Systems integration and decentralization of commodity management; A case of Kenya Medical Commodities supply chain.

Kenya Medical supplies authority (KEMSA) is a state owned corporation mandated to establish and maintain a reliable supply chain for all essential medicines and medical supplies in Kenya. KEMSA is currently in a 5 year USD 650 million contract with USAID. The Medical commodities program (MCP) currently in its 4th year of operation. The program's mandate is to establish and maintain a reliable supply chain for HIV/AIDS, Malaria, Nutrition and laboratory commodities. The contract is the first largest contract globally for USAID to award to a local contractor.

Intervention 1: Systems Integration

Since 2012, The Kenyan health supply chain is has gone through various maturity phases to ensure supply chain reliability especially for the people living with HIV/AIDs in Kenya. An estimated 1.5 million people are living with the virus with 1.2 million on lifelong treatment .In 2015 a major milestone was achieved where parallel supply chains were collapsed to one unified supply chain, albeit many information systems that were in use remained parallel and in operation.

Before the amalgamation of parallel supply chains to one, each supply chain had its own information management system. Different information systems brought complexity in information management coupled to lack of end-to-end visibility of data. Each sponsor of the systems made specific demands to the end user, a fact that put unnecessary strain to the facilities. There were instances where facilities were required to enter data in each of the system resulting to double work. The program in collaboration with NASCOP, donors and implementing partners began the journey to system integration. The process began by mapping all the available systems and their functions. Through the leadership of MOH, key systems were allocated specific mandates and smaller systems decommissioned. Integration was made possible with the creation of APIs between systems that made it possible for data exchange and interoperability.

Table 1: Current information systems in use in the Kenyan Programs supply chain.

Supply chain information system	Functional Objective
Kenya Health information system (KHIS)	Owned by the Ministry of health, KHIS is the sole Primary data entry platform at facility level. Contains both commodity and service data.
Commodity Management Information System (CMIS)	CMIS is the allocation platform where Counties validate data from facilities and quantify the quantities required for supply
Logistics management information system (LMIS)	LMIS is the order-processing platform that conveys orders to the warehouse. LMIS contain stock status, provides advance shipment notifications and links the facilities with the Central warehouse
Warehouse Management System (WMS)	WMS maintains the inventory, the platform facilitate order picking and packing

Enterprise Resource planning (ERP)	ERP platform facilitates the upper end support functions of procurement, human resource management and finance.

Figure 1 : Parallel Commodity Information Systems at facility and National Level before systems integration

Parallel Commodity Information Systems
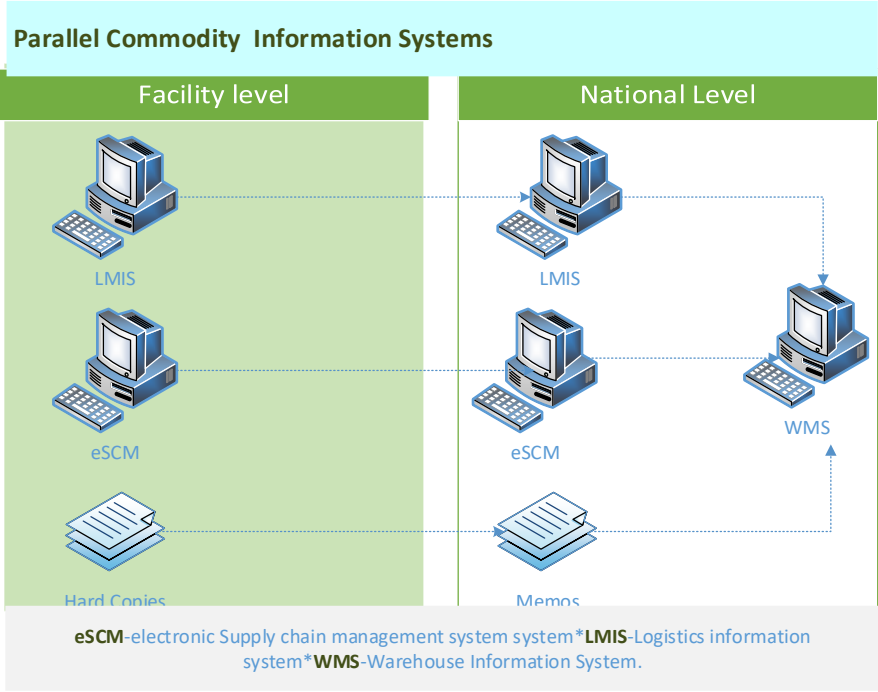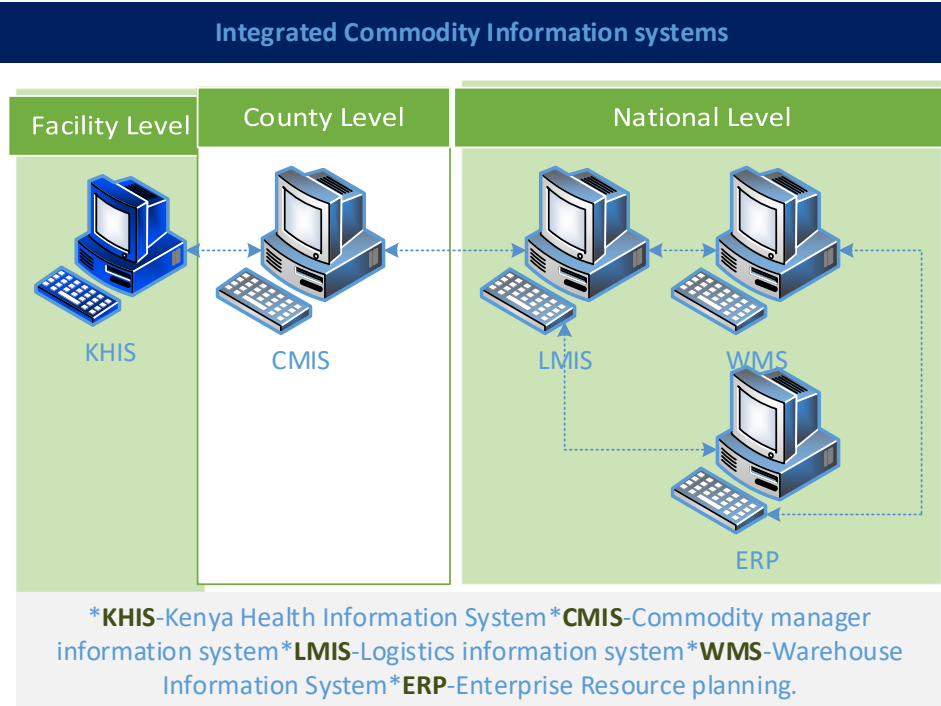
Facility level — National Level

LMIS — LMIS — WMS

eSCM — eSCM

Hard Copies — Memos

eSCM-electronic Supply chain management system system*LMIS-Logistics information system*WMS-Warehouse Information System.

Figure 2: Integrated information systems across the supply chain

Integrated Commodity Information systems

Facility Level — County Level — National Level

KHIS — CMIS — LMIS — WMS — ERP

*KHIS-Kenya Health Information System*CMIS-Commodity manager information system*LMIS-Logistics information system*WMS-Warehouse Information System*ERP-Enterprise Resource planning.
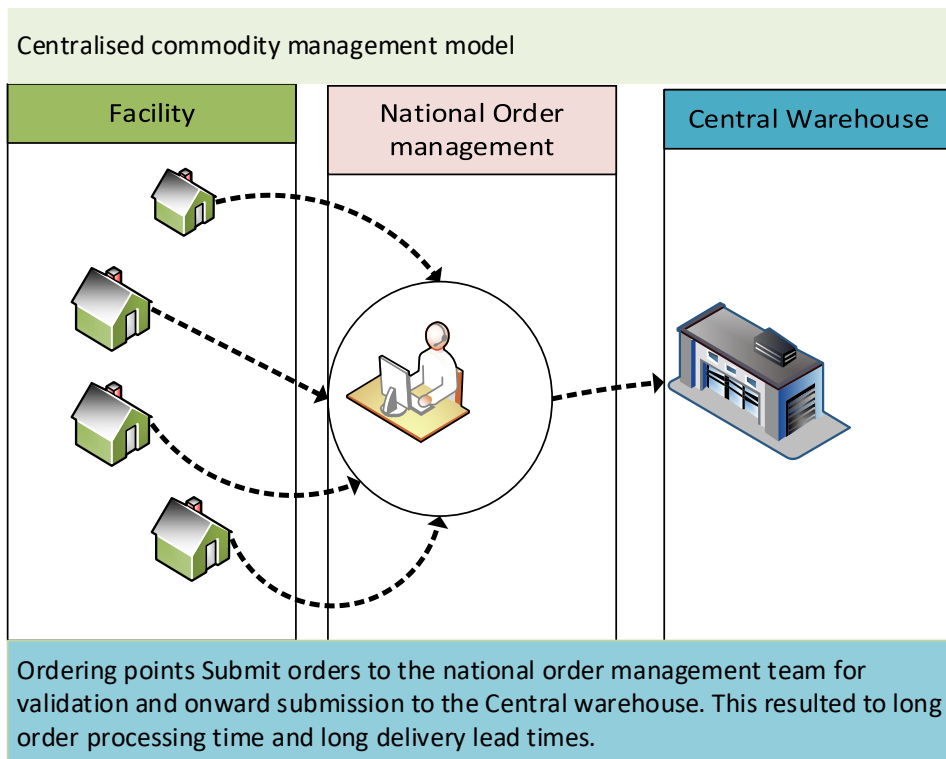
System integration enhanced end-to-end data visibility by all stakeholders enhancing decision making at facility, sub-county, county and national levels. The achievement of this milestone laid the foundation for decentralization of commodity management roles to the lower end of the supply chain.

Intervention 2: Decentralisation of commodity management

After successful system integration, the program in collaboration with other partners embarked on a six-month initiative to train Counties on the commodity allocation process. The process began with a pilot to five Counties and consequent roll out to the entire country through 3-day clustered workshops to train County and Sub county Pharmacists on the CMIS. At the end of the process commodity, management role was devolved to 47 counties. This initiative aimed at unlocking the 'bottle neck' effect that caused order-processing delays. After decentralisation, there were marked improved reporting rates, and improved data quality.

"Bottle neck," order management and commodity management model before decentralisation.

Centralised commodity management model

| Facility | National Order management | Central Warehouse |

Ordering points Submit orders to the national order management team for validation and onward submission to the Central warehouse. This resulted to long order processing time and long delivery lead times.

Order management and commodity management model after Decentralisation

Decentralised commodity management model		
Facility order submission	**County order management**	**Central Warehouse**
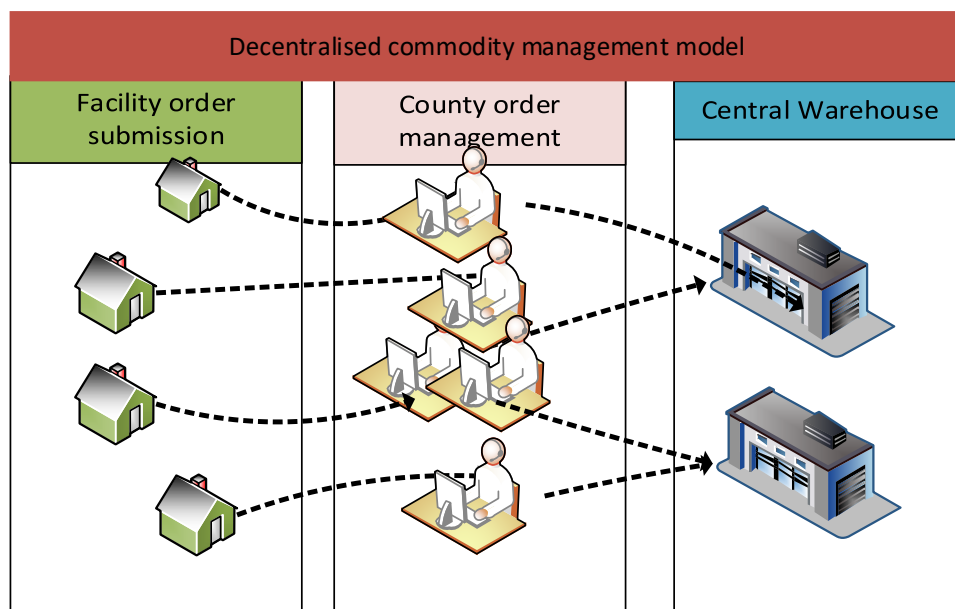
Unlike the previous model where all orders were managed by a team at the national level ,ARVs orders are now managed at each of the 47 Counties who are tasked to ensure timely ,complete and accurate submission of reports by their facilities. This has enhanced accountability, data ownership and improved inventory management at the facility level.

The interventions aimed to:

1. Enable end-to-end visibility of data for quick and infirmed decision-making
2. Improve the order processing turnaround time
3. Improve data accuracy, completeness and timeliness
4. Eliminate stock out occasioned by gaps in the order processing cycle
5. **Improve overall supply chain efficiency**

Performance metrics.

	Performance Indicator	Target	Year 4 achievement	Achievement
1	Stock outs at ordering sites as a result of inaccurate forecast or failure in order management process by the Program	ARVs/OIs: 0%	ARVs/OIs: 1%	The program maintained adequate stock level at facilities for all the main ARV items. Although stock-out was experienced on LPV/r 100/25 mg, Amphotericin B inj, Nevirapine Syrup and Rifabutin. The program reached out to facilities with excess stocks to redistribute to facilities where they did not have.
2	Customer complaint resolution cycle time	3 Days	2.1 Days	Decentralisation enabled prompt responses to complaints since Counties were empowered through sensitization and training to handle emerging issues.

3	Percentage of facilities with monthly reporting and data quality issues identified and resolved	100%	100%	Data validation checks at the point of entry ensured completeness and accuracy. County teams assisted all facilities with data gaps during monthly order processing reviews.
4	Order Turnaround time in network days from receipt in the warehouse to delivery at facility level.	5 Days Lab commodities:8 Days	7.2 Days	Improved order processing efficiencies improved over lead times.
5	Emergency orders serviced within 48 hours	90.00%	61.00%	In quarter three, 48 out of 79 orders were delivered within 2 days after receipt of order, translating to 61% timeliness. The delays were occasioned by single item stock out due to supplier delays.
6	Percentage value of expired ,damaged and lost items in the warehouse (Year to Date)	<1%	0.07%	The program through efficient commodity management ensured no expiry was reported during the quarter.
7	Cost savings and operational efficiencies			Efficient order management enabled order consolidation; co-loading and routing of program orders was made possible through improved order management, which help improve supply chain efficiency and cost reduction.

Project implementation and monitoring

The implementation plan adopted the PDCA improvement cycle model

Planning: These interventions were agreed upon after extensive consultations and brain storming forums involving all the key stakeholders in the supply chain including Ministry of health, National program, Supply chains, donors and other development partners.
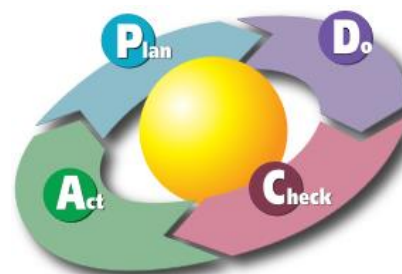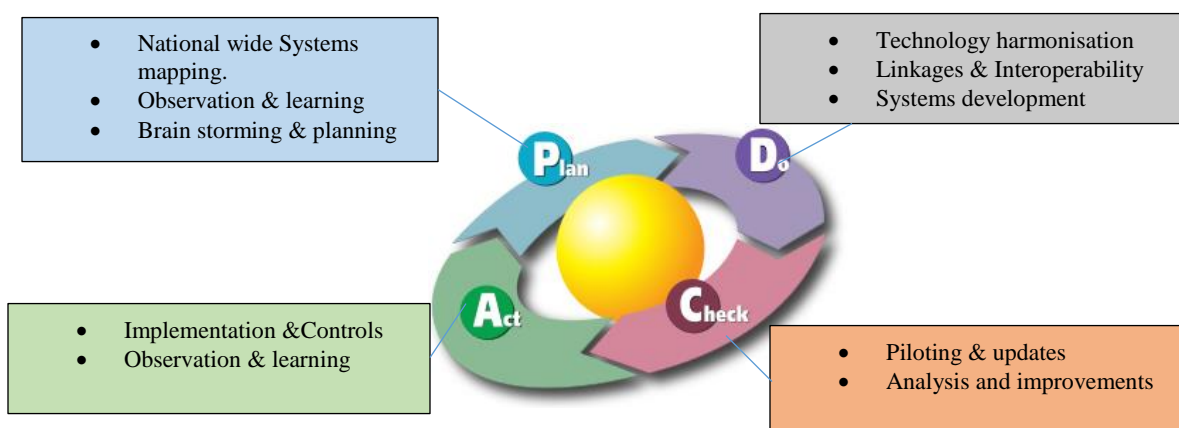
USAID provided the funds required to carry out the two interventions of system intervention and decentralisation of commodity management.

Doing: The actual implementation began with a pilot phase, several consultative meetings held and key decisions made; the initial process involved a mapping of all the systems in use across all the levels of the supply chain. The role of primary data entry at facility level was allocated to government owned KHIS. All other systems in use at that time were withdrawn amidst resistance from some partners. In-order to leverage strengths of each of the existing systems; the systems were linked through APIs (Application Programming Interfaces)

Checking: System interoperability required a harmonisation of technologies employed in the development of each system. Some outdated technologies were decommissioned to pave way for recent and advanced systems. System pilot was conducted in major high volumes facilities, updates implemented before the live pilot conducted in five focus Counties.

Acting: Lessons learnt in the pilot phase informed required changes and updates before the national wide roll out which began in January 2019 to April 2019.The PDCA improvement cycle is consistently in place.

Figure 3: System integration implementation model

- National wide Systems mapping.
- Observation & learning
- Brain storming & planning

- Technology harmonisation
- Linkages & Interoperability
- Systems development

- Implementation &Controls
- Observation & learning

- Piloting & updates
- Analysis and improvements

Implementation Challenges:

| Challenges	Interventions
Data entry errors at the facility level; Initially the KHIS had no data validation checks, validations checks at the County level caused process delays.	Data validation checks were in-built to ensure enhance data quality at the primary data entry. This has reduced stock outs, excess and ensured optimal utilization of storage space
Lack of milestones system prompts. Initially there were process delays where higher level approvals were delayed	System milestone prompts are now automated, the systems automatically sends emails to the next process owners
Reporting tools updates-Kenya is the pioneer Country to adopt DTG based regimen as first line drug of choice .This amongst many other treatment guidelines prompted regular reporting tools updates which was not done timely	All the reporting tools were upgraded in August 2019, enabling accurate data capture
Facility mapping: In correct facility mapping resulted to aggregation errors, resulting to under/over-supply of commodities	Implementation of regular updates

Frequent staff turnover at facility level, with no proper orientation done to the new comers.	Monitoring and training enhanced ,remotely and through targeted field visits

Future improvement

With the adoption and buy in of the interventions by all the key stakeholders and the PDCA quarterly improvement cycles, the interventions are on trajectory of growth that ensures sustainability and continuity.

Key achievements

1. Major data quality improvement has been witnessed after the institution of validation rules and checks at the primary data entry level. Data quality is a key factor that influences optimal stock availability at facility level. System integration has enabled data validation at the data entry level (See annex 1).
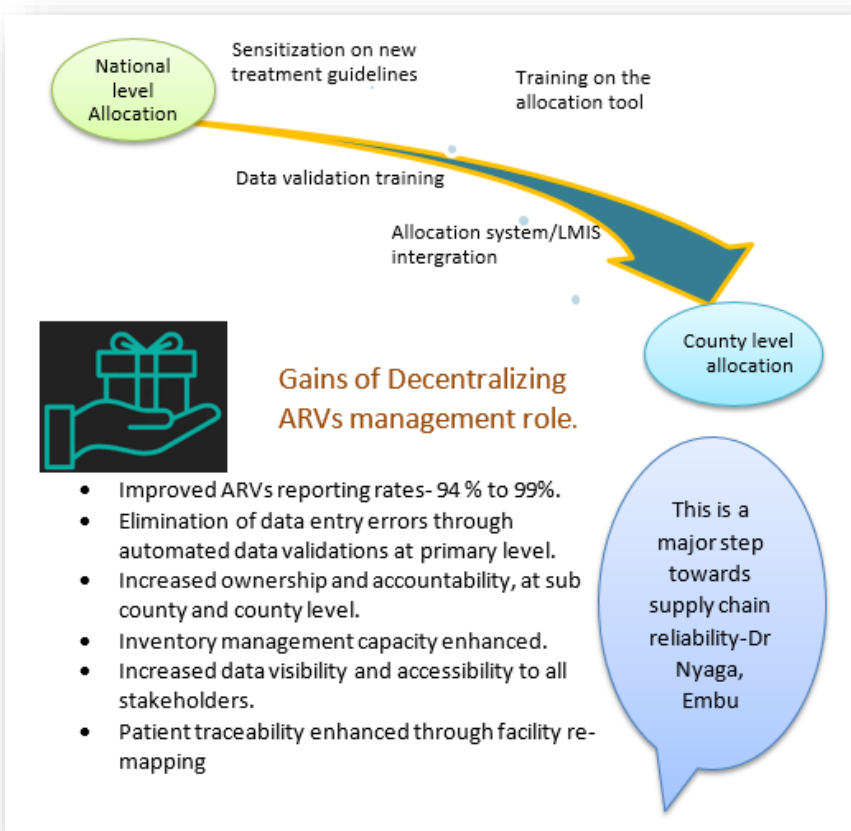
2. System integration has enhanced end-to-end data visibility by all supply chain players. This facilitates data driven decision-making processes.

3. Major improvement in the order management cycle turnaround time, system interoperability has enabled seamless process execution from order submission to delivery at facility level. Reduced human intervention has also eliminated data entry errors.

4. Seamless interoperability of system has led to improved reporting rates from 85% to 95%
5. Decentralisation has enhanced access of commodities to the remote facilities who previously had challenges in accessing commodities from the central site.
6. Decentralisation has also enhanced ownership an accountability at the County level
7. Improved accountability with audit trail visibility

Key success factors

1. Enhanced collaboration and coordination among the key stakeholders played a key role in the success of the interventions.
2. The success of the intervention was made possible through donor funding from USAID and CHAI.
3. Government overall ownership and leadership of the initiatives
4. Effective communication at all levels of the supply chain enabled buy in from all stakeholders

Longer-term sustainability of the interventions

All the information management system are government owned with the Donors funding plugging their support in the spirit of government led and owned approaches. This ensures longevity and sustainability as opposed to donor led and owned initiatives.

Lessons learnt for of locations

1. Decentralisation of commodity management to the lower end of the supply chain enhances ownership and accountability a key factor for supply chain reliability
2. Government owned initiatives assure long-term sustainability.
3. Standardized information systems is a great assist in obtaining accurate forecasting data.
4. Offline module enabled systems enable use of technology where there is no adequate internet connectivity, a reality in resource restrained setups

List of funders-Key stakeholders.

1. United states Agency for International Development (USAID).
2. Clinton Health access Initiative (CHAI).
3. National AIDS and STI Control Program (NASCOP).
4. Ministry of Health (MOH).

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Annex 1: KHIS data validation report

Validation Result ⚠️

The data entry screen has the following validation errors, please correct

Validation rule	Left side	Operator	Right side
MoH 730B Revision 2017 Adult preparations Ritonavir (RTV) 100mg 60s : (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ) != MoH 730B Revision 2017 Adult preparations Ritonavir (RTV) 100mg 60s : = Physical stock	0.0	!=	0.0
MoH 730B Revision 2017 Adult preparations Dolutegravir(DTG) 50mg tab 30s: (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ) != MoH 730B Revision 2017 Adult preparations Dolutegravir(DTG) 50mg tab 30s: Physical stock	11.0	!=	11.0
MoH 730B Revision 2017 Adult preparations Abacavir/Lamivudine (ABC/3TC) 600mg/300mg FDC Tablets 60s : (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ)= Physical stock	540.0	==	120.0
MoH 730B Revision 2017 Medicines for Amphotericin B 50mg IV Injection 1vial : (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ)= Physical stock	0.0	==	167.0
MoH 730B Revision 2017 Adult preparations Darunavir (DRV) 600mg 60sTablets : (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ) != MoH 730B Revision 2017 Adult preparations Darunavir (DRV) 600mg 60sTablets : Physical stock	0.0	!=	0.0
MoH 730B Revision 2017 Adult preparations Lamivudine (3TC) 150mg Tablets 60s : (OP + QR + POS ADJ)-(QI + LOSSES + NEG ADJ) == MoH 730B Revision 2017 Adult preparations Lamivudine (3TC) 150mg Tablets 60s : Physical stock	3.0	==	2.0

Annex 2
System URL links

CMIS URL link

LMIS URL link

WMS URL link