

**Republic of Namibia**



**Ministry of Health and Social Services**

**Developing and Implementing a Nationwide Electronic Pharmacy Dispensing System in Low-Resource Settings: The Electronic Dispensing Tool in Namibia's ART Program**

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The goal of the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program is to assure the availability of quality pharmaceutical products and effective pharmaceutical services to achieve desired health outcomes. Toward this end, the SIAPS result areas include improving governance, building capacity for pharmaceutical management and services, addressing information needed for decision-making in the pharmaceutical sector, strengthening financing strategies and mechanisms to improve access to medicines, and increasing quality pharmaceutical services.

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## **Key Words**

Electronic Dispensing Tool (EDT), National Database (NDB), ART, ARVs, HIV

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## ACRONYMS

ADT	Antiretroviral Dispensing Tool
AIDS	acquired immunodeficiency syndrome
ART	antiretroviral therapy
ARV	antiretroviral
EDT	Electronic Dispensing Tool
EWI	Early Warning Indicator
GPRS	General Packet Radio Service
HIV	human immunodeficiency virus
MoHSS	Ministry of Health and Social Services
MSH	Management Sciences for Health
MTC	Mobile Telecommunications
NDB	National Database
NHTC	National Health Training Centre
PMTCT	prevention of mother-to-child transmission
RPM Plus	Rational Pharmaceutical Management Plus
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SOUR	Specifications of User Requirements
SPS	Strengthening Pharmaceutical Systems
UNAM	University of Namibia
USAID	US Agency for International Development

## INTRODUCTION

### The Problem

In 2003, in response to the growing challenge of HIV/AIDS in Namibia, the Government of the Republic of Namibia through the Ministry of Health and Social Services (MoHSS) had put together a National Strategic Plan on HIV/AIDS: Third Medium-Term Plan, which aimed to reduce the incidence of HIV infection to below epidemic threshold. A crucial part of this plan was “ensuring an uninterrupted supply of antiretroviral (ARV) medicines” and related supplies. Ensuring uninterrupted supplies of ARVs required a structured process of ensuring timely availability of accurate information to inform decision making for efficient selection, procurement, transportation, storage, and issuing of medicines to patients. Accurate information on current stocks, consumption, and estimates of future requirements were crucial (a) to ensure optimum services and (b) to avoid ARV stocks running out or expiring, thereby resulting in costly waste that would negatively affect the sustainability of the ARV program in Namibia, interrupt access to medicines of people living with HIV/AIDS, and possibly lead to development of HIV drug resistance.

In 2004, as part of the technical assistance provided to the MoHSS to strengthen pharmaceutical management systems, the US Agency for International Development (USAID)-funded Rational Pharmaceutical Management Plus (RPM Plus) Program implemented by Management Sciences for Health (MSH) was requested to provide quantification data for pharmaceutical requirements including ARVs and other HIV-related commodities. At that time, six facilities were providing antiretroviral therapy (ART) services in Namibia, and 862 patients were on ART.

Even in the initial phase of the ART program (with few patients on treatment), one of the challenges experienced in undertaking quantification of requirements of ARVs and other HIV commodities was the difficulty in obtaining the accurate and timely data required. Where information was available, it was not uniformly recorded among the different facilities providing ART services, and it was insufficient for the quantification of pharmaceutical requirements. Also apparent was variation in the standards of service delivery in the management of HIV patients at all facilities.

### Baseline Assessment of the Pharmaceutical Sector

As a first step, in 2004 the MSH-implemented RPM Plus Program supported the MoHSS in carrying out a baseline assessment of pharmaceutical management information and monitoring systems. The key objective of this assessment was to determine “the capacity of the local government to meet medicine and other health commodity needs in support of the launch and establishment of the national prevention of mother-to-child transmission (PMTCT) and PMTCT-Plus programs.” USAID provided support under the President’s Emergency Plan for AIDS Relief, “in strengthening the pharmaceutical management systems of the [MoHSS] of Namibia, in support of the planned scale-up of PMTCT and ART services, specifically working with MoHSS and the Central Medical Stores to build capacity for logistical systems and pharmaceutical management, including but not limited to quantification, distribution channels and supply chains” (Bhattarai 2004).

## **Key Factors Evaluated**

The baseline assessment evaluated the following factors—

- Availability of information to all key users at various levels of the health system
- Ease in collection and compilation of data to generate various reports for decision making
- Existence of a structured and clear documentation process for data collection, processing, use, reporting, and feedback functions
- Monitoring and evaluation with appropriate indicators for assessing progress or outcomes
- Level of integration of the pharmaceutical management information system into the national Health Management Information System
- Use of computers for increased manageability and information use
- Efficiency and effectiveness in the use of emerging information technology (e.g., use of hand-held computers, Web-based solutions, etc.)

## **Key Findings of the Baseline Assessment of Management Information Systems**

### *Monitoring and Evaluation System*

#### Monitoring

- A structured routine monitoring system did not exist.
- Monitoring was done through irregular supervisory visits.
- A feedback mechanism was not in place.
- Special surveys were conducted every two years to capture the current status of implementation of medicine policy and stock availability.

#### Evaluation

- Strategies and methods were not in place to conduct in-depth analysis on the causes of indicated problems or successes.

#### Management Information System

- Service centres or health facilities did not record or report on medicine consumption and stock position.
- Supervisory visits were irregular and did not have documented guidelines.
- The regular health information system did not include medicine-related indicators except the periodic calculation of cost and human resources-related ratios.

- Service centres (hospitals and health centres) were not computerized.

#### Use of Information at Various Levels

- Service centres did not have information they need for quantification and to maintain stock position.
- Higher levels had medicine-related information based on irregular supervisory visits.
- Central and regional medical stores did not produce management indicators on a regular basis.
- Lack of actual consumption data from the service centres resulted in the belief that whatever was distributed was consumed.

“Since stock position and consumption data is not collected routinely at the health centres, there is no aggregate data available at the higher levels of the organization to make timely management and policy decisions. Whatever information is available is collected through supervisory visits and periodic national surveys. While this information, if properly processed and analysed, will help understand the situation, it cannot ensure continuous supply and rational use of medicines” (Bhattarai 2004).

From the challenges identified in the baseline assessment, an urgent need was evident to develop an information system that will ensure uninterrupted access to ARVs to a growing population of patients on ART in Namibia.



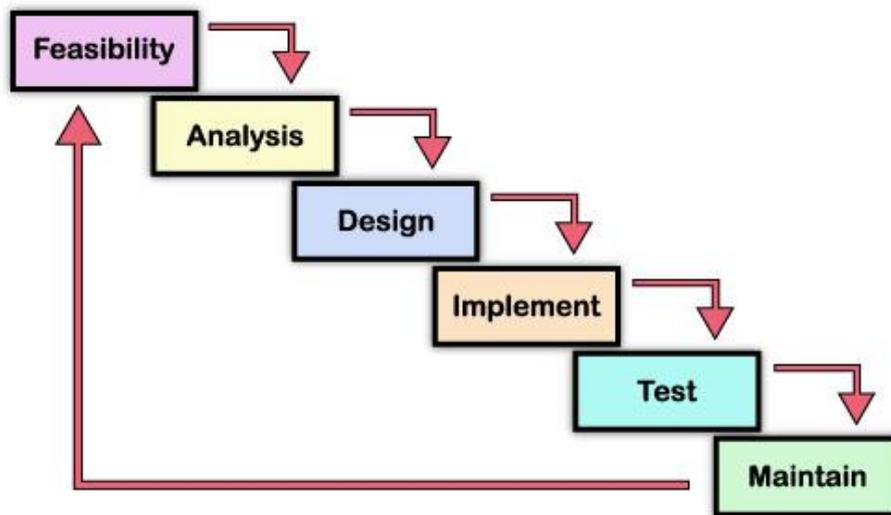
## DEVELOPMENT OF THE SYSTEM

### The Initial Idea and Goal

Initial deliberations were aimed at developing a national pharmaceutical service standard for ART service delivery and management, including a streamlined system for recording, monitoring, and reporting of ARV use for the ART program.

### Conceptual Framework

The conceptual framework was based on the information systems development cycle. The approach was to use a consultative process to develop a customised system for Namibia that will meet the needs of the users at the service delivery points (in the pharmacies across Namibia), the needs of managers in developing and analysing patterns, and the reporting requirement needs of national, regional, and facility levels. The system was designed to reduce the workload of the limited health workforce, to be user-friendly, and to be sustainable. Sustainability was a key attribute in development of the system because the system had to survive the overall transition to MoHSS maintenance and management.



Source: Mumford 2011.

**Figure 1: Stages in developing the information system**

The baseline assessment formed the basis for defining the feasibility of this system. Apart from the challenges identified, it was evident that health workers across the country were literate and able to handle an electronic dispensing system. The national level wanted a system that was efficient in providing accurate reports but that would not increase workload at facilities. From inception, it was evident a customised system had to be developed to meet the specific needs of Namibia. It was clear that this would take time and commitment from the government, the donor (USAID), and the provider of technical support.

## **Analysis Stage**

An initial situational analysis was conducted to review the systems that were in place for ART management in Namibia. Findings were as follows—

- The pharmacies used no standardized method of collecting data. Although some data were available at some pharmacies, other data were not available at all. Stock cards could be used to monitor consumption of individual medicines.
- The US Centers for Disease Control and Prevention had installed Epi-Info system in facilities providing ART. The Epi-Info system, however, did not cater for pharmacy data; data captured per patient ended with the prescription.
- Facilities generated monthly reports, but these reports did not contain all the necessary information required for quantification. For example, although regimens were reported on, only a few regimens were on the report, and the rest were lumped together as “other.” Because there was no consumption data, the reports could not be fully used.

An options analysis was conducted to chart the way forward. Two systems for health-related data capture and management were identified for comparison—

1. The CompuCare system by Diamond Health Services of South Africa. This is a commercial electronic patient management system that, however, did not include an HIV module.
2. The Antiretroviral Dispensing Tool (ADT), which was developed by MSH and was in use in Kenya and other countries. This tool was developed for use by the ARV dispenser and at that time it was able to maintain a record of patients obtaining medicines from the dispensary, including a basic patient profile, and the history of the medicines dispensed. It could also generate a few reports containing service statistics data and information necessary for quantification and patient management.

On comparing the two systems, the country opted for the ADT for the following reasons—

- The cost of customization of CompuCare to include the pharmacy HIV module was high.
- Maintenance of CompuCare posed a problem. Because it was not local software, technicians from South Africa would have to be called in and financed in case of any maintenance issues.
- ADT was an Access-based, user-friendly, RPM Plus tool and could be customised locally to suit Namibia's needs; it could also be maintained locally.
- Because Epi-Info was used at all other MoHSS facilities, the ministry was not keen on introducing additional software of the magnitude of CompuCare.
- The MoHSS agreed with the US Centers for Disease Control and Prevention that it would capture data only up to clinical encounters and that MSH would set up a

system that would capture required pharmacy data, but these data would be shared and validated regularly.

## **Design Stage**

### ***System Requirements and Definitions***

A Specifications of User Requirements (SOUR) workshop involving MoHSS pharmacy staff was held on 12 and 13 October 2004 at the Kalahari Sands Hotel in Windhoek. The following data were identified as necessary to effectively and accurately quantify for the needs of medicines for patients on ARVs (Pereko and Lates 2005)—

- Number of patients on treatment per regimen
- Consumption quantities per medicine
- Number of patient months' supply
- Patient scale-up or growth rate
- Stock on hand at both central medical stores and facilities
- Cost per medicine

To provide the preceding data as well as improve the efficiency of ART pharmacy staff, the following functionalities were initially identified as key to the system—

- Dispensing
- Production of printed labels
- Database for regular reporting
- Ability to track patient data over time; hence provide data for on-going patient management as well as for future operational research

### ***Customisation of the EDT***

The specifications from the SOUR workshop were used to customise the ADT. A local programmer was identified for the customisation. This was important because it would ensure that software support was readily available when needed. The tool also was customised in line with the Standard Operating Procedure for ART Dispensing in Namibia.

The main features of the customisation were as follows—

- The ability to print medicine labels was added. The printing feature was important because it made the tool useful for real-time dispensing as opposed to writing labels after entering all the dispensing information in the computer.
- Multiple local languages used by patients in Namibia, including Oshiwambo, Otjiherero, and Afrikaans, were included.
- A reporting module that was Namibia specific was incorporated.

Customisation of the tool was completed in June 2005. The finished product was presented at the Pharmacist's Forum held at the end of June 2005 at Heja Lodge in Windhoek. At this meeting, pharmacists from the regional directorates and district hospitals were in attendance.

Additionally in July 2005, three pharmacists responsible for ART provision held a meeting with the systems programmer to evaluate the tool and make input on required and preferred changes to the tool prior to piloting. The final customisation was completed at the end of July 2005, and the Namibia ADT was ready for piloting.

## **Test and Implementation Stage**

### ***ADT Integration and Piloting***

The purpose of piloting was as follows—

- Carry out a test run of the tool to check if it was working effectively
- Evaluate its ease of use and effect on the workload of the pharmacy staff
- Identify any problems with the tool and address them, identify any changes or additional functions required to enhance the tool before rolling it out to all other identified facilities
- Ascertain that the tool was suitable for what it was designed for and that it could assist the pharmacy staff in daily dispensing as well as gather data required for programmatic decision making

The piloting included—

- Installation of the tool in identified facilities (including importing patient data from the registration computer used by the data clerks to the tool, installation customisation and testing of the printer, and setting up of a local back-up system).
- Training on the tool (entering patient data, dispensing, stock control, reports, and patient management functions of the system). Training was done on site at the time of installation.
- Continuous monitoring of the tool to identify and address any problems that may arise. An evaluation and training workshop was conducted two months after installation.

A minimum of three days were spent at each facility during the installation for piloting. Four sites were selected as pilot sites: Oshakati Intermediate Hospital, Rundu Intermediate Hospital, Nankudu District Hospital (August 2005), and Katutura Intermediate Hospital (January 2006).

In addition to the individual on-site training, three pharmacy staff from the pilot sites underwent training in November 2005. The objectives of the training were to—

- Test the draft training manual
- Address specific problems identified while using the tool

The piloting period was expected to be a minimum of three months. However, with the challenges detailed below, the piloting went on for a year.

During the process of implementation (piloting of the ADT), the MoHSS requested that RPM Plus put the activity on hold. The MoHSS was concerned that too many tools were being used to gather information in the country with no harmonisation, thereby leading to duplication of effort. The activity was put on hold for two and a half months. After numerous meetings, the MoHSS gave the green light to proceed with the piloting and then later on the rollout of the system.

In some of the pilot sites, staff were initially reluctant to use the ADT, which led to duplication of work because both the ADT and the manual paper system were used. However, as the pharmacy staff became more confident in the ADT, staff became reluctant to use the manual paper system.

### ***Rollout of the ADT to All ART Sites in Namibia***

Once the piloting period was complete and the functioning of the tool found satisfactory, a phased rollout to other facilities was accomplished.

#### ***First Phase***

Three facilities that had more than 1,000 patients on treatment were selected. This rollout was accomplished in October/November 2006.

#### ***Second Phase***

This phase focused on 16 health facilities (all facilities with a patient load of more than 300 based on the December 2006 ART Monthly Report). This rollout was carried out from March to May 2007.

In June 2007, the pharmacy reporting requirements for the facilities were reviewed and updated. It was also noted that although there had been numerous trainings on quantification, the ordering patterns from the treatment facilities were not appropriate. It was therefore decided to consider the possibility of including a quantification module in the ADT. This change necessitated review of the ADT. To make the review comprehensive, all users were contacted telephonically and requested to suggest any changes needed to the ADT. A list of the changes was compiled and used to update the ADT.

The ADT update was completed at the end of October 2007. In October, “The Namibia ADT Version 2” was piloted in three health facilities in Windhoek—Katutura Intermediate Hospital, Katutura Health Centre, and Windhoek Central Hospital—where the tool was monitored closely to ensure that it was working appropriately and produced desired results. The functionalities of the tool were fine-tuned to allow for a smooth rollout.

### *Third Phase*

This was also the final rollout phase; all facilities received the updated tool. This rollout was conducted between November 2007 and March 2008. The first sites to be updated with the new tool were those that already had the ADT, followed by a national training in February 2008 and then rollout to all other facilities. By the end of March 2008, all 35 main ART sites nationally (34 hospitals and one health centre) had the ADT installed.

The rollout process can be summarised as follows—

- Identification of facilities to be computerised based on workload at the facilities
- On-site installation and training as was the case with the piloting
- National trainings of all users to ensure standardisation of practices across all sites
- Continuous support and monitoring of the tool with a proactive process of collecting suggestions from users and structured upgrades to meet the users' needs (which led to the upgrade of the tool in 2007)
- Keeping the tool up to date with changing needs at facility level and at the national ART program level

## **Evaluation of the System**

### ***Feedback from Users***

At the end of March 2008, 32 of the 35 public ART sites reported using the ADT for their patient and stock management. All 35 sites reported 47,382 patients on treatment, of whom 46,876 were captured by the ADT with more than 46,000 transactions in the system monthly and more than 552,000 ART patient transactions annually. This corresponded to 98.9 per cent patient coverage by ADT based on ART Monthly Reports received at the end of March by the Division: Pharmaceutical Services. This coverage further represented 98.9 per cent of adults and 99.3 per cent of paediatric patients covered by the ADT.

Feedback received from some facilities and users at the end of March 2008 highlighted the following advantages of the system—

- The appointments feature was helping organize and plan work for each day.
- Identification of treatment interrupters and no-show patients was easier through the appointment system. This information was used by other members of the ART team to trace these patients in the community.

- Compared to the paper-based system, the ADT provided a more efficient and better record-keeping system.
- Printed labels provided faster dispensing and more legible and uniform labelling of medication. Labelling in patient's own languages was an added bonus.
- Stock could be more accurately accounted for because records of every transaction were now saved on the system.
- The quantification feature had improved the time it took to perform quantification of ARVs and yielded more realistic orders irrespective of who did the quantification.
- Dispensing was faster and more efficient, resulting in shorter waiting times for patients.
- Statistical reports were more accurate and easier to compile than before. Workload was also easier to estimate because the number of patients seen per day could be obtained from the ADT.

*“The ADT has made my work at the ART pharmacy much easier. Reliance on manual methods for data capture and reporting has been eliminated; without the ADT it would take a whole weekend to do the ART Monthly Report (AMR), but with the ADT, at the click of a button on various reports on the reporting module, the AMR can be compiled within a normal working a day. Generation of daily appointment register enables pre-planning or pre-packing of expected medicines and this has reduced a lot of movement between the dispensing point, the main store and the medicine cabinet.”* Greatjoy Mazibuko-Pharmacist at Oshakati State Hospital in Northern Namibia.

### **Further Customisation of the System**

Use of the ADT was monitored continuously from March 2008 to December 2009, mainly through telephonic one-on-one communication with the users and support visits. After the system was in place, and based on user experiences and feedback, the following additional functionalities were proposed for inclusion—and eventually added between March to June 2009—

- There was increasing need to capture other medicines used by patients on ART for comorbidities. Medicines commonly used by ART patients such as co-trimoxazole and multivitamin tablets were added to the system. With this addition, the name of the tool changed from the Antiretroviral Dispensing Tool to the Electronic Dispensing Tool (EDT).
- Following adoption by Namibia of the World Health Organization HIV Drug Resistance strategy and initial assessments that showed that most of the Early

Warning Indicator (EWI) data were available from the EDT, EWI reports on HIV drug resistance were added to the system.

- Because of increased volume of records, the Access-based system became slower, and the database was converted from MS Access to SQL Server to enable it to handle the larger volumes of data.
- Because of high staff turnover at the facilities and the need for on-going training of staff in the use of the EDT, a user guide video was developed and incorporated into the EDT. Health workers can refer to this tool for help and guidance in procedures.
- To enhance ART adherence monitoring, a pill count function was added to the dispensing module. In addition, individual patient adherence scores and graphs were added as well as facility adherence reports. The main method of adherence monitoring in the EDT is by pill count and timely pick-up of refills. These two methods have been shown to be useful in monitoring patient adherence to treatment (Bisson et al. 2008). Figures 2–4 illustrate routine reports that are obtained from the EDT's reporting module. This information is used in providing evidence for the on-going adherence counselling and monitoring of patients at the facility level.

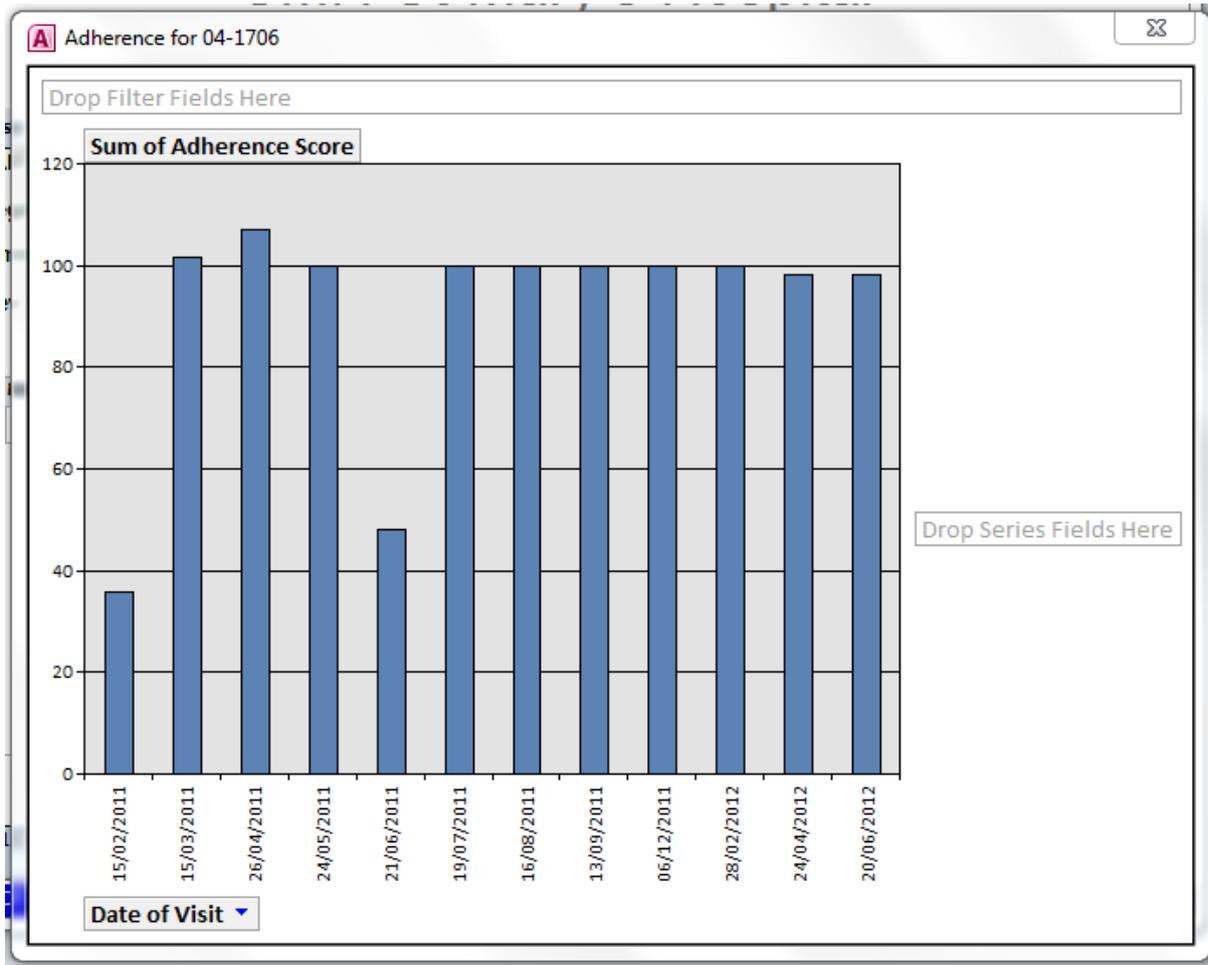


Figure 2: Graph showing the adherence pattern (based on pill count) of an individual patient over time

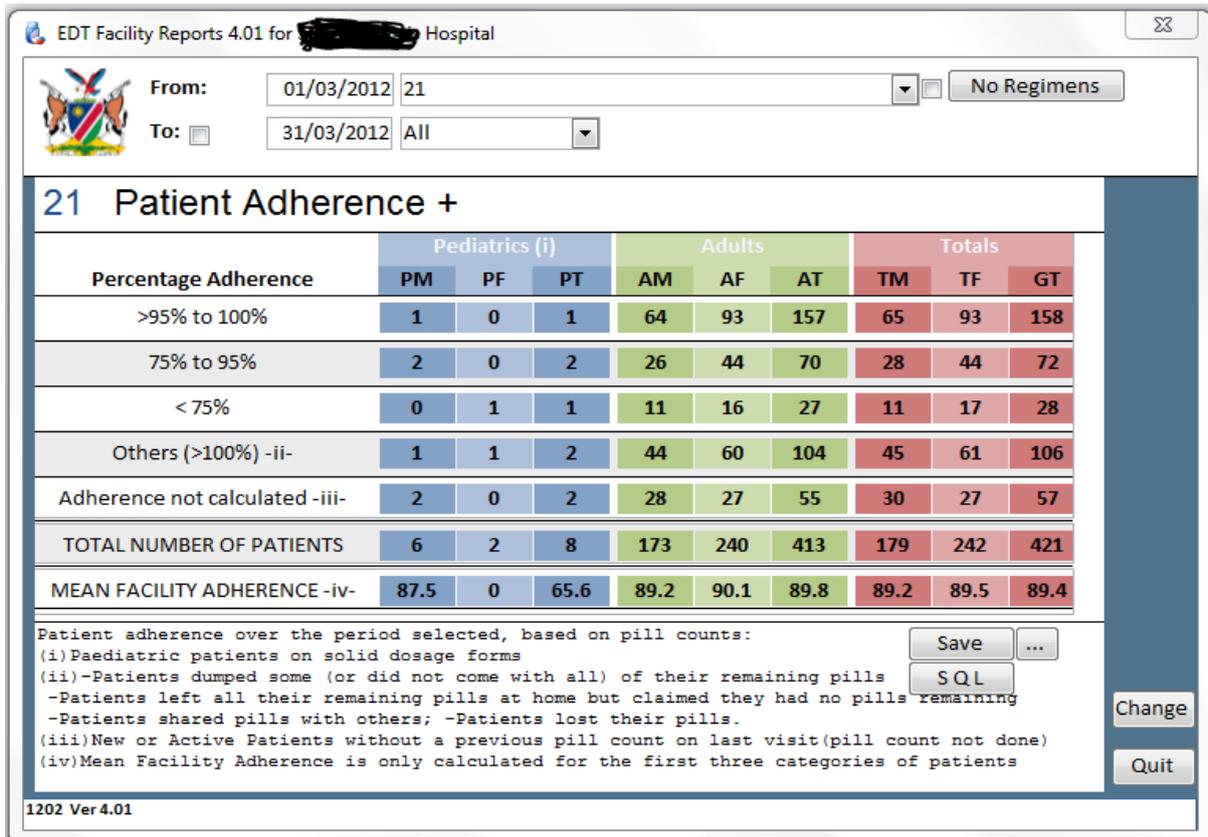


Figure 3: Period-specific average adherence level of patients (based on pill count) at one of the hospitals in Namibia

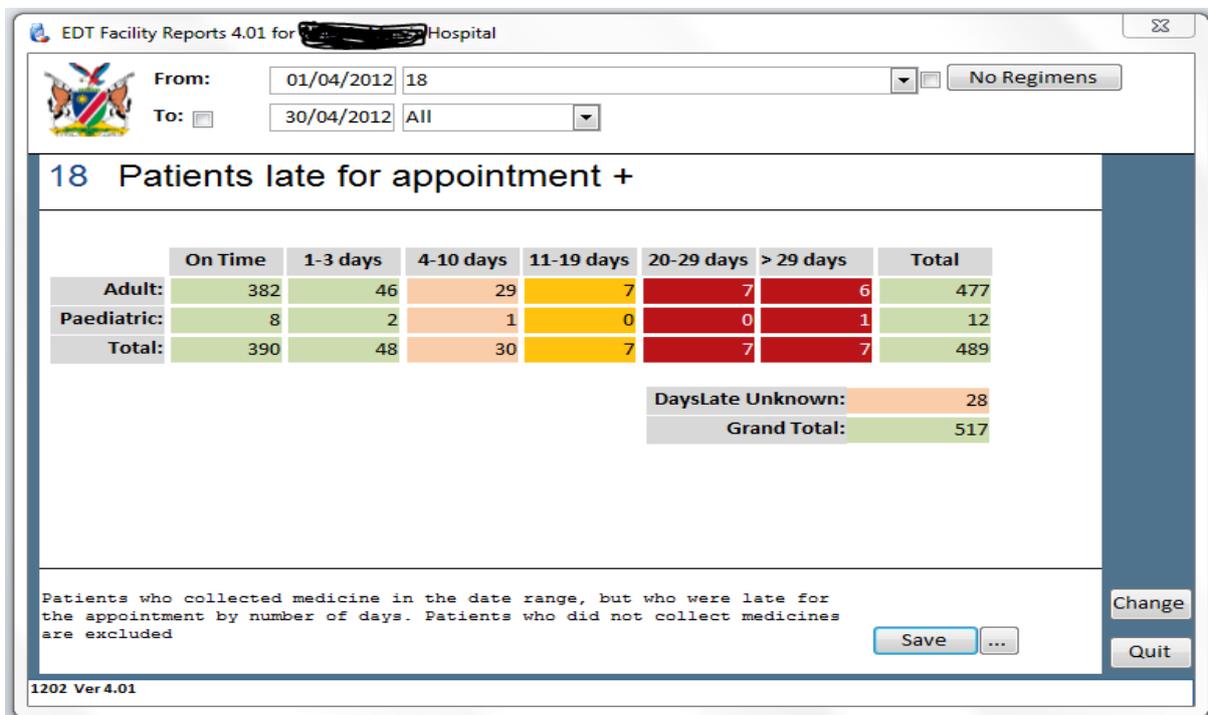


Figure 4: Period-specific ARV refill data at a hospital in Namibia

- An EDT mobile and EDT outreach module were developed: the EDT mobile comprised hand-held battery-powered scanners that were used for dispensing at the outreach site. Data is then uploaded onto the main EDT computer via a Bluetooth or a cradle connection. The EDT mobile eliminated double entry of data for patients seen at outreach sites; previously, dispensing data were entered on paper at the outreach site and then re-entered on the EDT at the main site. A picture of the EDT mobile device is shown in figure 5.



**Figure 5: The EDT mobile device**

- The EDT mobile is particularly useful for the local setting. Namibia is the second most sparsely inhabited country in the world. Vast distances have to be travelled to district hospitals, which can greatly compromise quality of care and services, resulting in patients being non-adherent in attending clinic appointments and medicine collection.
- Outreach services offered by hospital health workers at health centres and clinics within their districts help improve access to ART services in remote areas. The health workers visit these facilities at least once a month, and in addition to medical and nursing services, ARVs are dispensed to these patients. The EDT mobile device facilitates data capture during these outreach visits. Because it is battery powered, the scanner can be used in areas without electricity.
- As at of October 2010, 16.5% per cent (15,900) of all ART patients were serviced at outreach sites through the EDT- mobile (Sumbi, et al. 2011) (Sumbi et al. 2011).
- The EDT mobile is also used at busy hospital pharmacies that have several dispensing staff but, owing to space constraints, only one EDT computer. The additional staff use

the EDT mobile to dispense to patients and then upload the data to the EDT computer at the end of the day. Figure 6 shows the EDT mobile in use at one of the public health facilities in Namibia.



**Figure 6: A pharmacist's assistant scans medicines to enter into the EDT mobile**

- A field for indicating reasons for change for all regimen changes was added to the dispensing module. This field was useful for tracking regimen changes caused by adverse events or treatment failure.
- The quantification module was revised to include cost information for all ARV medicines in the system. This enabled managers to know how much of their pharmaceutical budget was being spent on ARVs.

## SYSTEM LAUNCH AND HANDOVER TO MOHSS

In February 2010, the EDT system was officially launched by the Deputy Minister of Health and Social Services. During this event, the entire system was handed over to the MoHSS. The system consisted of the main EDT software, an electronic EDT manual, a non-electronic manual, and the EDT mobile.



The EDT handover to the Deputy Minister of Health and Social Services: Hon. Petrina Haingura (*right front*) in the presence of Mr K.SM.Kahuire PS MoHSS (*third from left*); Mr. Gregory Gotlieb, USAID Mission Director (*first on right*); Mr Albertus Aochamub, Mobile Telecommunications (MTC) (Private Sector) (*second right*); Ms. Jennie Lates, Deputy Director Division: Pharmaceutical Services (*fourth from left*); David Mafirizi, Country Director MSH, presented by Ms. Dineo Pereko, Senior Program Associate: MSH.

**Figure 7: EDT handover to the Ministry of Health and Social Services**



**Figure 8: The EDT in use at Katutura Health Centre, Windhoek**

## ADDITIONAL DEVELOPMENTS AFTER HANDOVER TO MOHSS

### Development of the National ART Database

A national database (NDB) for EDT data was conceptualised in 2007. The aim was to have EDT data from individual facilities aggregated and summarised centrally to enable quick generation of up-to-date data at national level for informed planning and decision making. Several options were tried out—

- Linking of facility EDTs to the NDB through a General Packet Radio Service (GPRS) modem that would be set to automatically send data to the server at specified times (e.g., once a week, daily, etc.). This option was not successful because—
  - The cost of GPRS modems was quite high.
  - The GPRS modem required that the pharmacies have a direct telephone line, which was not the case for almost all facilities. Facilities worked through a switchboard system and the pharmacy had to go through switchboard to get a line.
- Use of PCAnywhere software to create a link between the facility EDTs and the NDB. The option was found to be unsuitable because—
  - Like the first option, this software worked well with facilities that had a direct telephone line (i.e., did not go through switchboard to make a call). This was not the case for most health facilities.
  - The dial-up system kept the telephone line engaged for long periods, especially when transferring heavy files.
- Use of USB drives to transfer data from the facility EDTs to the NDB. Pharmacy staff would back up data to USB drives and send these by courier to be uploaded onto the NDB in Windhoek. The USB drives would then be sent back to the facilities, also by courier, with antivirus updates and any EDT software updates. Although this system was successful, some challenges were experienced, including the following—
  - Regular loss of USB drives
  - USB drives not sent on time or at all
  - USB drives that often got corrupted and therefore corrupted the EDT at facilities
  - High cost

These challenges meant that the goal of having the most up-to-date information at the click of a button could not be achieved most of the time.

In 2008, an arrangement was made with a local telecommunications company in Namibia, Mobile Telecommunications (MTC), to enable EDT data transfer services to the NDB by MTC's 3G network that has wide coverage across Namibia. The arrangement was found to

be suitable during the testing, and the data transfer costs were also found to be acceptable. In November 2008, through a social responsibility initiative with MTC, 3G devices were purchased for all 35 ART sites and installed in December 2008<sup>1</sup>. Data transfer was set such that data would be transferred daily during the test period. The 3G devices were configured to use a wide area network with no access to the Internet, thus eliminating the possibility of use for personal access to the Internet by facility staff.



(Left to right) Mr. Lazarus Indongo (Ag. Deputy Director Pharmaceutical Services, MoHSS), Dr. David Mafirizi (Country Director, MSH), Ms. Dawn Pereko (MSH), and Mr. Albertus Aochamub (MTC General Manager for Corporate Affairs)

**Figure 9: Agreement of support by a Namibia Telecommunication company MTC to strengthen data transfer from health facilities across Namibia to the MoHSS**

Some challenges were experienced during the piloting of the electronic data transfer, and these were resolved as follows—

- In some facilities, the devices were installed outside the computer because of weak network signals. In some of these facilities, the devices were removed by the users.

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<sup>1</sup> Although this process was initiated in late 2008, efficient data transfer from facilities to national level was achieved only in 2010 and 2011 after the handover of the system to the MoHSS.

- The 3G modem creates a USB device icon in the task bar that can be removed (same as a memory stick). Staff at some of the facilities accidentally removed the USB modem instead of their memory sticks, which disabled the modem, necessitating a reset.
- The 3G modems required resetting after long periods of the computer being idle or switched off. Resetting required a PIN code that the users did not have access to in order to minimise the risk of abuse of the devices.
- Remote desktop support was designed to enhance support to facilities.

The flow chart in figure 10 provides an overview of the functioning of the EDT as at June 2012 with all the changes that were made based on user feedback and MoHSS needs.

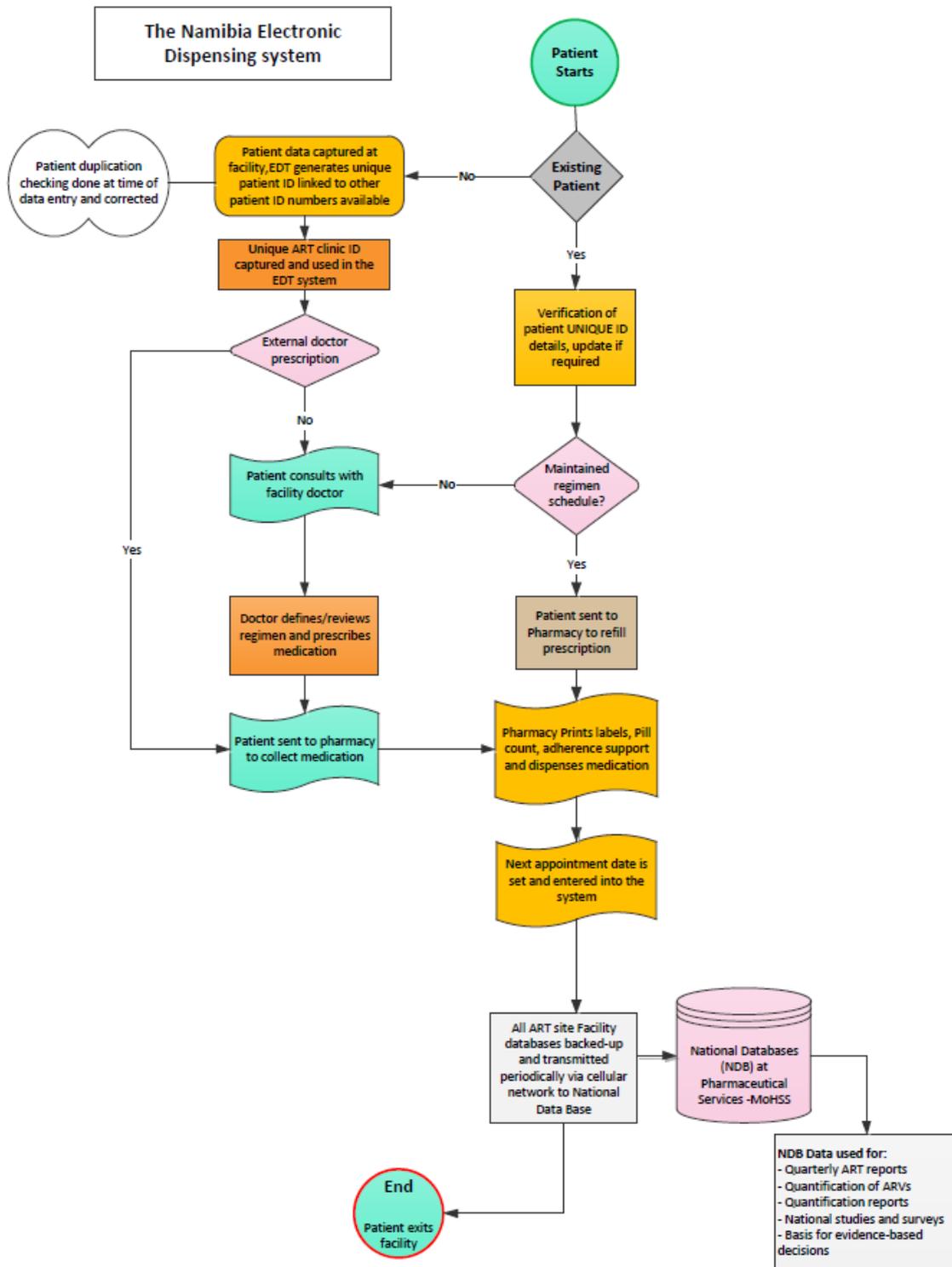


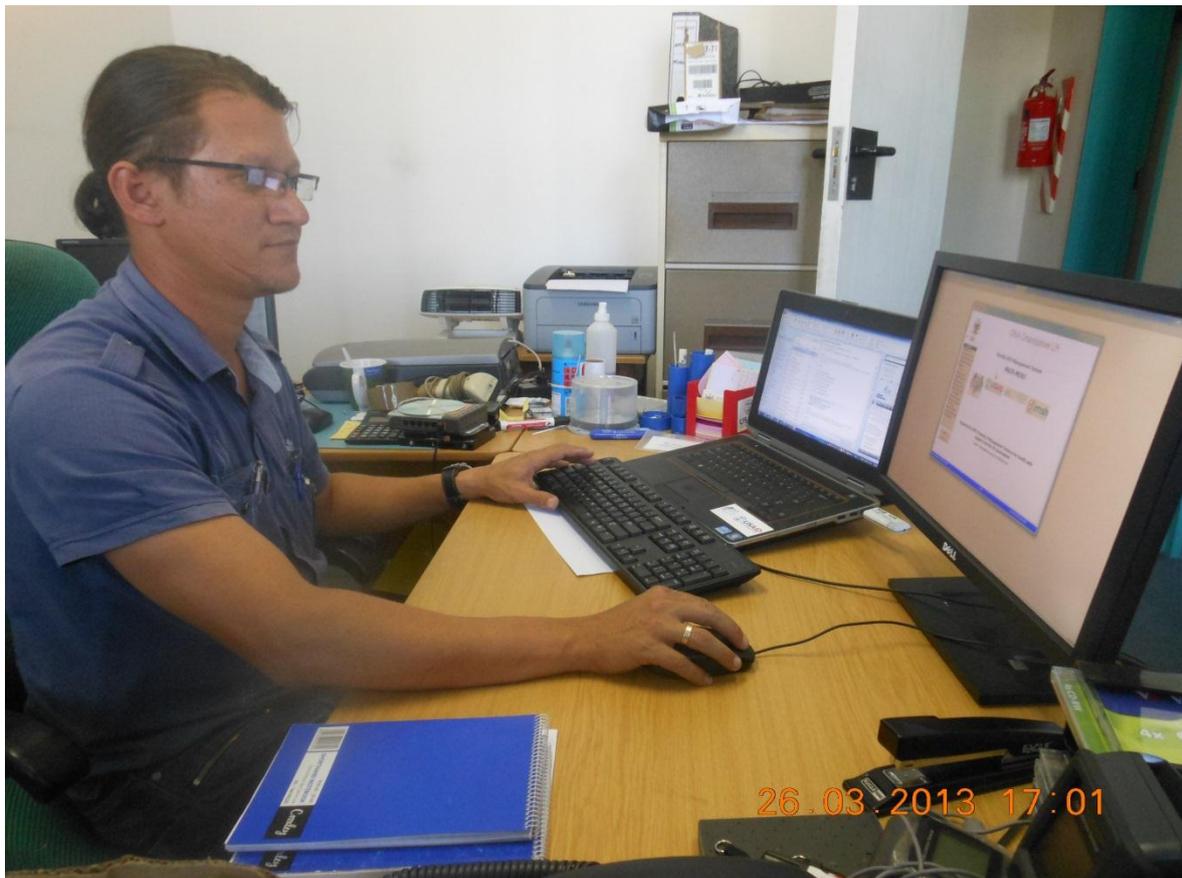
Figure 10: The Electronic Dispensing Tool flow diagram

## Remote Desktop Support

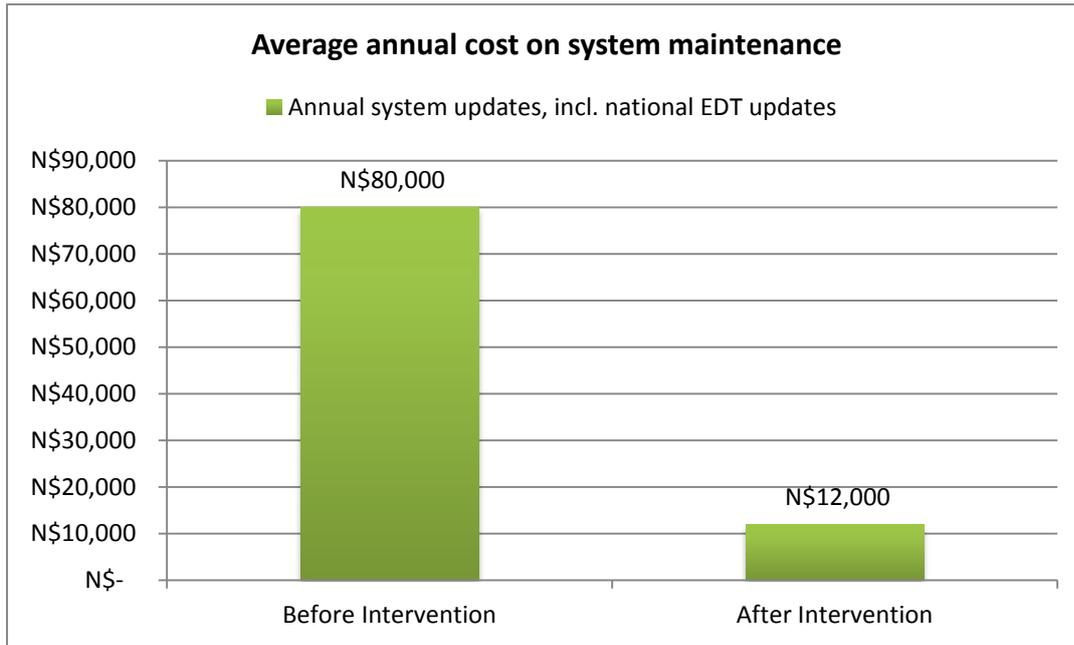
This service was implemented in 2011 to enable off-site management of EDT computers. The service is based on Microsoft Windows Remote Desktop Connection technology over MTC's 3G network (Mwinga et al. 2012). The system works as follows—

- User reports a problem telephonically to the Systems Administrator at Division: Pharmaceutical Services.
- Information technology specialist logs on remotely, troubleshoots, and attempts to resolve the problem. This may take 5–30 minutes.
- Problem is resolved and the user is informed telephonically. The user can then log back onto the system and continue working.

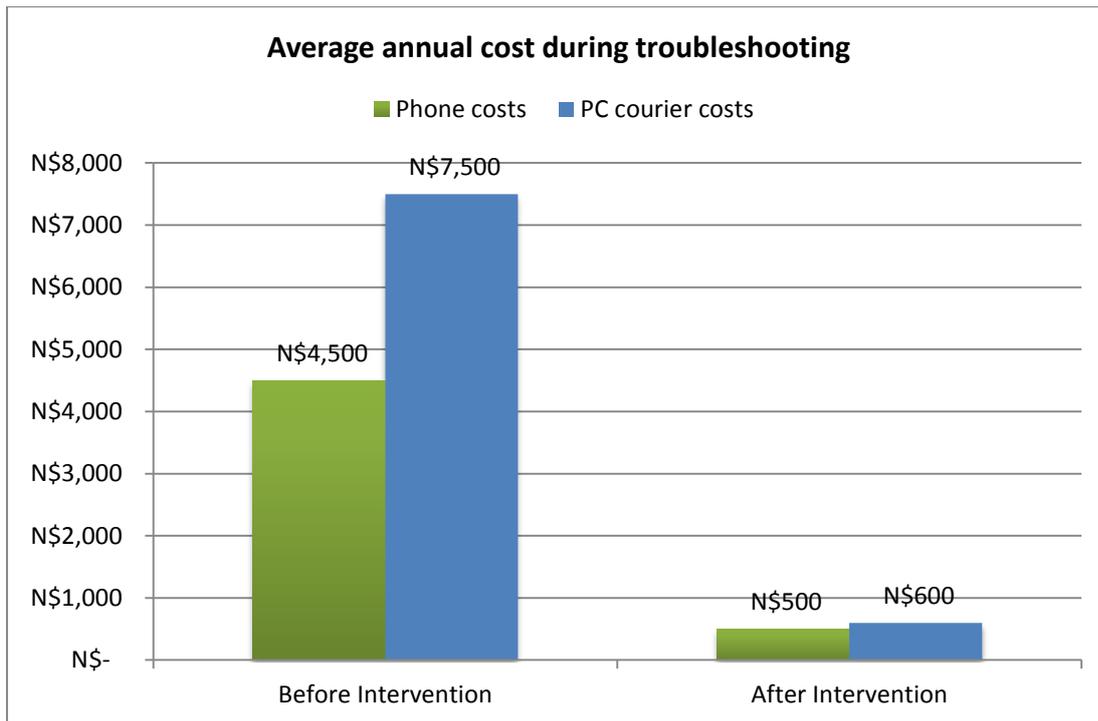
Remote Desktop Support helped reduce the average EDT downtime at facilities from 120 hours (5 days) to just 2 hours, thus reducing gaps in EDT data. This was done while reducing the money previously spent on express delivery of faulty EDT computers from facilities to Windhoek and mitigating the risk of theft or damage to computers during transportation (Mwinga et al. 2012).



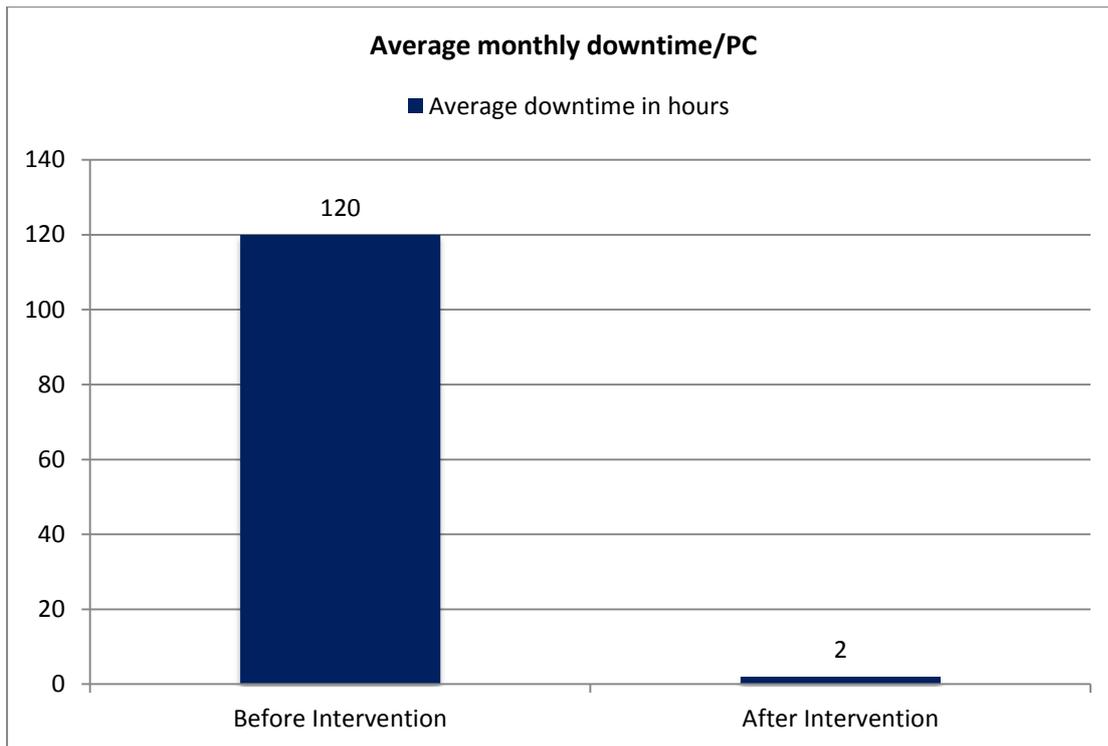
**Figure 9: Remote Desktop Support in use: The Information Systems Administrator at Division: Pharmaceutical Services, Mr. Abraham Blom, remotely connected to the EDT system of Katima Mulilo ART pharmacy, about 1,200 kilometres from Windhoek**



**Figure 10: The reduction in the cost of system maintenance with introduction of Remote Desktop Support**



**Figure 11: The reduction in annual cost of troubleshooting system challenges at remote sites**



**Figure 12: Reduction in downtime of PCs at health facilities after introduction of Remote Desktop Support**



## ACHIEVEMENTS AND SUCCESS FACTORS

### Use of EDT Data for Evidence-Based Decision Making

The EDT serves as the primary source of data for the ART monthly reports, which are compiled by all main ART facilities and submitted to the ART logistics pharmacist at national level. If used consistently and correctly for all patients on ART, the EDT greatly facilitates monthly reporting because all the data required in the monthly report is readily available in the EDT. Patient numbers from these reports are used for planning and decision making (Niaz et al. 2012).

In Namibia, EDT data have been analysed and used extensively at facility level and national level. Key examples of EDT data use include the following—

- EDT output has been used to better inform pharmacovigilance and connect medicines used with potential adverse events. Heterogeneous information sources have been successfully used in Namibia to connect adverse events with their potential medicine cause: a good example of this practice is the assessment of the connection between anaemia and zidovudine-based ART to inform treatment choices (Corbell et al. 2012). The longitudinal monitoring of medicine dispensing, use, and health outcome at the patient level is invaluable in providing real-world evidence on the efficacy and safety of medicines.
- The EDT has allowed health workers to monitor the adherence rate of each patient through pill count and time of prescription refill: this information has been used to provide more support and attention to the patients who are at higher risk of developing complications and ultimately failing treatment due to non-adherence (Lates et al. 2011; Mbirizi, Sumbi, and Sagwa 2011).
- Data from EDT and NDB have been used to extract HIV drug resistance EWIs in Namibia and to identify health facilities whose patients are at a higher risk of developing resistance (Hong et al. 2010).
- The EDT mobile supports decentralisation of ART services by providing cost-effective tools for patient and stock management at peripheral facilities with limited staff and other resources (Sumbi et al. 2011).
- ARV stock consumption and stock status data are used by the MoHSS to conduct forecasting and quantification exercises that are used to inform the budgeting process for ARV medicines.
- EDT data and reports are used in the compilation of the National Quarterly and annual reports of the MoHSS.

- The EDT data have been used in the national survey of determinants of adherence to ART and baseline indicators of adherence

ARV consumption data are used in analysis of ARV consumption patterns and quantification of ARV needs as well as monitoring of stock levels. To be able to generate accurate consumption data and therefore determine the correct order quantities, all stock movement receipts and issues must be captured in the EDT in a timely manner. Use of the stock management module of the EDT has been sub-optimal, however, and this is an area targeted for improvement by MoHSS.

### **Success Factors**

The EDT implementation was widely successful in Namibia because of several factors, including the following—

- The design of the tool was readily accepted by the system's pharmacists and pharmacist's assistants because it reduced the administrative burden of dispensing ARVs and increased the efficiency of pharmacy operations.
- Recruitment of an Information and Systems Administrator at MoHSS national level ensured that the necessary information technology support was available for EDT users to ensure smooth and continuous running of the system.
- Technical assistance was provided to the MoHSS's Division: Pharmaceutical Services in aggregation and analysis of data from the EDT and NDB, thus ensuring that all the data collected was utilised to inform decision making. Technical assistance and a feedback loop to users on the data from the EDT resulted in interest by health workers to ensure that data in the system are accurate and reliable.
- Leadership and buy-in from the Division: Pharmaceutical Services in Windhoek was key in facilitating the introduction and rollout of this tool in Namibia.

## **MAINTENANCE STAGE**

For the EDT system to continue functioning optimally and supporting ever-increasing numbers of facilities and patients, the following measures have been put in place by the MoHSS and its partners—

### **Information and Systems Administrator Office**

This office was set up at the MoHSS's Division: Pharmaceutical Services in Windhoek to support health facility staff with EDT-related problems and to provide scheduled maintenance of the NDB. The post was initially supported using USAID funds, but it is set for absorption into the MoHSS's staff establishment in 2012/13. The existence of this office ensures that support for the system is available even in the absence of donor funding.

### **ART Logistics Pharmacist Office**

This office is also based at the Division: Pharmaceutical Services. The office bearer ensures that data from the EDT and NDB are analysed and used for decision making at national level. She or he participates in ARV forecasting and quantification exercises that use data from the EDT and the ART monthly reports from health facilities. The office was supported using USAID funds but has been absorbed into the MoHSS's staff establishment.

### **On-going Support for Training on Data Analysis and Use**

With the EDT development process mostly completed, focus has shifted to making use of the rich data set available from the system to inform decision making. Several activities have been conducted using EDT data, including an on-going Adherence Improvement Initiative that started in May 2011 with a nationwide survey of adherence levels and adherence monitoring and improvement practices at health facilities.

Support has also been provided to the MoHSS to conduct on-going training for newly recruited pharmacy staff on use of the EDT, with emphasis on certain functionalities of the system such as adherence measuring and monitoring as well as use of the EDT to generate data on HIV drug resistance EWIs.

The EDT trainings have involved lecturers from the University of Namibia's (UNAM) Pharmacy Department as well as from the National Health Training Centre (NHTC) with the intention of providing the same training at pre-service level to pharmacy degree students and pharmacist's assistant students at UNAM and NHTC, respectively.



**Figure 13: Mr. Victor Sumbi, Senior Technical Advisor with the MSH/SIAPS Namibia project, assists two training participants during a practical session of the EDT training held 14–16 August 2012**



**Figure 14: Dr. Tim Renee and Mr. Dan Kibuule from the UNAM Pharmacy Department participate in the EDT training to be able to provide the same training to UNAM pharmacy degree students**

## Responsiveness to Changing Local Needs

With the MoHSS planning to introduce a nationwide comprehensive hospital information system (known as eHealth) that will cover all hospital services, MSH is currently (2012) working on a system to ensure interoperability of the EDT with the new system. Interoperability will facilitate data exchange in the event that EDT data is to be imported into the new system. It will also facilitate exchange of data between the EDT and the eHealth.

## Taking over of EDT Equipment Procurement and Maintenance by MoHSS



**Figure 17: Dr. Nobert Foster, Deputy Permanent Secretary (second left) MoHSS, receiving the EDT equipment on behalf of the MoHSS from Ms Elzadia Washington (first right), Mission Director USAID Namibia (September 2012)**



**Figure 18: Mr. Victor Muthiani (STA-SIAPS) presenting details of the EDT system to Dr. Norbert Foster, Deputy Permanent Secretary MoHSS (*first left*), on the occasion of receiving the EDT equipment on behalf of the MoHSS from Ms Elzadia Washington, Mission Director USAID Namibia (*first right*). Looking on is Ms. Jennie Lates, former deputy director Pharmaceutical Services MoHSS (*second left*) (September 2012)**

In September 2012, the MoHSS's Directorate of Special Programmes procured EDT computer and label printers for all health facilities that required their equipment replaced. A total of 54 computers, 25 label printers, and 44 Uninterruptible Power Supply (UPS) devices were procured for health facilities across the country. This marked a major step in government takeover of the EDT system that had hitherto been supported using USAID funds. The procured equipment will be included in the inventory of the respective regional directorates, which will then be responsible for maintaining and replacing the equipment as necessary, thus ensuring long-term sustainability.

## CONCLUSION

### Lessons Learnt

Development of the EDT for Namibia was a long and eventful process. Intensive engagement of all the relevant stakeholders, customising the tool to meet local needs, and ensuring use of data from the system for evidence-based decision making have all contributed to ensuring that the final product is well suited to support provision of ART pharmaceutical services in Namibia. The following were key lessons learnt during the EDT development process—

- Engagement of key stakeholders at policy and management levels is critical for the implementation of any tools or systems to support services at facility level.
- Obtaining and acting on user feedback on an on-going basis helps update and improve the system and ensure that it meets the needs of the health system.
- Use of data to inform decision making and planning should be a key activity when developing any information system or tools in the health sector.
- Sustainability of a new tool or system is enhanced by ensuring that the tool or system is supported by the existing structures in the health system; if this is not the case, then arrangements should be made to create the appropriate support structures within the health system at the earliest opportunity

### Recommendation

The process followed and lessons learnt that have been documented in this report can be used in other countries that are planning to introduce an electronic system at any level of the health care system.



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