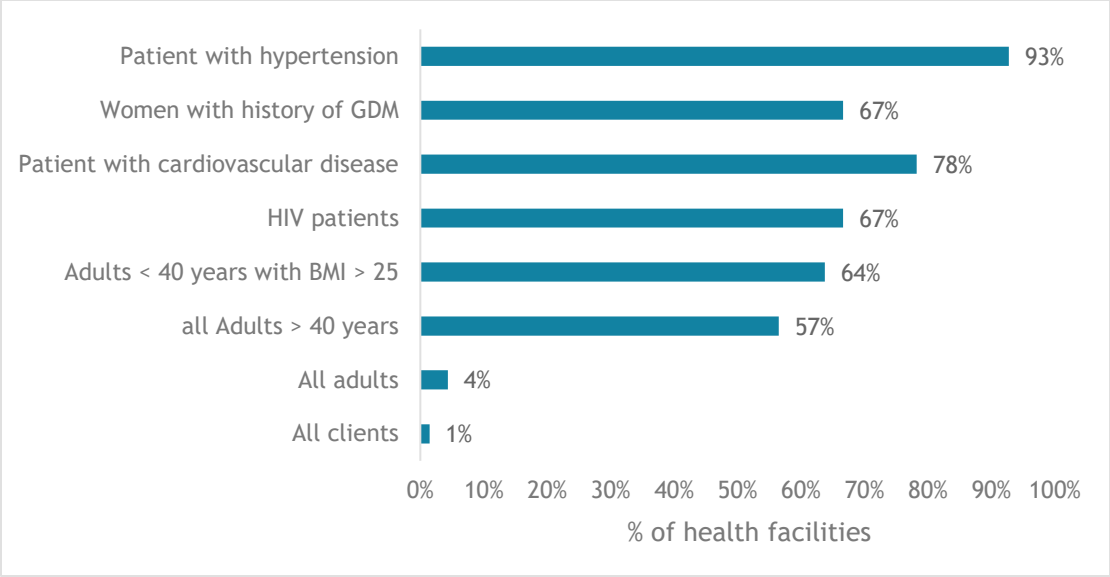

Figure 28: Proportion of surveyed health facilities providing screening service by their target population for diabetes screening (N=69, representing number of facilities that reported providing diabetes screening service).

Interview respondents described a range of activities conducted within facilities to raise awareness of and educate patients on diabetes, alongside screening activities. Approaches included nurse-provided counselling, televisions in the waiting room that show educational messages, distribution of flyers, and distribution of a magazine in Amharic to patients on their appointment day.

3.7.3.5. Community screening, education and awareness

Interview participants reported that outside facilities, the MOH promotes NCD awareness creation via occasions such as World Diabetes Day, and the Ethiopian Diabetes Association (EDA) provides monthly health education and counselling to patients, including their families for patients under 14 years old. While some facility-level interview respondents noted their facilities do not conduct screening or awareness-raising in the community, others mentioned a range of activities. For example, one referral hospital respondent described hosting awareness raising activities and blood pressure and blood glucose screening three times per year in the community; while it can provide this for free to all adults due to provision of strips from assisting organizations, the respondent expressed concern that in the future they would not have access to supplies to keep screening. A general hospital respondent described the family health team in urban settings provides screening twice per week in the community. A primary hospital reported that community level screening and awareness creation is conducted by Woreda officers, and a health center respondent explained health extension workers educate community members via home visits four times per month (while blood pressure screening occurs, blood glucose screening is not yet included).

Facility-level interview respondents reported several challenges to conducting screening, education and awareness raising activities. The most reported challenges were shortages of glucometers, strips, and lancets, as well as health care workers, which prevent screening activities from taking place as planned (e.g., sometimes leading the facility to screen a smaller sub-population than they would ideally target). One respondent mentioned its facility requires patients to buy strips from the pharmacy to be screened, and since the screening site isn't close to the pharmacy that may be inconvenient for clients. A few

respondents also explained that shortages of educational materials and resistance among the population to attend and comply with counselling, and to be screened, are barriers to success.

3.7.3.6. Insulin initiation

Of 95 facilities with complete data on insulin use among T2D patients, 67 did not report any patients on insulin. Across the remaining 28 facilities, on average 31% of T2D patients were on insulin.

Several interview respondents explained that, in Ethiopia, the physician is responsible for initiating patients on insulin, however as noted above, only 16% of health centers had at least one physician available per service rotation, which is consistent with only 11% of health centers that reported initiating newly diagnosed cases of diabetes on insulin (the rest referred such patients to higher levels of the health system). While all of these nine health centres reported at least one patient on insulin, five also reported having no physicians available per rotation. Further investigation is required to understand if health centers with no physicians are initiating insulin or if these cases are down referrals from higher level health facilities.

While one facility respondent reported there is no protocol in place for starting patients on insulin, and rather decisions are made by senior physician based on their expertise, consistent with the low availability of a treatment algorithm and job aids noted earlier, a few respondents explained that there is a new guideline in place which recommends initiating insulin if HbA1C result is 9%, or if fasting blood glucose is 250mg/dL or higher. Several respondents also noted that type 2 DM patients are put on insulin if their blood glucose is not controlled by oral glucose-lowering agents.

Respondents reported challenges with insulin initiation including a lack of insulin and an inability to respond to DKA or other serious complications. Further, resistance among patients to initiate insulin use was described as a challenge. The most commonly cited drivers were fear of injection and inconvenience due to refrigeration needs, followed by low insulin availability, discomfort, and cost of insulin. Respondents explained that education and counselling does tend to help overcome these barriers, and that early awareness raising activities and opportunities for peer-to-peer sharing should be used to help further address these challenges.

3.7.3.7. Self-monitoring of blood glucose

Less than half (43/107) of facilities reported providing counselling to their patients on insulin on SMBG. Of these, majority (49%) of health facilities advised their patients on insulin to self-5test their blood glucose once every month, with more health centers (13/21) advising patients do self-test monthly compared to the higher levels of the health system (referral hospital—2/21, general hospital—2/21). Approximately 14% (6/43) of facilities counselled their patients to self-test when symptomatic, and another 14% counselled on self-testing between 1 and 3 times per week (Figure 29).

Low reported levels of counselling on SMBG may be driven by a gap in availability of glucometers and strips to actually conduct monitoring. Further, the limited in-service diabetes management training provided to HCWs (see section 3.7.2.2 Staffing, above) makes it unlikely available HCWs are equipped to provide appropriate counselling, including standardized guidance on consistent SMBG. In the community, education and screening is likely limited by HCW capacity and lack of commodities, as noted by some interview respondents. Given low awareness of diabetes is a driver noted by several interview respondents, community outreach may be important to promote prevention, early detection and treatment.

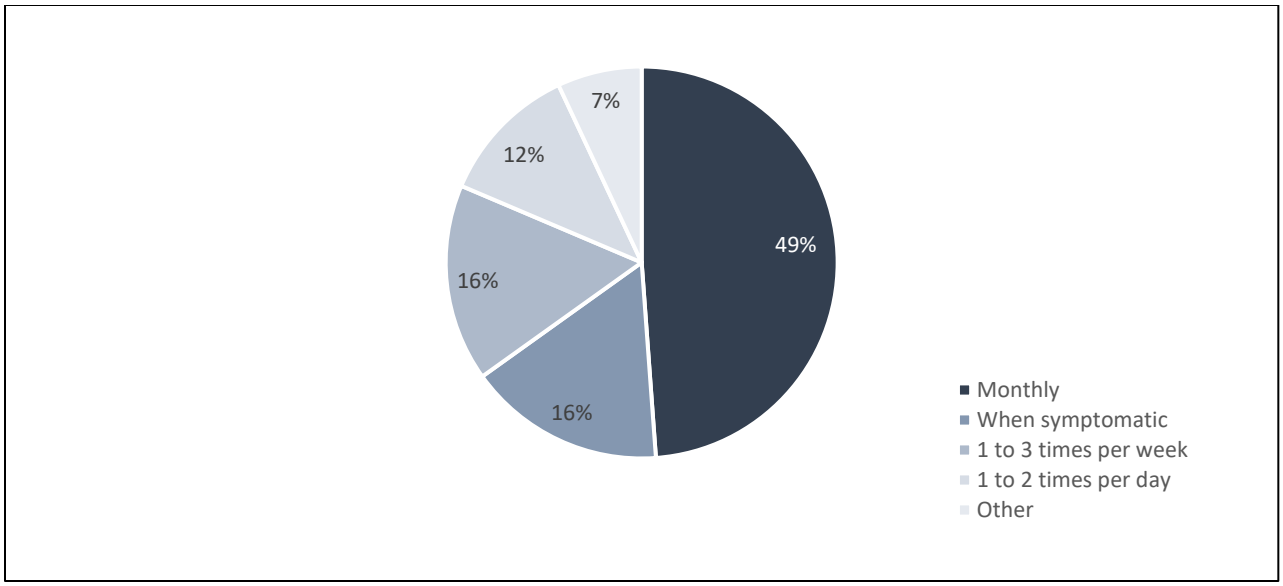

Figure 29: Facilities' frequency of counselling patients on insulin on self-monitoring of blood glucose (N=43, representing number of facilities that reported counselling patients on self-monitoring)

3.7.3.8. Reasons for DM Referrals

A total of 60 primary health care facilities (8 primary hospitals and 52 health centers) reported on referral of DM patients to higher level facilities. The most common reason for referrals from health facilities was chronic complications followed by acute complications and comorbidities (Figure 30). Insulin initiation was also a major reason for referral of DM patients by health centers.

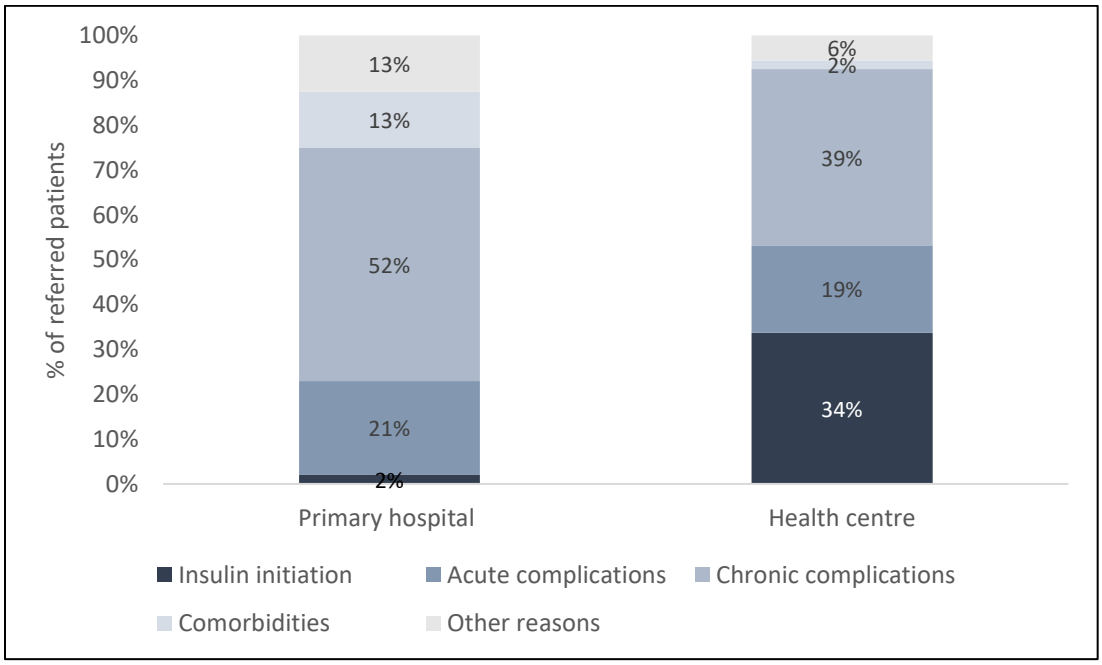

Figure 30: Proportion of diabetic patients, by indications, at surveyed primary hospitals and health centers referred to higher levels.

Most referrals reported to be received by higher-level facilities were received by referral hospitals (84%, versus 16% received by general hospitals). Acute complications were the most common reason for in-referral reported by both referral and general hospitals (Figure 31)[17].

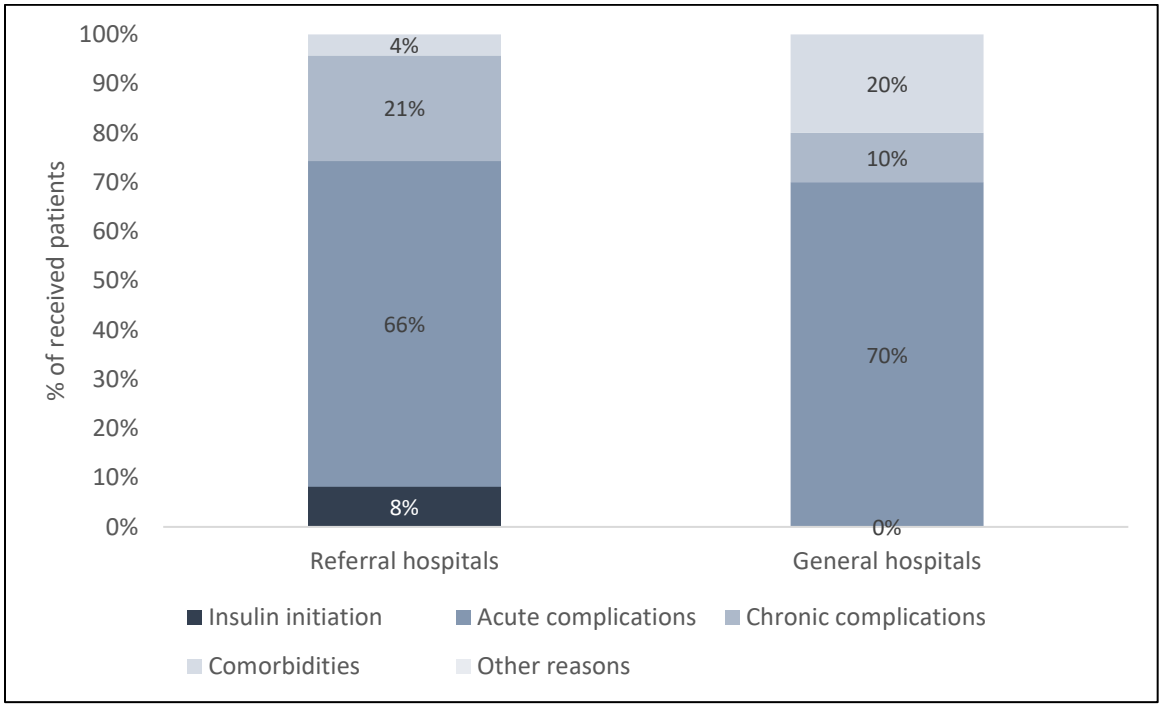

Figure 31: Proportion of diabetic patients, by indication, by referral and general hospitals from primary hospitals and health centers.

3.7.3.9. Challenges in DM Service Delivery

Interview respondents from MOH, RHBs and EDA described a variety of challenges in diabetes service provision. The most commonly cited challenges were: inadequate NCD budget (a key driver of other challenges), limited implementation of NCD policies, protocols, guidelines and job aids at service delivery sites, governance issues (e.g., need for NCD structure to be revised across all levels, limited inter-sectoral collaboration among influential government sectors and other partners, and challenges with leadership commitment at all levels), inadequate capacity building for HCWs, poor infrastructure at facilities, and shortage of DM commodities. At home, these respondents most often cited challenges including severe supply shortages -with an emphasis on lack of strips and challenges matching strips to glucometers- medicine costs and insulin storage requirements, poor patient education, and misconceptions about diabetes among community members, for example:

> "There is a gross misconception of DM and its management in the community. Rather than taking medicines for their disease they prefer traditional ones like [the] milk of camel."

> "Of course, there are also some misconceptions related to the cause of DM which could affect patients' adherence to medication. There are sayings that DM could come from evil spirit, or a

[17] Given the facilities surveyed are not in a closed referral network, the patients lower-level health facilities referred may have sought care in facilities out of scope, and higher-level facilities may have received patients referred from lower-level facilities out of scope.

DM patient could die immediately. Because of such things, patients may discontinue drugs and develop complications."

Among respondents from referral and general hospitals, the most commonly cited challenges in diabetes service provision were supply shortages, particularly for strips, other tests (e.g., renal function tests and lack of HbA1c reagent), lack of trained HCWs (including specialists, and HCWs for at-home support), and high patient load (and challenges ensuring HCWs trained on NCDs are present for each rotation). They most often cited low awareness of diabetes and resistance to be screened or begin treatment (especially for insulin) as patient-side barriers.

At the PHC level (primary hospitals and health centers), the most cited challenges were unavailability of medications and other commodities like HbA1c reagent, poor NCD service availability and lack of separate NCD units, lack of trained HCWs and unavailability of HCW trainings, as well as budget shortages.

3.8. Data management and M&E

3.8.1. Patient data tools

Survey data showed a number of data tools are used to capture relevant health data on patients screened for and diagnosed with diabetes and initiated on treatment. The most common of these data tools were the registry (cohort register) for diabetic patients and screening tally sheet, which were available in approximately 80% and 59% of surveyed health facilities respectively, followed by the patient follow-up form which was available in 37% of facilities. The trend was similar across facility types, except for the screening tally sheet which was available in a lower proportion of health centers compared to the higher-level facilities (see Table 12).

Table 12: Availability of data tools for capturing the health data of patients with diabetes among surveyed health facilities.

Data tool	**All health facilities** (N=107)	**Referral hospitals** (N=6)	**General hospitals** (N=6)	**Primary hospitals** (N=10)	**Health centres** (N=85)
Screening tally sheet	63 (59%)	5/6 (83%)	5/6 (83%)	6 (60%)	47 (55%)
National Diabetic Patient intake form	21 (20%)	2/6 (33%)	1/6 (17%)	3 (30%)	15 (18%)
Patient follow up form	40 (37%)	4/6 (67%)	2/6 (33%)	6 (60%)	28 (33%)
Registry for diabetic patients (cohort register)	86 (80%)	5/6 (83%)	5/6 (83%)	8 (80%)	68 (80%)

Use of the cohort register across surveyed facilities appears relatively high; however, interview responses suggest the approach to register and document diabetes patients is not well-standardized, especially given these patients are seen by different departments depending on the facility, and the inconsistent use of the various data management tools observed across facilities likely drives significant gaps. For example, without proper use of the cohort register patients may be incorrectly registered twice upon return to clinic.

3.8.2. Monitoring & Evaluation

Key performance indicators for NCDs are incorporated into the national Health Management Information System (HMIS); every month, HMIS officers of each health facility are responsible for collecting data and reporting on these indicators to RHBs. Alongside this, there may be performance monitoring systems in place at health facilities. In one region, at the end of the month, a team at each facility evaluates the report with the quality team before it is shared upwards; if gaps are observed versus the plan, necessary actions will be taken to address them. The RHB monitors this activity by reviewing facility meeting minutes.

Multiple MOH representatives from the central and regional levels reported the national indicators in place for M&E of diabetes care are well-defined and reported to the health bureau, in line with Health Sector Transformation Plan II 2020/21-2024/25 (MOH, 2021) and the NCDs strategy. These include number of patients screened for diabetes, with raised blood glucose, enrolled to care, on different treatments (lifestyle modification, drug treatments), with controlled blood glucose, lost to follow up, and dead.

According to respondents from RHBs, for each facility, data from the quarterly HMIS report are generated and analyzed by the RHBs. Every quarter the RHB sends the report to regional health bureau senior management which provide written feedback based on the report. In addition, the RHB determines the activities' strengths and weaknesses and provides feedback to zonal health offices. The data is also used to inform decision-making, performance evaluation and strategy formulation.

Respondents reported a variety of strategies to build capacity and share ideas related to M&E: one RHB respondent reported cross-checking paper-based reports with DHIS2 data to identify any gaps which are then addressed via a mentoring system and the health facility is asked for a justification. Another noted a Telegram group was created to exchange ideas, experiences and suggestions on activities. At the facility level, high workload among the workforce was reported as a key driver of reporting challenges. Several respondents were unaware of the national indicators related to DM.

4. Recommendations

Several critical activities are recommended to strengthen the impact of DM services in Ethiopia, based on the results of this assessment. The following activities, which are in line with the NCD strategic plan, especially including decentralization of NCD management to primary health care facilities, are recommended for prioritization:

1. Commodity Selection
    a. Strengthen DTCs, especially at the lower levels of the health system, to perform functions critical to improving access to diabetes commodities, such as developing and executing appropriate medicines lists, and conducting adequate quantification, stock management, and procurement processes.
    b. To ensure improved access to the entire package of commodities required for DM management, MOH, should support health facilities, especially primary hospitals and health centers, on the development and regular update of facility-level medicines lists, based on the Ethiopian Essential Medicines List and the VEN framework.
2. Quantification
    a. To improve the accuracy of facility-level RDF commodity forecasting and supply planning, capacity building exercise on quantification should be expanded to more health facilities, especially at the lower levels, alongside improved dissemination of guidance documents, such as the written guide/manual for facility-level quantification, to these facilities.
3. Procurement
    a. Given budget constraints for procurement of DM commodities noted at the EPSS and facility level, it is recommended to explore additional funding and/or savings opportunities to increase volumes of DM commodities procured which will reduce morbidity and mortality from diabetes, unlocking further savings for the government and MOH.
4. Stock Management and Storage Practice
    a. To support improved inventory management at the central level, further investigation into commodity-specific inventory turnover ratio and line fill rate is recommended, plus qualitative investigation into the drivers of inaccurate order fulfillment. Opportunities to improve inventory turnover ratio and line fill rate should be explored, for example increasing the inventory turnover ratio by accessing lower prices during procurement and improving the line fill rate by reducing the gap between national-level and facility-level forecasted quantities, EPSS-forecasted quantities, and EPSS-procured quantities.
    b. Further investigation into specific drivers of poor storage conditions including associated costs, especially at lower-level health facilities, is highly recommended. Following this, interventions to address identified barriers should be explored and implemented, including consideration of integrated solutions across biologics requiring cold chain storage.

5. Service Delivery
    a. Awareness creation on the national NCDs strategy, and ensuring availability of guidelines and job aids, especially at lower level of the health care system is important to ensure access to decentralized and quality care to DM patients.
    b. Prioritization of developing and implementing a comprehensive evidence-based decentralization plan, as noted in the NCD strategy, is recommended to reduce the high burden of care at higher levels of the health system and reduce the proportion of patients experiencing complications that require treatment at higher levels of the health system. This can include an emphasis on:

- Efforts to improve access to diabetes commodities for health workers and patients in lower-level facilities, taking into account the package of diabetes services expected to be provided at each level of care.
- In-service training for HCWs at lower-level health facilities.
- Task shifting for more effective management in facilities with staff shortage.
- Strengthen mentorship for down referral of patients with controlled DM.

c. Further research be conducted to establish a more consistent method for measuring readiness of health centers for DM service delivery. This measurement should then be employed as a determinant for prioritizing interventions and as a source of information to guide the implementation of decentralization initiatives.
d. To close the 70% diagnosis gap for DM, it is recommended to increase availability of diabetes screening at lower levels of health system, in order to improve health outcomes and decrease costs associated with treating complications of diabetes.
e. Efforts to expand provision of counselling on self-monitoring of blood glucose for people using insulin will be important to overcome patient-side barriers to achieving blood glucose control. These should be complemented by interventions to increase access to insulin and particularly glucometers and strips, given the large observed gap in availability.
f. To support insulin treatment initiation and maintenance at lower levels of the health system, additional physicians at primary hospitals and health centers will be needed, alongside appropriate task shifting (e.g., via introduction of widespread capacity building for nurses). This should be complemented by establishing and disseminating a clear algorithm for insulin treatment initiation and titration.
g. Given the significant gaps in the availability of DM commodities identified at the health facility level, MOH should prioritize recommendations in other areas which are expected to have synergistic effects on facility-level supply, for example improving use of facility-level medicines lists based on the VEN framework across facilities, accurate quantification of required DM commodities at EPSS and health facilities, and successful procurement of required quantities of DM commodities especially at EPSS level.

6. Data Management and Monitoring and Evaluation
   a. Strengthening data management and M&E for diabetes at health facilities will be critical to ensuring future progress – and any barriers to success – are well-understood. Strengthening already existing platforms for data management (such as the cohort register and patient formats) and looking into alternative, more efficient data management options such as electronic platforms, at the facility level, will be a crucial step to drive data use for clinical decision making.

5. Conclusion and Next Steps

Taking place at mid-point in the strategy timeline, the landscape assessment findings shed important light on successes so far and areas to seek improvement by 2024/25.

This report intends to inform MOH, EPSS, regional health bureaus, and health facilities, as well as health professionals and development partners working on diabetes, on the status of the management of the supply chain of DM commodities, and on the availability and utilization of DM services at each level of the health system.

Therefore, this report is a tool to advocate for the implementation, especially at the lower levels of the health system, of policies laid out in the NCD strategy. The report highlights important opportunities for RHBs and facilities to work together to improve forecasting and distribution of DM commodities to better meet patient need. By shedding light on the current readiness level of lower-level health facilities to provide DM services, the report provides a reference guide to inform an MOH-led development of a framework for the decentralization and integration of DM services at the primary health care level. Critically, the results also inform recommendations on how forecasting and procurement of DM commodities at the central level can be strengthened to enable procurement of higher volumes that better reflect patient need, improving facility access to affordable, publicly procured commodities, and ultimately improving access to life-saving DM commodities for all those in need. As there is limited evidence on the status of DM service landscape in low- and middle-income countries, this study adds to evidence base and serves as an additional resource to inform the global scientific community about the landscape of DM in Ethiopia.

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Appendices

Annex I: List of individuals who contributed to the landscape assessment of Diabetes in Ethiopia.

Name	Organization	Contribution
Abdurahman Hussein	Jimma Zone Health Office	Data collection coordinator
Abebaw Ademe	Amhara Regional Health Bureau	Data collection coordinator
Addisu Worku	Ministry of Health	Reviewer & data collection supervisor
Afendi Ousman	Ministry of Health	Reviewer & data collection supervisor
Ajema Bekele	Ethiopian Food and Drug Administration	Reviewer
Amanuel Yadesa	Oromia Regional Health Bureau	Reviewer & data collection supervisor
Bekele Boche	Independent Consultant	Data collector
Biniam Bahiru	Ministry of Health	Reviewer
Clarke Bhandari Cole	CHAI Global	Data analysis & report writing
Demisew Beyene	Independent Consultant	Data collector
Dr. Barkhad Abdi	Independent Consultant	Data collector
Dr. Deribew Fikadu	Independent Consultant	Data collector
Dr. Getahun Tarekegn	Ethiopian Diabetic Association	Reviewer
Dr. Mussie G/Michael	Ministry of Health	Reviewer & data collection supervisor
Dr. Yordanos	Independent Consultant	Data collector
Eshetu Bekele	CHAI Ethiopia	Reviewer
Eyerusalem Abate	Addis Ababa City Administration Health Bureau	Data collection coordinator
Fana Birhanu	Bale Zone Health Office	Data collection Coordinator
Fisseha Abebaw	Amhara Regional Health Bureau	Reviewer & data collection supervisor
Fozia Mohammed	Ethiopian Pharmaceutical Supply Services	Reviewer & data collection supervisor
Gachana Mideksa	Independent Consultant	Data collector
Girma Teketelew	Independent Consultant	Data collector
Gizew Dessie	Independent Consultant	Data collector

Habtamu Beyene	Ethiopian Food and Drug Administration	Reviewer
Haileyesus Wossen	Independent Consultant	Data collector
Hewan Abnet	CHAI intern	Data manager
Jemal Siraj	Arsi Zone Health Office	Data collection coordinator
Margaret Prust	CHAI Global	Guidance on data analysis
Miratu Hailu	Independent Consultant	Data collector
Nahom Solomon	Independent Consultant	Data collector
Nigussie Mengistu	South Gonder Zone Health Office	Data collection coordinator
Nine Steensma	CHAI Global	Reviewer
Dr. Okechukwu Amako	CHAI Global	Data analysis & report writing
Oliyad Kebede	Independent Consultant	Data collector
Rahma Abubeker	Somali Regional Health Bureau	Data collection coordinator
Salem Fisseha	CHAI Ethiopia	Reviewer
Solomon Abdella	Independent Consultant	Data collector
Tsegamlak Zerihun	Ethiopian Diabetic Association	Reviewer
Wondwosen Berhe	Addis Ababa City Administration Health Bureau	Reviewer & data collection supervisor
Yeshiemebet G/Giorgis	Independent Consultant	Data collector

Annex II: Consent Script

Hello, my name is_____.

You are invited to take part in a study. Let me explain a little about the study. The study is aimed at assessing the Landscape of diabetes in Ethiopia. I am a data collector for the study, which is conducted collaboratively among MOH and CHAI.

I would like to speak with you for few minutes. Do you have a few minutes to listen?

[If no] Thank you for your time. Have a nice day!

[The data collector notes refusal in key informant recruitment sheet]

[If yes], the data collector begins the next step below.

"I will ask you some questions about Landscape of diabetes mellitus in Ethiopia, including the supply chain management of diabetes commodities, and availability and utilization diabetes service at health facilities. "I will take some notes and tape record the discussion without recording your name or place of work. All the collected data will be kept confidential". "If you do not want to participate, it will not affect your job or benefit.

Are you interested in learning more about this study?"

[If no]: "Ok, Thank you for your time. Have a good day!

[Interviewer notes refusal on the recruitment sheet]

[If yes]: "Ok I will tell you more about the study. Then you can tell me whether you agree to participate."

[Immediately the data collector will proceed to explaining the details of the study as indicated below]

Study Title: Assessment of the landscape of diabetes mellitus in Ethiopia**.**

Aim

To assess the supply chain of insulin and other diabetes mellitus commodities, and the availability and utilization for diabetes mellitus related services at public health facilities in Ethiopia.

What We Will Do?

If you participate in this study, I will ask you some questions to discuss on diabetes mellitus in Ethiopia. I will take some notes and tape record the discussion without recording your name or place of work.

Time Needed

The consent process takes about 10 minutes, and the discussion takes about 45 minutes.

Confidentiality of Data

I will facilitate the discussion, and no one will be present with me. The discussion will take place in a private space, and I will record ad write your response, but not your name. I will keep your responses confidential. I will not show to anyone at this facility or other facilities. I will submit the collected information to the study team, and the study team will enter the data in a computer. The final report on the study will not have any information about individual participants and their organizations.

Risks/Discomforts

The study will not affect your job in any way. All measures will be taken to keep the collected data confidential. Your name or your organization will not be recorded. The collected data will not be shared to anybody outside the study team.

Benefits

Benefits to you

You will receive no direct benefit from the study. But you may get some satisfaction from knowing that the findings from this study may help to improve the quality of diabetes care provided to patients at health facilities.

Benefits to the society

The result of this study is expected to inform MOH, EPSS and health facilities as well as health care providers to ensure availability of diabetic commodities and quality diabetic care services at health facilities in Ethiopia

Voluntary Participation

You are free to choose to participate or not. You do not have to answer any question that you do not want to. You can change your mind and stop participation at any time. If you decide not to participate or stop participation at any stage of the data collection, it will not affect you personally or your organization.

Who should you call for more information, if you have questions, concerns, or problems?

If you have questions about the study, you can ask me now or anytime during the study. If you have concern about your rights or want to obtain more information, you can contact the principal investigator, Dr Yared Tilahun, at phone: +251 911244390, or email; ytilahun@clintonhealthaccess.org

Additionally, if you have concerns about your right as a study participant can contact the regulatory body for this research (AAERC IRB) at ahri.alerterc@ahri.gov.et or phone no. +251118342742

Permission to Proceed

May I have your permission to proceed with the study?

Agree [ ] Refused [ ]

[If the participant refuses, note the refusal and contact the next potential participant]

[If the participant agrees, continue with the interview]

Annex III: Tool for Collection of quantitative data from Health Facilities

Instructions:

- Meet with the facility manager, present the support letter from MOH/RHB and explain the objective and process of data collection, and your role to obtain permission to proceed.
- With the support of the facility manager meet with the pharmacy head and NCD coordinator, explain the objective and process of the data collection and obtain their verbal consent to proceed.
- Complete this tool by reviewing appropriate records/documents, interviewing the pharmacy head, pharmacy store man and the NCD coordinator as appropriate.
- Make sure that your data is complete and accurate before leaving the health facility.

Part I: General Information			
NO	**Questions**	**Response**	**Skip**
G1	Enumerator ID	----------	
G2	Health facility ID	----------	
G3	Date of Visit (D/M/Y) (Use Gregorian calendar)	----------	
G4	Type of Facility	A. Referral hospital B. General hospital C. Primary hospital D. Health Center	
G5	What is the type of Health center?	A. Type A B. Type B C. Type C D. Not categorized	For HCs only, go to G6 otherwise
G6	Catchment population of the health facility (2015 EFY)	----------	
G7	Region	A. Addis Ababa B. Amhara C. Oromia D. Somali	
G8	Zone	A. Arada B. Gulele C. Yeka D. East Gojam E. West Gojam F. South Gondar G. Arsi H. Bale I. Jimma	Link the zones to respective regions under G8 as indicated below A-C ----Addis Ababa D-F …… Amhara G-I…. Oromia J-K---- Somali

Part II: Diabetic Commodities Supply Chain management			
NO	**Questions**	**Response**	**Skip**
S1	Is DTC established at the health facility?	A. Yes B. No	If No go to S3
S2	Is the DTC functional? A. Assigned members by official letter B. Has approved TOR C. Met at least once per month with documented minutes (check minutes)	 A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No	

	D. Developed action plan E. Conducted supply and medicine use problem studies in 2014 EFY? F. Took action based on medicine use study findings G. Reported its performance to management	D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No	
S3	Is there a health facility-specific medicines list?	A. Yes B. No	If No go to S6
S4	If 'yes' to S3 the facility-specific medicines list categorized based on VEN?	A. Yes B. No	
S5	If 'Yes' to S3, review the list and identify which of the following diabetes commodities are included in the list A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Long-acting analog insulin E. Insulin syringe F. Glucometer G. Glucometer strip H. Lancet I. HbA1C reagent J. Metformin K. Gelebenclamide	A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No K. A. Yes B. No	
S6	Does the health facility do quantification of medicines and medical devices?	A. Yes B. No	If No go to S9
S7	If yes to S6, identify the forecasted and consumed quantities for the following diabetic commodities for the past fiscal year (Hamle 1, 2013 to Sene 30 2014, EFY) A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Long-acting analogue insulin E. Insulin syringe F. Glucometer G. Glucometer strip H. Lancet I. HgA1C reagent J. Meftormin K. Glebenclamide	**Forecasted Consumed** **(For 2014 EFY)** A. ---------- ---------- B. ---------- ---------- C. ---------- ---------- D. ---------- ---------- E. ---------- ---------- F. ---------- ---------- G. ---------- ---------- H. ---------- ---------- I. ---------- ---------- J ---------- ---------- K, ---------- ----------	
S8	Is there a written manual/guideline that is used for facility-level quantification? (if yes, check the document)	A. Yes B. No	

S9	Who are the main suppliers of the following diabetic commodities for the health facility? (based on quantity) A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Long-acting analog insulin E. Insulin syringe F. Glucometer G. Glucometer strip H. Lancet I. HGA1C reagent J. Metformin K. Glebenclamide	 A. A. EPSS B. Other suppliers B. A. EPSS B. Other suppliers C. A. EPSS B. Other suppliers D. A. EPSS B. Other suppliers E. A. EPSS B. Other suppliers F. A. EPSS B. Other suppliers G. A. EPSS B. Other suppliers H. A. EPSS B. Other suppliers I. A. EPSS B. Other suppliers J. A. EPSS B. Other suppliers K. A. EPSS B. Other suppliers	
S10	What was the average lead time for diabetic commodities procured from EPSS (in days)? Take the average of recent 3 orders	----------	
S11	What was the average lead time for diabetic commodities procured from other suppliers (in days)? Take the average of recent 3 orders	----------	
S12	What was the stock out duration (in days) of the following diabetic commodities in the past fiscal year? A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Long-acting analog insulin E. Insulin syringe F. Glucometer strip G. Lancet H. HGA1C reagent I. Metformin J. Glebenclamide	 A. ---------- B. ---------- C. ---------- D. ---------- E. ---------- F. ---------- G. ---------- H. …… I. …… J. ……	
S13	Is there unusable stock (expired or damaged) of the following diabetic commodities at the time of visit? A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Insulin syringe E. Glucometer F. Glucometer strip G. Lancet H. HgA1C reagent I. Metformin J. Gelebenclamide	 A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No	
S14	What is the overall wastage rate (%) of the following products at the facility for the past fiscal year? A. Insulin regular B. Insulin NPH C. Insulin mixed (biphasic) D. Long-acting analog insulin E. Insulin syringe F. Glucometer strip	Value of ending balance in 2013 A. _____ B. _____ C. _____ D. _____ E. _____ F. _____	Value of total received stock in 2014 A. _____ B. _____ C. _____ D. _____ E. _____ F. _____	Value of unusable stoke in 2014 A. _____ B. _____ C. _____ D. _____ E. _____ F. _____

	G. Lancet H. HgA1C reagent I. Metformin J. Gelebenclamide	G. _____ H. _____ I. _____ J. _____	G. _____ H. _____ I. _____ J. _____	G. _____ H. _____ I. _____ J. _____
S15	Are the following conditions maintained for storage of diabetic commodities at the main storage area? A. Products arranged on shelves with arrows pointing up and with identification labels and expiry dates clearly visible B. Products are organized to FEFO procedure and accessible for general stock management C. Outer packages (like cartons) are in good condition D. Damaged and expired products are separated from others E. Products are stored in a dry, well-ventilated storeroom F. Products and cartons are protected from direct sunlight G. No evidence of rodents or insects accessing the storage area H. Storage area is well secured (lock and key, window grills, limited access to authorized person) I. Room is clean with all trash removed, no evidence of food and drinks, all boxes and shelves are neat J. There is adequate space for storage of products K. Drugs, reagents, inflammables and other chemicals are stored separately L. Temperature and humidity is regularly monitored in the storeroom M. Insulin and other biologicals are stored in refrigerator according to manufacturer's recommended condition	A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No A. Yes B. No		
S16	Are bin cards available for all products in the store?	A. Yes B. No		If 'No', skip to 'Part III'
S17	If yes S16, are bin cards in the store updated for all diabetic commodities?	A. Yes B. No		

Part III: Diabetes Service Availability

NO	Questions	Response	Skip
A1	Where do you provide service for diabetic patients?	A. OPD clinic B. NCD clinic C. Chronic OPD D. DM clinic Other, specify_____	
A2	How many of the following health professionals do you have to provide diabetes service (per rotation)? (For Primary Hospitals and HCs only) A. Internist B. General practitioner C. Family physician D. Health officer E. Nurses F. Pharmacy professional	A. ---------- B. ---------- C. ---------- D. ---------- E. ---------- F. ---------- G. ----------	Skip A2 for General and specialized Hospitals

	G. Lab professional		
A3	How many of the following health professionals do you have to provide diabetes service? (Per rotation)? (For General and specialized hospitals) A. Endocrinologist B. Nephrologist C. Neurologist D. Cardiologist E. Ophthalmologist F. Obstetrician G. Pediatrician H. Orthopedist I. Podiatrist J. Dietician K. Internist L. General practitioner M. Family physician N. Nurses O. Pharmacy professional P. Lab professional	A. ---------- B. ---------- C. ---------- D. ---------- E. ---------- F. ---------- G. ---------- H. ---------- I. ---------- J. ---------- K. ---------- L. ---------- M. ---------- N. ---------- O. ---------- P. ----------	Skip A3 for primary hospitals and HCs
A4	How many staff got in-service training on diabetes management? (check document at training committee/officer) A. Internists B. General practitioners C. Family physicians D. Health officers E. Nurses F. Pharmacy professionals G. Lab professionals	A. ---------- B. ---------- C. ---------- D. ---------- E. ---------- F. ---------- G. ----------	
A5	Are the following materials (guidelines, protocols, aids) available at the clinic for diabetes service provision? (check availability of the documents) *Mark all that apply* A. National NCD management protocol B. National standard treatment guideline C. Facility-level diabetic treatment guideline D. Diabetes training participant manual E. Ethiopian PHC clinical guideline (EPHCG) F. Diabetes treatment algorisms G. Health education materials-flyers H. Health education materials-Audios and Videos I. Health education materials-posters J. National Diabetic patient intake form K. Screening tally sheet L. Patient follow up form M. Registry (cohort)for diabetic patients N. other, specify----------	A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No K. A. Yes B. No L. A. Yes B. No M. A. Yes B. No	
A6	Are the following equipment available for diabetes service? A. Adult weight and height scale	A. A. Yes B. No	

	B. BP apparatus C. Stethoscope D. Measuring tape E. Glucometer (with strips and lancet) F. ECG G. Ophthalmoscope H. Monofilament I. Fundus camera J. Reflex hammer	B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No	
A7	Are the following diagnostics available at the health facility for diabetic service? /For primary Hospitals and Health Centers/ A. Blood glucose B. HbA1C C. CBC D. Urine analysis E. Urine dipstick F. Electrolyte (K+) G. Renal function test (creatinine and BUN) H. LFT (SGOT, SGPT, ALP)	A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No	Skip A7 for Specialized and General Hospitals
A8	Are the following diagnostics available at the health facility for diabetic service? For general and referral Hospitals A. Blood glucose B. HbA1C C. CBC D. Urine analysis E. Urine dipstick F. Electrolyte (K+) G. Renal function test (creatinine and BUN) H. Lipid profile I. LFT (SGOT, SGPT and ALP) J. OGTT (75 gm) K. Thyroid function test L. Vitamin B12 level	A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No K. A. Yes B. No L. A. Yes B. No	Skip A8 for primary hospitals and HCs
A9	Are the following medications currently available at the health facility? A. Insulin-Regular B. Insulin-NPH C. Insulin mixed (biphasic) D. Insulin long-acting analog E. Metformin F. Glibenclamide /glimepiride G. Normal saline (NS) H. Dextrose in water (DW) I. 40% glucose J. Potassium chloride K. Multivitamin	A. A. Yes B. No B. A. Yes B. No C. A. Yes B. No D. A. Yes B. No E. A. Yes B. No F. A. Yes B. No G. A. Yes B. No H. A. Yes B. No I. A. Yes B. No J. A. Yes B. No K. A. Yes B. No	
Part IV: Diabetes Service Utilization			
NO	**Questions**	**Response**	**Skip**

U1	Is diabetes screening done at the health facility?	A. Yes B. No	If no skip to U4
U2	If 'yes' to U1, what is the target population? *Mark all that apply.*	A. All clients visiting health facility B. All adults C. All adults > 40 years D. Adults < 40 years & BMI ≥ 25 Kg/m^2 E. HIV patients F. Patients with CV disease G. Women with history of gestational diabetes H. First degree relatives with diabetes and BMI ≥25 kg/m^2 I. Those with hypertension J. General population K. Others, specify_____	
U3	If 'yes' to U1, where is screening done? *Mark all that apply*	A. At triage B. Emergency OPD C. NCD clinic D. Adult OPD E. Pediatric OPD F. Adult wards G. Pediatric Ward H. MNH clinic I. During home visit/outreach service J. Other, specify_____	
U4	For patients requiring insulin, where is initiation done? (For Health centers only)	A. At the health center B. Referred to hospital	Skip this question for hospitals
U5	How many diabetic patients do you have (disaggregated by type, age and sex)? Review chart/register A. Type 1 diabetes-children (<13 years) B. Type 1 diabetes- Adults C. Type 2 Diabetes-children D. Type 2 diabetes-Adults E. Gestational F. Other types of diabetes-children G. Other types of diabetes-Adult H. Total patients	**Male** **Female** A. ---------- ---------- B. ---------- ---------- C. ---------- ---------- D. ---------- ---------- E. ---------- ---------- F. ---------- ---------- G. ---------- ---------- H. ---------- ----------	
U6	How many of the above diabetic patients are on insulin? A. Type 1 diabetes-children B. Type 1 diabetes- Adults C. Type 2 Diabetes-children D. Type 2 diabetes-Adults E. Gestational F. Other types of diabetes -children G. Other types of diabetes -adult	A. ---------- B. ---------- C. ---------- D. ---------- E. ----------	

	H. Total patients on insulin	F. ---------- G. ---------- H. ----------	
U7	Of the diabetic patients how many have controlled blood glucose level? A. Children B. Adults	A. ---------- B.----------	
U8	How many patients are referred to higher level due to each of the following reasons in the 2014 EFY? *For HCs and primary Hospitals only* A. Acute complications B. Chronic complications C. Insulin initiation D. Comorbidities E. Other reasons, specify	A. ---------- B. ---------- C. ---------- D. ---------- E. ----------	Skip U8 for general and specialized Hospitals
U9	How many patients are referred to your facility due to each of the following reasons in the 2014 EFY? *For general and referral Hospitals only* A. Acute complications B. Chronic complications C. Insulin initiation D. Comorbidities E. Other reasons, specify	A. ---------- B. ---------- C. ---------- D. ---------- E. ----------	Skip U9 for Primary Hospitals and HCs
U10	How often does your facility see patients using insulin for follow up?	_____	
U11	How often does your facility advise patients using insulin to self-test their blood glucose?	_____	

Annex IV: Key informant interview Guide

A. For MOH, RHBs and Ethiopian Diabetes Association

1. To what extent is the national NCD strategy and associated policies and guidelines being implemented?
2. To what extent are diabetes service decentralized? Please describe. Is the service package defined for each level of service delivery/health facility?
3. Are there health facilities that don't provide diabetes care? what are the reasons?
4. Are there appropriate structures for provision of diabetes service at Bureaus and facility level?
   - What type of structure is there at each level for management and provision of diabetes service?

- To what extent are the available positions for NCD in general and diabetes filled with qualified personnel at each level?

5. Are there guidelines, protocols and job aids for management of Diabetes programs and provision of diabetes services at facility level?
   - Availability of diabetes protocol by level of health facility
   - Availability of job aids for patient education and community awareness reaction
6. What are the key challenges in diabetes management for patients at home?
   - Probe on issues around availability of insulin, glucose monitoring strips/devices, syringes; probe on issues around ability/knowledge to manage & titrate dosage; availability of support close to home.
7. What solutions do you propose to the challenges mentioned in questions 5 and 6 above?
8. What M&E system is in place for diabetes?
   - To what extent are indicators defined and reported
   - Alignment of reportable indicators with the HSTP and NCD stagey indicators
   - Utilization of service delivery data for informed decision
9. What are the key challenges in diabetes service provision
   - Prob on policies, training for healthcare workers, availability and affordability of medicines and other patient commodities, availability of diagnostics and other products required by facilities, screening, patient follow-up, availability of services at Primary Health Care level, etc.

B. For EPSS

1. Describe the national quantification process for RDF products including diabetic commodities
   - Who will lead the process?
   - Which stakeholders are involved? Describe the role of each stakeholder
   - When does it takes place and how long will it take?
   - What guideline and job aids are used in the process?
   - What data sources are used?
   - How do you validate the forecast amount?
2. How do you evaluate the quantification accuracy of RDF products?
   - Was procurement conducted as per the quantification plan?
   - What are the main reasons for the difference between forecast amount and actual procurement?
3. What are the key challenges in quantification of RDF products, and what solutions do you propose?
4. Describe the national procurement process of RDF products including diabetic commodities
   - Who will lead the process?
   - Which stakeholders are involved? Describe the role of each stakeholder
   - How often will it take place in a year?
   - How long will it take place?
   - How are prices set through the procurement process?
   - How are suppliers selected through the procurement process? Are there certain requirements or preferences?
   - What are the main challenges in procurement of RDF products (prob on custom clearance, budget, regulatory issues, etc.)
5. How are final decisions made on how much is purchased?
   - How is the budget for procuring these commodities set?
   - Who is the final decision-maker?
   - What data sources and factors are taken into account, in addition to the quantification/forecast itself, when deciding how much to purchase?
6. What are the main mark-ups in the procurement and distribution of RDF products?

- What costs beyond procurement price need to be considered, and which are the most significant, e.g., duties and import taxes)?

7. Which diabetic commodities are included in the national procurement list? If syringes, lancets, blood glucose monitors and strips are not included, why not?
8. How do you select suppliers for RDF products included diabetic commodities?
   - Do you have preferred suppliers for the following diabetic commodities?
     - Insulin
     - Insulin syringe
     - Glucometer and strips
     - HbA1c reagent
9. What are the key challenges in national procurement of diabetic commodities? What solutions do you propose for the challenges?
10. How do you distribute RDF products to health facilities?
    - Describe the role of EPSS and health facilities in the distribution process
    - What are the main challenges? What solutions do you propose?
11. Describe the inventory management practice for RDF products
    - What inventory control system is used? Please describe
    - How is the SCM process monitored and evaluated?
12. What are the main drivers of stockouts of RDF products?

C. For Health Facilities

1. Describe the quantification process for diabetic commodities
   - Who will lead the process?
   - Which units/departments are involved? Describe the role of each unit/department
   - When does it takes place and how long will it take?
   - What guideline and job aids are used in the process?
   - What data sources are used?
   - How do you validate the forecast amount?
2. What are the key challenges in quantification of diabetic commodities? What solutions do you propose?
3. Describe the procurement process for diabetic commodities
   - Who leads the process?
   - Which units/departments are involved? Describe the role of each unit/department?
   - How often does it take place in a year?
   - How long does it take?
4. How are final decisions made on how much is purchased?
   - How is the budget for procuring these commodities set?
   - Who is the final decision-maker?
5. What data sources and factors are taken into account, in addition to the quantification/forecast itself, when deciding how much to purchase? How are decisions made on how much is purchased?
   - How data sources, experts and influential stakeholders are involved, how is budget set and how does this influence purchasing decisions”
6. Which diabetic commodities are included in the facility-level product list? If blood glucose monitors and strips are not included, why not?
7. How do you select suppliers for diabetic commodities?
   - Do you have preferred suppliers for the following products?
     - Insulin
     - Insulin syringe
     - Glucometer and strips
     - HbA1c reagent

8. What are the key challenges in procurement of diabetic commodities? What solutions do you propose for the challenges?
9. Describe the inventory management practice for RFA products
    - What inventory control system is used? Please describe
    - Who do you monitor and evaluate the SCM process?
10. What are the main drivers of stockouts of RDF products?
11. What national guidelines/documents are available to guide/lead diabetes service provision in the region?
12. What are the service packages you have for diabetic patients?
13. What activities are there on awareness creation and screening of diabetes at facility and community level? Please describe each activity
    - Where and how you do awareness creation/
    - How you do diabetes screening? What are the target population for screening?
    - What challenges did you face on awareness creation and screening of diabetes?
14. How do you put patients on insulin for type 2 diabetes?
    - What criteria do you use to initiate insulin for type 2 diabetic patients?
    - What are the practical challenges in putting patients on insulin?
    - What are the reasons, often mentioned by patients, not to be on insulin?
    - How do you convivence them if they resist? What strategies do you use?
    - What should be done to improve on this?
15. How well is the blood glucose level controlled for diabetic patients on medications?
    - What strategies best work to ensure blood glucose is well controlled?
    - What are the main reasons for poor blood glucose control? Prove on provider and client perspectives
16. How do you document and report diabetes services?
    - How do you register, and document diabetes service provided at the facility?
    - How do you analyze/summarize and report your performance? What are the nationally reportable indicators?
17. What challenges are experienced in providing services to patients, e.g., in terms of screening/diagnosis, referral, treatment initiation, monitoring and follow-up, and at-home management

Annex V: Data Abstraction Template on Quantification, Procurement and Import of Diabetes Commodities

Target products: Regular insulin (vials, Pen), NPH insulin (vials, pen), biphasic insulin, HgA1C reagent, glucometer, glucometer strip and lancet

Part I: forecasted/Quantified amount of selected diabetic commodities					
Product name	**Forecast amount**				
	2014	2013	2012	2011	2010
Regular Insulin (Vials)					
Regular Insulin (PEN)					
Insulin Biphasic (mixed)					
NPH insulin (Vials)					
NPH insulin (PEN)					
Insulin syringe					
HgA1c reagent					
Glucometer					
Glucometer strip					
Lancets					
Part II: Budget allocated for each diabetes commodities					
Product name	**Allocated Budget**				
	2014	2013	2012	2011	2010
Regular Insulin (Vials)					
Regular Insulin (PEN)					
NPH insulin (Vials)					
NPH insulin (PEN)					
Biphasic insulin					
Insulin syringe					
HgA1c reagent					
Glucometer					
Glucometer strip					
Lancet					
Part III: Actual procurement of diabetic commodities					
Product name	**Amount procured**				
	2014	2013	2012	2011	2010
Regular Insulin (Vials)					
Regular Insulin (PEN)					
NPH insulin (Vials)					
NPH insulin (PEN)					

HgA1c reagent					
Glucometer					
Glucometer strip					

Part IV: EPSSS performance indicators related to product availability for RDF products

Indicators	Annual Results (values)				
	2014	2013	2012	2011	2010
Procurement lead time					
Product wastage rate					
Line fill rate					
Inventory turnover rate					
Forecast accuracy					

Part IV: Diabetes Commodities imported by Private importers

Product name	Applicant (importer / Distributer)	Manufacturer	Country of Origin	Qualification status	Volume imported/distributed (EFY)					Unit cost
					2014	2013	2012	2011	2010	