

University Partnership Initiative: Creation of a COVID-19 Clinical Telehealth Program for Distance Learning, Telementoring, and Telemedicine in Botswana

Final Report



Foreword

This is the final report of the *University Partnerships Initiative (UPI): Creation of a COVID-19 Clinical Telehealth Program for Distance Learning, Telementoring, and Telemedicine in Botswana* Project, (hereinafter referred to as the UPI-Health Information Technology, or UPI-HIT Project)

The project, which took place from November 2020 to November 2021, was launched through the University Partnerships Initiative (UPI) of the United States State Department. Through this effort, a technical advisory committee and implementation team was assembled, comprising of members from the Government of Botswana (MoHW), the University of Botswana, Rutgers Cancer Institute of New Jersey, Botswana-Rutgers Partnership for Health, and Rutgers Global Health Institute. Together, the members present recommendations to the Botswana Ministry of Health and Wellness that support telementoring, tele-education, and future telemedicine efforts.

The assessment team evaluated the health information technology at Botswana health care facilities (Nyangabwe Referral Hospital, Sekgoma Memorial Hospital) and University of Botswana affiliated clinical sites (Princess Marina Hospital, Letsholathebe II Memorial Hospital). In addition, the team focused on equipment support for virtual related activities and access to online learning, telementoring, and other professional development opportunities for health care professionals and students during the COVID-19 pandemic.

This report explains the current health information technology landscape in the targeted areas, identifies infrastructure gaps, and offers recommendations for enhancing e-learning.

Acknowledgments

We wish to express our appreciation for all the hard work and support completed by the committee members, implementation team, and participating members from assessment sites. The diverse expertise and insight have helped strengthen Botswana's virtual learning and meeting efforts.

Additionally, we would like to thank the U.S. Embassy in Botswana; the Minister of Health and Wellness, Dr. Edwin Dikoloti, for launching this initiative; and the Deputy Vice Chancellor for Academic Affairs at the University of Botswana, Professor Happy Siphambe, along with his team, for supporting this important initiative during the era of COVID-19. We look forward to disseminating knowledge through virtual provider education and other professional development opportunities.

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Abbreviations

BHP	Botswana-Harvard AIDS Institute Partnership
BRPH	Botswana-Rutgers Partnership for Health
COVID-19	Coronavirus Disease of 2019
DHMT	District Health Management Team
GABS	Government Accounting and Budgeting System
GOB	Government of Botswana
HIT	Health Information Technology
IP	Internet Protocol
IPMS	Integrated Patient Management System
IT	Information Technology
LMH	Letsholathebe II Memorial Hospital
MBPS	Megabits Per Second
MoHW	Ministry of Health and Wellness
NCDs	Noncommunicable Diseases
NMS	Network Monitoring System
NRH	Nyangabwe Referral Hospital
PMH	Princess Marina Hospital
RCINJ	Rutgers Cancer Institute of New Jersey
RGHI	Rutgers Global Health Institute
RU	Rutgers University
SKMTH	Sir Ketumile Masire Teaching Hospital
SMH	Sekgoma Memorial Hospital
UB	University of Botswana
UPI	University Partnerships Initiative

Executive Summary

The global health crisis due to coronavirus disease 2019 (COVID-19) and mitigation efforts have impacted all of us. As a result of the global economy's destabilization, nationwide shutdowns and travel restrictions, as well as the vulnerabilities of health care systems have impacted health care, public health, and, most importantly, quality of life.

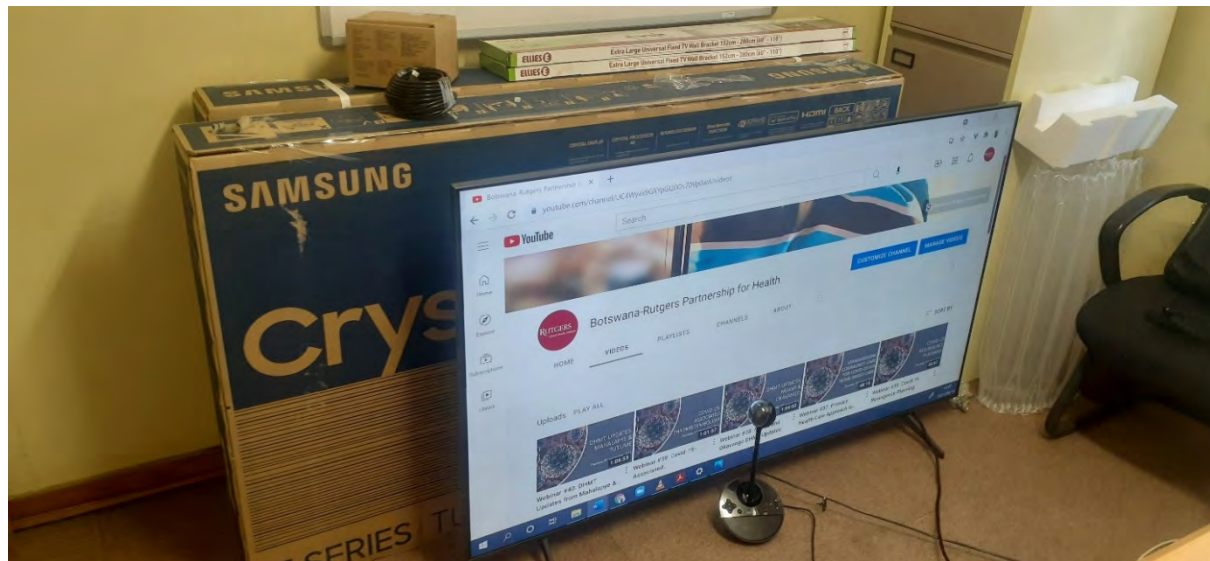
The world has embraced and adopted health information technology to help solve for the growing communication demands across all sectors. For example, digital tools helped create operational and surveillance responses to COVID-19, transition from in-person to virtual education and training, increase telemedicine visits, and improved communication in real-time.

Accelerating digital transformation in low- and middle-income countries requires building capacity and shifting resources to improve communication solutions. Through an award from the U.S. State Department's University Partnerships Initiative (UPI), the Rutgers Global Health Institute engaged with experts and stakeholders across Botswana and Rutgers University to strengthen the interconnectedness among government, academic, and health care in Botswana. With the help of these efforts, the Botswana government, the University of Botswana, and Rutgers' Cancer Institute of New Jersey and the Rutgers Global Health Institute formed a government-academic partnership. The resulting joint project, the *UPI: Creation of a COVID-19 Clinical Telehealth Program for Distance Learning, Telementoring, and Telemedicine in Botswana*, inventoried the landscape of digital technology capabilities, capacities, and needs; and identified simple solutions for broader communication among health care facilities, the government, and academic and clinical partners.

In November 2020, the Botswana-Rutgers Partnership for Health (BRPH) facilitated this in-country project together with key stakeholders and information technology (IT) experts from the government and the University of Botswana (UB). The needs assessment provided insights into site-specific IT equipment requirements to support telementoring, distance education, and future telemedicine efforts. This report summarizes the assessment's key findings and provides recommendations to improve the IT infrastructure for clinical learning, workforce development training, and elevating existing business practices and functions through virtual support.

The findings from this project are that the assessed sites have an array of challenges hindering them from benefitting from programs that use information technology to enhance health care delivery through optimized exchange of relevant, time-sensitive information, such as during the COVID-19 pandemic. These challenges included poorly maintained and obsolete equipment, unreliable internet network, exacerbated by limited network infrastructure, unavailability of relevant technologies and infrastructure, and the undertraining of clinical staff on the use of information technology.

Figure 1: Health care facilities were provided with equipment to facilitate distance learning



Introduction

In early January 2020, Chinese health authorities identified a novel coronavirus as the causative agent for an outbreak of pneumonia of previously unknown etiology in that country, dating back about a month, with all cases linked to the city of Wuhan. Within a week, several other Asian countries reported cases of the disease. By the end of the month, the World Health Organization declared it a Public Health Emergency of International Concern. COVID-19 was declared a pandemic on March 11, 2020, requiring every nation to mobilize resources in response to this new threat.

One challenging factor was that fighting COVID-19 required the imposition of social distancing rules, leading governments around the world to institute severe travel restrictions and lockdowns. However, even during nationwide lockdowns, COVID-19 cases were rising at alarming rates; in neighboring South Africa, the number of infections was climbing past 15,515, pushed along by a new record high of 1160 infections over 24 hours by May 17, 2020¹. In Botswana, the first lockdown started on April 2, 2020, and lasted 35 days. Key challenges during lockdown included resource allocation and effectively training health care workers on COVID-19 disease management under the prevailing conditions. Prior to the pandemic, in-service training for health care workers had occurred in person and at a central location, ranging from a few days to a week at a time. However, the COVID-19 pandemic necessitated a swift pivot to virtual connection, requiring information technology support.

Virtual provider education has been a major component of mitigation and resiliency efforts. In November 2020, Rutgers Global Health Institute received funding from the U.S. State Department's University Partnerships Initiative to assess health information technology tools and mobilize staff to be part of the assessment at the selected public health care facilities in Botswana. This was based on a shift in both operations and care delivery and on the need to keep the country's health care workforce informed about national guidelines, new developments in COVID-19 treatment, and resiliency efforts in a timely manner.

¹ South African National Health Laboratory Service Report from May 17, 2020, accessed from <https://www.nhls.ac.za/covid-19-update-74/>

Project Objectives

The objectives for the UPI-HIT Project are:

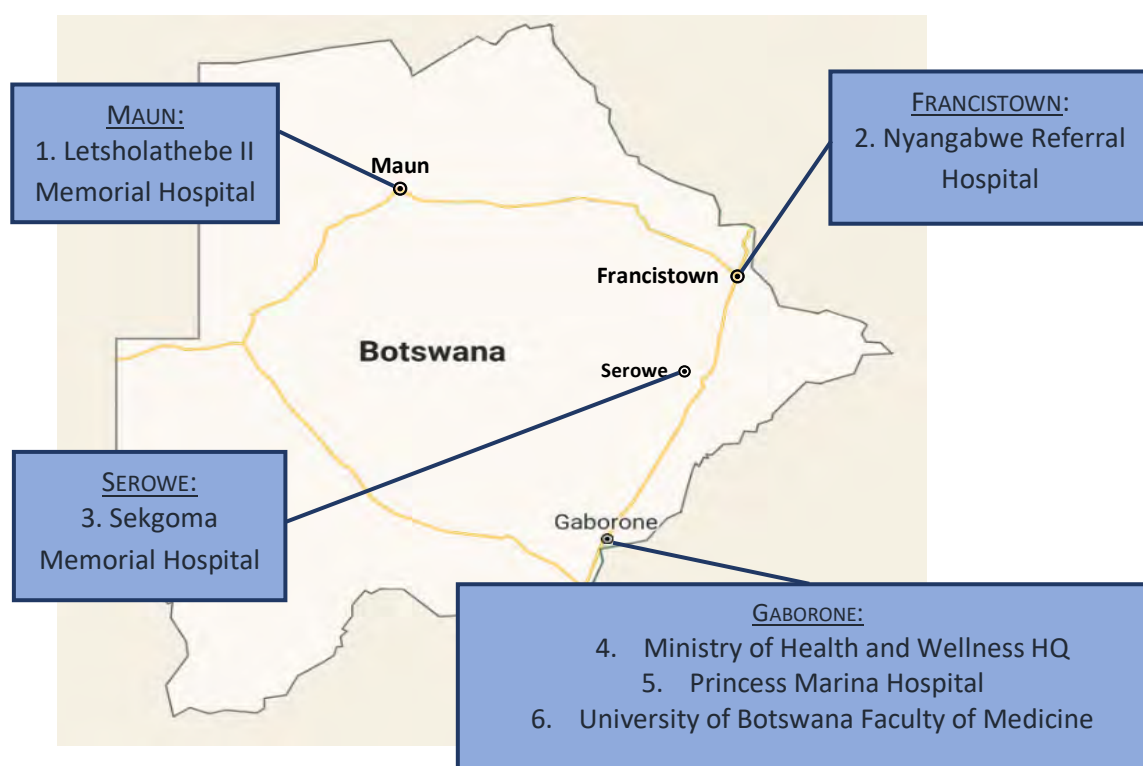
1. to assess the current health information technology and infrastructure at the following facilities (assessment sites):
 - Letsholathebe II Memorial Hospital (LMH) in Maun
 - Nyangabgwe Referral Hospital (NRH) in Francistown
 - Sekgoma Memorial Hospital (SMH) in Serowe
 - Princess Marina Hospital (PMH) in Gaborone
 - University of Botswana (UB), Faculty of Medicine in Gaborone
 - Ministry of Health and Wellness, Non-communicable Diseases (NCDs) Office in Gaborone
2. to conduct a commercial bandwidth exercise,
3. to design a pilot telementoring initiative as an urgent training intervention for COVID-19 infection and disease management,
4. to assess the capacity of health care facilities in their ability to build technology infrastructure (equipment, software, and bandwidth) and recruit personnel (technical experts, administrative, and managerial), to better facilitate distance learning, telementoring, and telemedicine initiatives at the target sites, and
5. to expand commercial bandwidth through a trial between the six locations with the Government of Botswana (GoB) and UB.

Methodology

Site Selection

The 6 selected sites for this project are shown in the map below. They represent both urban and remote settings, with varying levels of HIT infrastructure, per the initial assessment.

Figure 2: Sites and locations of facilities in the UPI-HIT project



Technical and Assessment Teams

The project's technical team was comprised of representatives from all stakeholders, including the Botswana Ministry of Health and Wellness, the University of Botswana, the Botswana-Rutgers Partnership for Health, the Rutgers Cancer Institute of New Jersey, and the Rutgers Global Health Institute. Table 1 shows the personnel participating in both the technical and assessment teams. The assessment team consisted of a selected group of IT experts and a coordinator who conducted site visits and performed the HIT assessment.

Table 1: Technical and Assessment Teams that drove the project

Name	Project Role	Title, Organization
Richard Marlink	Advisor	Director, Rutgers Global Health Institute
Reena Antony	Advisor	Senior Program Coordinator, Rutgers Global Health Institute
Adrian Rodrigues	Advisor	IT Director, Rutgers Cancer Institute of New Jersey
Refeletswe Lebelonyane	Program Manager	Botswana-Rutgers Partnership for Health
Tebogo Motlhatlhedhi	IT Officer	UB Faculty of Health Sciences
Matlhogonolo Sorinyane	IT Officer	UB Faculty of Medicine
Percy Thutoetsile	Network Specialist	University of Botswana
Onalenna Otlhomile	IT Officer	Ministry of Health and Wellness
Robert Moumakwa	Project Manager	Telehealth Coordinator (October 2020 – March 2021) Botswana-Rutgers Partnership for Health
Vusikhaya Ndaba	Project Manager	Telehealth Coordinator (April – November 2021) Botswana-Rutgers Partnership for Health

1. Needs Assessment of identifying current health information technology and infrastructure needs

An assessment tool was designed to identify the available resources and determine the needs at each hospital site for optimal participation in these activities. An online survey and virtual meetings with stakeholders were part of the initial design. The assessment team changed the implementation strategy to an in-person site visit because of the low response rate to the online survey. See Appendix 1.

A total of 28 IT personnel and staff were interviewed during the needs assessment. Additionally, the University of Botswana Faculty of Medicine, and the Ministry of Health and Wellness Noncommunicable Disease Office, both in Gaborone were also assessed.

Data was collected by the assessment team. The team asked participants about the facility's connectivity, software, hardware, user experience, and meeting space for video conferencing. Additionally, site visits helped establish good working relationships with hospital management at each location.

The assessment tool can be found at Appendix 1, and the results of the assessment as carried out at each facility are as follows:

I PRINCESS MARINA HOSPITAL, GABORONE

Date of Assessment: 25th November 2020

Princess Marina Hospital (PMH) campus hosts both PMH and University of Botswana Internet Protocol (IP) networks running separately and independently.

Findings:

a) Connectivity

Table 2 gives a summary of connectivity at Princess Marina Hospital

Table 2: Connectivity at Princess Marina Hospital

COMPONENT	DETAILS
Bandwidth	50MBPS (On Government Data Network)
Internet speed	50MBPS
Network Topology	Star
Network equipment type	Cisco 2950 Switches
Wi-Fi availability	None
Access to internet at Home	None
Quality of Service	None

Despite bandwidth for the facility being 50MBPS, Mr Dikgokgwane (PMH Head of IT) reported that the internet connection is not very stable as evidenced by frequent timeouts usually experienced during tele-conferences attempts. Staff members are not provided internet access at home, including IT department personnel. Staff often must resort to purchasing data bundles for themselves to attend presentations, conduct online research as well as engage with colleagues on patient cases. The Princess Marina Hospital data network runs on obsolete equipment, such as network switches that can only go up to 100 Mbit/s (versus the modern 1000 Mbit/s switches) which negatively impacts on the network performance. There is a Libre Network Monitoring System (LibreNMS) in place.

b) Hardware and Computing Devices

PMH wards and clinics have an average of two desktop computers per location, which are used mainly for processing patient transactions on the Integrated Patient Management System (the government's

health care Information Technology System). These computers are shared by all the department personnel. No mobile gadgets have been provided for staff except for IT staff who have laptops.

Table 3: Computing Devices at Princess Marina Hospital

EQUIPMENT	STATUS
Desktop PCs	Available – 531 computers*
Screens	Not available
Speakerphones	Not available
cameras	Not available
Laptops	Not issued to employees
Tablets	Not issued to employees
Cell phones	Not issued to employees

**Most admin staff do not share computers but too many clinicians must share a computer. Sharing of computers is not equitable across hospital units.*

c) Software / Applications

Princess Marina Hospital has access to 1 WEBEX license which is facilitated by IT Department for administering tele-conferences. The following applications are run on the network:

- i. Integrated Patient Management System (IPMS),
- ii. Government Accounting and Budgeting System (GABS),
- iii. Email,
- iv. IP-based phones.

d) Office Space and Conference Rooms

Most doctors do not have offices. This is not just a problem in Oncology Department but throughout the entire hospital. There are two conference rooms in the administration block, none of which are equipped with video conferencing equipment. One of the two rooms has an MiV Video Phone used mainly by top management for voice conferences.

e) Personnel and Training

Out of a staff complement of 1349, 1045 need to use computers. Clinicians (Doctors, Nurses, dieticians, etc.) are computer literate. PMH is also

End user training on utilization of conferencing software and training of IT staff on administration of Conferencing software have not been done.

f) Observations

Resource sharing is not done equitably at PMH. Access to resources (the internet, computers, etc.) is not uniform and depends on the institution in which they work, whether MoHW, UB, etc. This project should not follow this pattern, but rather offer equal access to resources for health workers.

With the current situation of Covid-19 pandemic, staff members are discouraged from sitting in groups to attend tele-conferences, and attendance from separate locations is encouraged. The solution offered the facility should be cognizant of this.

Lack of office space and access points impacts on the number of computers which can be allocated to a department.

II LETSHOLATHEBE II MEMORIAL HOSPITAL, MAUN

Assessment date: 23rd February 2021

The Letsholathebe II Memorial Hospital (LMH) hosts both LMH and UB IP networks running separately and independently. The following areas were investigated, and findings are as shown below.

Findings:

1. LMH GOVERNMENT NETWORK

a) Connectivity

Table 4 summarizes connectivity at LMH:

Table 4: Government Network Connectivity at Letsholathebe II Memorial Hospital

COMPONENT	DETAILS
Bandwidth	50MBPS (On Government Data Network)
Internet speed	50MBPS
Network Topology	Star
Network equipment type	Cisco 2960 Switches
Wi-Fi availability	None
Access to internet at Home	None
Quality of Service	None

b) Hardware and Computing Devices

The LMH wards have an average of two desktop computers per location, which are utilized mainly for processing patient transactions on the Integrated Patient Management System (IPMS), which is the government's network-based patient information management system. These computers are shared by the department personnel. Mobile gadgets have not been provided for staff, except for IT staff who have laptops.

Table 5: Computing devices on the Government network at Letsholathebe II Memorial Hospital

EQUIPMENT	STATUS
Desktop PCs	Available – computers*
Screens	1 55-inch smart TV screen

Speakerphones	Small speaker
Cameras	Small Logitech camera
Laptops	Not issued to employees
Tablets	Not issued to employees
Cell phones	Not issued to employees

**Most admin staff do not share computers but too many clinicians must share a computer. Sharing of computers is not equitable across hospital units.*

c) Software / Applications

The hospital has access to one WEBEX and one Zoom license which are used by the IT Department for administering tele-conferences. The following applications are run on the network:

- i. Integrated Patient Management System (IPMS),
- ii. Government Accounting and Budgeting System (GABS),
- iii. Email,
- iv. IP-based phones.

d) Office Space and Conference Rooms

Most medical officers do not have offices. There are two conference rooms in the administration block, only one of which is equipped with a few components needed for video conferencing, for example, a smart screen, camera, and microphone. These are not sufficient, nor do they meet the standard of the room and capacity.

e) Personnel and Training

Out of a staff complement of over 600, 250 need to use computers. Clinicians (Doctors, Nurses, dieticians, etc.) are computer literate.

End user training on utilization of conferencing software has not been done and training of IT staff on administration of conferencing software has not been undertaken.

f) Observations

The LMH building roof leaks, which could be a threat to electronic devices in the building.

With the current situation of the COVID-19 pandemic, staff members are discouraged from sitting in groups to attend tele-conferences; they are encouraged to attend from separate locations. The solution to be offered the facility should be cognizant of this.

Lack of office space impacts on the number of computers which can be allocated to a department.

2. Letsholathebe II Memorial Hospital; University of Botswana Network

These are the findings for the UB network at LMH

a) Connectivity

Table 6 summarizes connectivity for the UB network at LMH:

Table 6: UB Network Connectivity at Letsholathebe II Memorial Hospital

COMPONENT	DETAILS
Bandwidth	20MBPS connecting back to UB main campus through Metro Network
Internet speed	6 GBPS shared by UB main campus and all 11 remote sites
Network Topology	Star topology
Network equipment type	Cisco equipment still on support
Wi-Fi availability	available
Access to internet at Home	None

The University of Botswana occupies a small section of LMH, with a presence at the paediatric ward, and the administration block Library.

The current Internet bandwidth is sufficient and was recently upgraded to enhance remote or distance learning to the university community at LMH.

b) Hardware

The UB has an existing IP network running mainly on wireless Cisco devices to encourage mobility.

Table 7: Computing devices on the UB network at Letsholathebe II Memorial Network

EQUIPMENT	STATUS
Desktop PCs	Available at library and Paeds
Smart Screens	1 interactive smart board and 2 smart screens
Speakerphones	Not available
Cameras	1 Avaya camera and codec
Laptops	Issued to some staff members
Tablets	Not issued to employees
Cell phones	Not issued to employees

c) Software / Applications

The UB has subscriptions to Zoom and Microsoft Teams for virtual conferencing and teaching.

Staff who do not have laptops equipped with cameras do have desktop computers which allow participation in conferencing without video. These computers run on Windows 7 and later versions.

d) Office Space

All UB staff at Letsholathebe II have offices, and only students share learning spaces.

e) Personnel and Training

Doctors/lecturers and students are computer literate and have been utilizing the resources at their disposal efficiently.

f) Observations

The UB school of medicine had hoped to increase their teaching rooms and equip them with laptops and relevant software applications to enhance learning, as well as extending wireless connectivity could be extended to other areas where the students do their practical learning.

There is currently a sharing arrangement between UB and LMH through guest connectivity, but it is not very efficient. For the University to be able to share internet and some network resources there should be a unified access control solution which is currently not in place. Access control is a concern in conference rooms for equipment safety.

III NYANGABWE REFERRAL HOSPITAL, FRANCISTOWN

Assessment date: February 2021

The University of Botswana does not have a presence at Nyangabwe Referral Hospital. The following areas were investigated, and findings are as shown below:

Findings:

a) Connectivity

Table 8 summarizes the connectivity at NRH:

Table 8: Connectivity at Nyangabwe Referral Hospital

COMPONENT	DETAILS
Bandwidth	20MBPS (On Government Data Network)
Internet speed	20MBPS on Metro network
Network Topology	Star
Network equipment type	Cisco 2901 router, Catalyst 2900XL core and Cisco 2950 Switches
Wi-Fi availability	None
Access to internet at Home	Only for the Superintendent (mobile Internet router)
Quality of Service	None

According to the Head of IT, despite a facility bandwidth of 20MBPS, internet connection is relatively good, but the hospital local area network is too old and does not meet today’s Internet Protocol needs.

The assessment team observed that the hospital conference room was well equipped with video conference equipment in the past, but because of lack of proper support the equipment no longer works and needs replacing.

b) Hardware / Computing Devices

NRH wards and clinics have an average of three desktop computers per location, and these are used mainly for processing patient transactions on IPMS. These computers are shared by all personnel in the department. Mobile gadgets such as cell phones are available, but these are of lower specification that does not allow for video conferencing.

Table 9: Computing devices at Nyangabwe Referral Hospital

EQUIPMENT	STATUS
Desktop PCs	Available – computers
Screens	Available (old model and not smart)
Speakerphones	Available but old
Cameras	Not available
Laptops	2 managers, superintendent and 7 senior management officers
Tablets	Not issued to employees
Cell phones	Issued to some employees

**Most admin staff do not share computers but too many clinicians must share a computer. Sharing of computers is not equitable across hospital units.*

c) Software / Applications

NRH has one WEBEX license and one Microsoft Teams license, which is used by the IT Department for administering virtual conferences. Applications run on the network include:

- i. Integrated Patient Management System (IPMS),
- ii. Government Accounting and Budgeting System (GABS),
- iii. Email,
- iv. IP-based phones.

d) Office Space and Conference Rooms

There are two conference rooms in the hospital, and lack of office space poses a challenge. The larger conference room in the administration block has a seating capacity of 24, and the smaller one in the extension building can accommodate approximately ten people.

e) Personnel and Training

Out of a staff complement of 900, 400 need to use computers. Clinicians are computer literate.

End user training on utilization of conferencing software has not been done, neither has there been training of IT staff on administration of conferencing software.

f) Observations

The general observation is the obsolete network equipment and the conference room with obsolete video conference equipment. Access control is a concern for equipment safety.

IV SEKGOMA MEMORIAL HOSPITAL, SEROWE

Date of assessment: February 2021

The Sekgoma Memorial Hospital does not host University of Botswana IP networks. The following areas were investigated, and findings are as shown below:

Findings:

a) Connectivity

Table 10 gives summarizes connectivity at SMH:

Table 10: Connectivity at Sekgoma Memorial Hospital

COMPONENT	DETAILS
Bandwidth	30MBPS (On Government Data Network)
Internet speed	30MBPS on Metro network
Network Topology	Star
Network equipment type	Cisco 2901 router, Catalyst 4506 core and Cisco 2960 Switches
Wi-Fi availability	None
Access to internet at Home	none
Quality of Service	None

With a bandwidth of 30MBPS, the internet connection is relatively good. The IT head continued to emphasize that the hospital local area network is functional and performing well.

b) Hardware / Computing Devices

SMH wards and clinics have an average of two desktop computers per location, mainly for processing IPMS transactions. These computers are shared by all personnel in the department. There are some mobile gadgets such as cellphones, but these are of low specification and cannot provide video conferencing services.

Table 11: Computing devices at Sekgoma Memorial Hospital

EQUIPMENT	STATUS
Desktop PCs	Available – computers*

Screens	Available
Speakerphones	Not available
Cameras	Small one
Laptops	4 laptops, 2 shared through loans
Tablets	Not issued
Cell phones	Not issued

**Most admin staff do not share computers but too many clinicians must share a computer. Sharing of computers is not equitable across hospital units.*

c) Software / Applications

Segkoma has one WEBEX license and one Microsoft teams license which are used by the IT Department for administering conferences. The network runs the following applications:

- i. Integrated Patient Management System (IPMS),
- ii. Government Accounting and Budgeting System (GABS),
- iii. Email,
- iv. IP-based phones.

d) Office Space and Conference Rooms

There are three conference rooms in the hospital, and there is a challenge with office space. The larger of the conference room in the administration block has a seating capacity of about 30, and the remaining one has a capacity of five to ten.

e) Personnel and Training

The facility has a staff complement of 850, and out of that number 450 need to use computers. Clinicians are computer literate.

There has not been any training on utilization of conferencing software by end users, nor for IT staff on administration of Conferencing software.

f) Observations

Access control is a concern here for equipment safety.

V MINISTRY OF HEALTH AND WELLNESS HEADQUARTERS, GABORONE

Assessment date: March 2021

The following areas were investigated, and findings are as shown below:

Findings:

a) Connectivity

Table 12 gives a summary of the connectivity at the MoHW Headquarters:

Table 12: Connectivity at Ministry of Health and Wellness Headquarters

COMPONENT	DETAILS
Bandwidth	70MBPS (On Government Data Network) Alternative connectivity: BTC modem at 70MBPS
Internet speed	70MBPS on Metro network
Network Topology	Star
Network equipment type	Cisco, Polycom, D-Link
Wi-Fi availability	Partial
Access to internet at Home	Limited to Executives
Quality of Service	None

With bandwidth for the facility at 70MBPS, internet connection is relatively good.

b) Hardware / Computing Devices

Each staff member has computing devices, either a desktop computer or laptop.

Table 13: Computing devices at Ministry of Health and Wellness Headquarters

EQUIPMENT	STATUS
Desktop PCs	Available – computers
Screens	Smart screens available
Speakerphones	Available
Cameras	Available
Laptops	Available
Tablets	Limited to Executives
Cell phones	Limited to Executives

c) Software / Applications

The MoHW has five WEBEX licenses and five Microsoft Teams licenses, which are used by the IT department for administering conferences. The network runs the following applications:

- i. Integrated Patient Management System (IPMS),

- ii. Government Accounting and Budgeting System (GABS),
- iii. Email,
- iv. IP-based phones.

d) Office Space and Conference Rooms

Generally, there is adequate office space with seven conference rooms, five of which are equipped. The largest conference room has a capacity of approximately 30, while the other rooms are standard conference rooms with a capacity ranging from 10 to 15.

e) Personnel and Training

End user training on utilization of conferencing software may be necessary, as well as training of IT staff on the administration side of conferencing software.

f) Observations

The Ministry Headquarters has functional video conferencing facilities.

Table 14 presents a summary of findings from each site location of the Health Information Technology needs assessment exercise

Table 14: Summary of Baseline HIT Findings

COMPONENT	MoHW	SKMTH	PMH (GOV'T NETWORK)	PMH (UB NETWORK)	SEKGOMA	NRH	LMH (GOV'T NETWORK)	LMH (UB NETWORK)
Bandwidth	70Mbps (On Government Data Network) Alternative connectivity: BTC modem at 70Mbps	10 Gbps connecting back to UB main campus	50 Mbps (On Government Data Network)	20 Mbps connecting back to UB main campus through Metro Network	30 Mbps (On Government Data Network)	20 Mbps (On Government Data Network)	50 Mbps (On Government Data Network)	20 Mbps connecting back to UB main campus through Metro Network
Internet speed	70Mbps on Metro network	6 Gbps shared by UB main campus and all 11 remote sites	50 Mbps	6 Gbps shared by UB main campus and all 11 remote sites	30 Mbps on Metro network	20 Mbps on Metro network	50 Mbps	6 Gbps shared by UB main campus and all 11 remote sites
Network equipment type	Cisco Polycom D-Link	Cisco equipment still on support	Cisco 2950 Switches	Cisco equipment still on support	Cisco 2901 router, Catalyst 4506 core and Cisco 2960 Switches	Cisco 2901 router, Catalyst 2900XL core and Cisco 2950 Switches	Cisco 2960 Switches	Cisco equipment still on support
Wi-Fi availability	Partially	Available	None	available	None	None	None	available
Smart Screen	Yes	Yes	No		Yes	No	Yes	
Laptop	No dedicated laptops for the conference rooms in any of the sites; officers have to use either personal laptops or work-assigned computers							
Speakers	No	No	No		No	No	Small speaker	

Figure 3: Assessment team meeting with the Letsholathebe II Hospital representatives



2. Commercial Bandwidth

The commercial bandwidth testing was dependent on the presence of a functional IT infrastructure. Only LMH and SMH had sufficient equipment and network capacity to participate in this exercise, and therefore those sites were piloted first. Each site's IT officers at each site were instructed to register for the webinar, and then log in using the hospital's bandwidth to connect. Afterwards the IT officers provided feedback on the quality of the connection, such as the number of times there were breaks in transmission, or any connection problem they had experienced LMH was able to attend Botswana COVID-19 Webinar 30 on June 10, 2021 which addressed Mechanical Ventilation, while SMH first joined the webinars on June 24, 2021 (Webinar 31) which featured a District Health Management Team COVID-19 update from Boteti District. On November 11, 2021, a virtual meet-and-greet session was organized between the four sites following the procurement and installation of essential equipment. Additionally, the commercial bandwidth from Nyangabwe (NRH) and PMH were tested during this virtual meet-and-greet session, and the connection was found to be satisfactory.

3. Training Intervention for COVID-19 Management

To implement provider education, the Botswana COVID-19 webinars used the Project ECHO Zoom online platform from the University of New Mexico to disseminate knowledge and new information across the country. A coordinating team was comprised of subject matter experts and support staff from UB, BHP, BRPH, and RGHI. This included platform administrators (responsible for invitations), and experts in clinical and research fields (lecturers) were responsible for curating presentation and supporting material for the presentations. Presenters represented academic, government program and policy, medical, and allied professional fields, and all webinars were on topics related to COVID-19. A total of forty-four webinars were delivered weekly on Thursdays at 4pm, and sometimes twice weekly on demand.

The Botswana COVID-19 Webinars remotely reach and prepare local clinicians with the knowledge and skills to effectively manage and treat COVID-19 patients. This series was the primary vehicle for the dissemination of Botswana's National Guidelines on COVID-19 Treatment and Management. Topics covered in the series have included, among others:

- i. Airway Management in COVID-19,
- ii. Clinical Management and Contact Tracing,
- iii. Critical Care for the Non-ICU Provider,
- iv. Emergency Response Coordination at the district level,
- v. Genomics of SARS-CoV-2 in Botswana,
- vi. Oxygen Therapy, Pulmonary Embolism:
- vii. Risk Stratification and Management,
- viii. Research Findings, and Vaccines,

The webinars were available not only to MoHW personnel, but also to private sector practitioners, medical residents in training, administrators, and policy makers, depending on the topic for the day. Relevant topics and diverse participation allowed for fruitful interactive sessions. To improve service delivery, they also gave an indication of the critical areas of need that needed to be addressed. This allowed for access to officers that are not usually accessible.

Attendance of the webinars hosted through this initiative ranged from 20 to well over 200 clinicians, depending on the subject matter and the alert status of the country regarding COVID-19; initial attendance was very high, but it tapered down significantly as clinicians got more comfortable handling COVID patients. Webinars were subsequently uploaded to YouTube and can be accessed on YouTube at: <https://www.youtube.com/playlist?list=PLSWfnqV02sZsVpqUvhJW430GEatillyEk>. As of 16 March 2022, a total of 44 webinars were conducted.

4. Local Coordinating Teams for Telemedicine and Training Efforts

After capacitating the sites with equipment and ensuring that they could participate in telementoring activities, there was need to provide local support for remote education and training activities. To achieve this, a coordination team was assembled at each site. The assessment team identified point of contacts at each site to assist with the coordination of virtual events and initiatives, participant recruitment, optimal event times, and on-site technical support. The coordinating teams are listed below, in Table 15.

Table 15: On-Site Points of Contact for Health Care Workforce Training

Princess Marina Hospital	Sekgoma Memorial Hospital	Nyangabwe Referral Hospital	Letsholathebe II Memorial Hospital
Pelontle Mmolawa (IT)	Olebogile Oki (IT)	Mbatshi William (IT)	Letty Moshoeshoe (IT)
Mr Dikgokgwane (IT)	Kgomotso Makwati (IT)	Kabelo Majaga (IT)	Mr Heyabo (IT)
Bontshwanetse Baaitse (Nurse)	Tshoganetso Masole (Nurse)	Nancy Kablay (Nurse)	Charity Montshiwa (Nurse)
Keaobaka Kebuang (Nurse)	Kebobonye Keolebale (Nurse)	Neo Modise (Nurse)	Themبani Kenalemang (Nurse)

5. Bandwidth Expansion and Provision of Infrastructure

The data from the needs assessment showed that there was a severe shortage of end-user devices to facilitate virtual activities in the era of COVID-19. The GoB internet network insufficiently stable to support remote connections for virtual learning. As a result, this project included the provision of peripheral devices to facilitate optimal connectivity for participation in distance learning.

Each site received equipment based on the identified gaps in that area and the available budget. Smart TVs were given to PMH and NRH, while SMH and LMH already had functional smart TV screens. Every facility received a laptop, a conference camera, a speakerphone system, and a 24 months activation of a 5G mobile internet at 20Mbps. Table 3 below provides a summary of the equipment provided per site.

Table 16: Equipment that each site received under this project

	Princess Marina Hospital (PMH)	Sekgoma Memorial Hospital (SMH)	Nyangabwe Referral Hospital (NRH)	Letsholathebe II Memorial Hospital (LMH)
Samsung 65-inch Smart TV Screen	✓	--	✓	--
Mercer Rugged Laptop with MS Office	✓	✓	✓	✓
Logitech Conference Camera/Speakerphone Device	✓	✓	✓	✓
BTC LTE Modem with 20Mbps Connection	✓	✓	✓	✓
Date of Handover	28/09/2021	11/10/2021	13/10/2021	14/10/2021

Findings

The following were the common key findings across sites that posed a challenge during the implementation phase:

- i. Unreliable internet network
- ii. Obsolete equipment
- iii. Poorly maintained equipment
- iv. Inadequate or obsolete network infrastructure
- v. Limited end user devices; most employees share devices
- vi. Restricted accounts for video conferencing software (e.g., Zoom, Microsoft Teams)
- vii. Unavailability of key peripheral devices for remote learning, such as speaker, microphone, and camera systems
- viii. Facility maintenance challenges (e.g., leaky roofs, security issues)
- ix. Undertraining of clinical staff in the use of information technology
- x. Need for IT Staff training on the administration of virtual meetings

Challenges

The implementation of this project was not without its fair share of challenges. Several important challenges were:

1. Internet connectivity were challenges at most sites, with timeouts during videoconference sessions
2. Cross-border clearance of goods purchased from outside the country was delayed due to COVID-19, pushing back the implementation schedule.
3. Budget limitations only allowed for a mobile network-based internet solution to be provided to the sites, instead of a more reliable terrestrial-based internet service.

Achievements

1. Hardware, which included laptops, smart TV screens, conferencing speakers, and internet devices were procured to address some of the identified gaps. This has made it possible for Health Care Workers in these facilities to participate in virtual learning, paving the way for future telehealth initiatives to improve patient care.
2. Over the course of the project, more than 1,000 health care workers participated in the Botswana COVID-19 Webinars.

Figure 4: Handover ceremony at Nyangabwe Referral Hospital



Drs Lowell Chansa (left – Deputy Hospital Superintendent) and Kobamelo Motshidisi (middle – Hospital Manager-Clinical) are pictured, receiving the equipment.

Conclusion and Recommendations

COVID-19 emphasized the importance of rethinking how information is disseminated to health care workers. A major challenge in the past has been staff shortages, which have been mitigated by this project's use of HIT to reach more health care workers quickly and without having them leave their duty stations. This project enabled the assessment team to reach more health care workers, facilitated standardization of care for COVID-19 patients and paved the way for future uses of the technology. This work has allowed for reaching an even larger network of health care workers and for applying virtual learning in other areas, such as communicable and noncommunicable diseases.

Recommendations

1. MoHW to work with Ministry of Science, Technology and Infrastructure to improve the Government internet network, both the physical and the logical aspects, in order to make it more stable
2. Equip all hospitals' conference rooms with a reliable high-speed internet connection, a computer, a screen, and a conferencing speaker system

3. Train IT staff on virtual meeting administration
4. Ensure that internet connectivity is available in most areas of the facilities
5. Acquire more licenses for collaboration software such as Microsoft Teams
6. Adopt the use of HIT to reach all health care workers for training, telementoring or dissemination of information for all programs
7. Formalize the training units and assign an officer to coordinate virtual learning

Figure 5: An ideal setup like this should be availed for every health care facility in the country



Appendices

Appendix 1: Assessment Questionnaire

HOSPITALS ASSESSMENT

COMPONENT	DETAILS
Connectivity	
Bandwidth	
Internet Speed	
WAN Connectivity/ Technology	
Network Topology	
Cabling type	
Network Equipment Type/Vendor	
Wi-Fi – Availability	
Access to Internet at Home	
End User Devices/Hardware	
Smart Screens – for video conferencing	
Speaker Phones	
Camera	
Desktop PC's availability	
Laptops	
Tablets	
Cell Phones	
Software / Applications	
Video Conference Licenses	
Video Conference Equipment	
Collaboration Tools	
Personnel and Training	
Space/Rooms	
Office Space	
Video Conference Space	

NOTES/OBSERVATIONS:

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RECOMMENDATIONS:

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Appendix 2 – Committees and Key persons involved in the project (by site):

Name	Organization	Title	Email	cell phone
Mr Dikgokgwane	PMH	Head of IT		
Mr Mmolawa	PMH	IT Officer		
Ms Moreki	PMH	IT Officer		
Ms Macheng	PMH	IT Officer		
Ms Kamanga	PMH	Oncology Nurse		
Ms Makhanda	PMH	Oncology Nurse		
Ms Masalila	PMH	Oncology Nurse		
Dr Motswakae	PMH	Oncology Physician		
Mr Baaitse	PMH	Oncology Nurse		
Mr Kebuang	PMH	Oncology Nurse		
Ms Makwati	SMH	Head of IT		
Mr Oki	SMH	IT Officer		
Ms Magashula	SMH	IT Officer		
Mr Masole	SMH	Nurse		
Ms Keolebale	SMH	Nurse		
Ms Moyo	NRH	Head of IT		
Mr William	NRH	IT Officer		
Ms Majaga	NRH	IT Officer		
Ms Kablay	NRH	Oncology Nurse		
Ms Modise	NRH	Oncology Nurse		
Ms Moshoeshoe	LMH	Head of IT		
Mr Heyabo	LMH	IT Officer		
Ms Montshiwa	LMH	Oncology Nurse		
Mr Kenalemang	LMH	Oncology Nurse		
Dr Eliecer	LMH	Oncologist		

Advisory Committee

Name	Role	Organization
Richard Marlink	Director	Rutgers Global Health Institute
Reena Antony	Senior Program Program Coordinator	Rutgers Global Health Institute
Adrian Rodrigues	IT Director	Rutgers, Cancer Institute of New Jersey
Tebogo Motlhatlhedhi	IT Officer	UB Faculty of Health Sciences
Matlhogonolo Sorinyane	IT Officer	UB Faculty of Medicine
Percy Thutoetsile	Network Specialist	University of Botswana
Onalenna Otlhomile	IT Officer	Ministry of Health and Wellness
Refeletswe Lebelonyane	Program Manager	Botswana-Rutgers Partnership for Health
Robert Moumakwa	Telehealth Coordinator (October 2020 – April 2021)	Botswana-Rutgers Partnership for Health
Vusikhaya Ndaba	Telehealth Coordinator (April – November 2021)	Botswana-Rutgers Partnership for Health

Implementation Team (IT, network, technical)

Name	Role	Entity
Tebogo Motlhatlhedhi	IT Consultant	University of Botswana
Robert Moumakwa	Telehealth Coordinator (October 2020 – March 2021)	Botswana-Rutgers Partnership for Health
Vusikhaya Ndaba	Telehealth Coordinator (April 2021 to date)	Botswana-Rutgers Partnership for Health
Onalenna Otlhomile	IT Officer	Botswana Ministry of Health and Wellness
Matlhogonolo Sorinyane	IT Consultant	University of Botswana
Percy Thutoetsile	IT Consultant	University of Botswana

Local Coordination Teams by Site

Princess Marina Hospital	Sekgoma Memorial Hospital	Nyangabwe Referral Hospital	Letsholathebe II Memorial Hospital
Pelontle Mmolawa (IT)	Olebogile Oki (IT)	Mbatshi William (IT)	Letty Moshoeshoe (IT)
Mr Dikgokgwane (IT)	Kgomotso Makwati (IT)	Kabelo Majaga (IT)	Mr Heyabo (IT)
Bontshwanetse Baaitse (Nurse)	Tshoganetso Masole (Nurse)	Nancy Kablay (Nurse)	Charity Montshiwa (Nurse)
Keabaka Kebuang (Nurse)	Kebobonye Keolebale (Nurse)	Neo Modise (Nurse)	Themhani Kenalemang (Nurse)