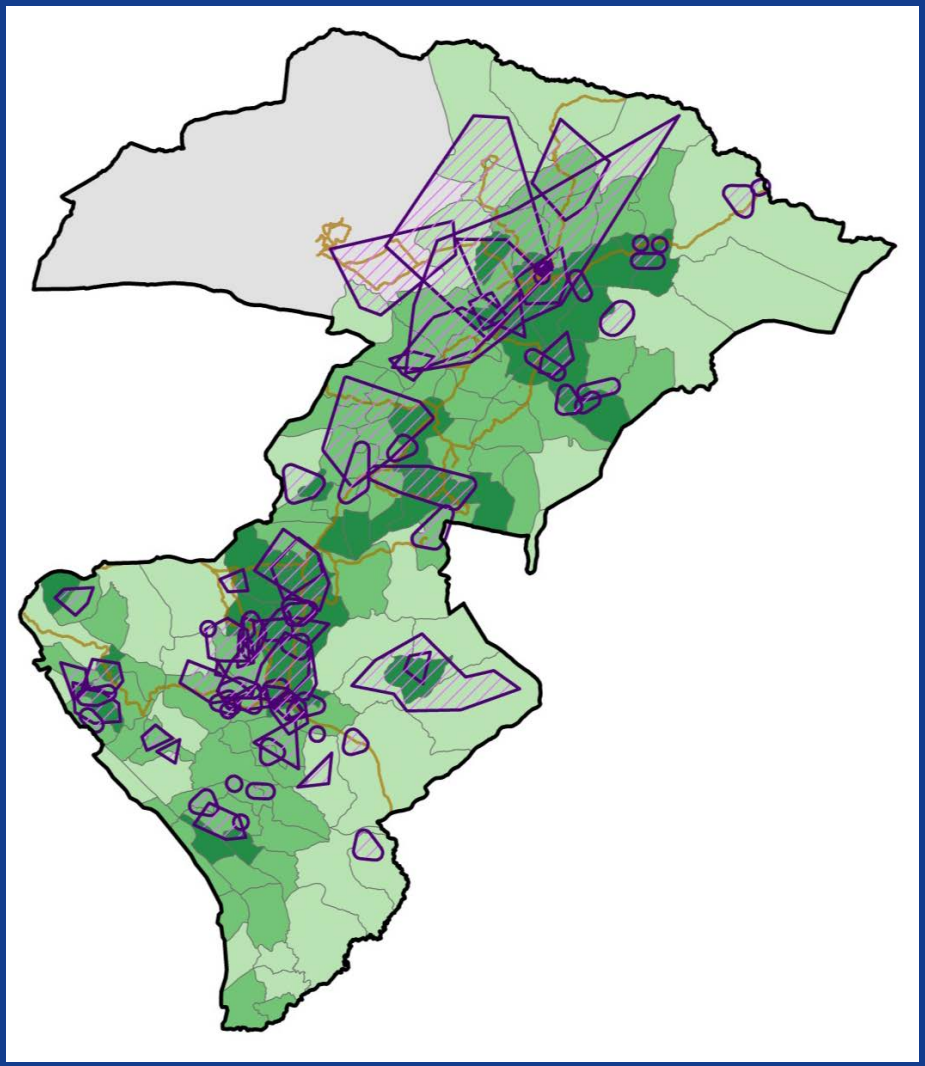
Using Geospatial Analysis to Improve Resource Allocation for HIV Programs in Iringa Region, Tanzania



MEASURE Evaluation
SPECIAL REPORT

Cover shows a map of VCT catchment areas and population density in Iringa Region, Tanzania.

Using Geospatial Analysis to Improve Resource Allocation for HIV Programs in Iringa Region, Tanzania

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Contents

Acronyms

AIDS	acquired immune deficiency syndrome
CBO	community-based organization
CCHP	Council Comprehensive Health Plan
CT	care and treatment
DDU	data demand and use
DED	district executive director
DHMT	district council health management team
DMO	district medical officer
GIS	geographical information system
GPS	global positioning system
HBC	home-based care
HIV	human immunodeficiency virus
HMIS	health management information system
M&E	monitoring and evaluation
NGO	nongovernment organization
OVC	orphans and vulnerable children
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PLACE	Priorities for Local AIDS Control Efforts
PMTCT	prevention of mother-to-child transmission
QGIS	Quantum GIS
TACAIDS	Tanzania Commission for AIDS
USAID	U.S. Agency for International Development
USG	United States government
VCT	voluntary counselling and testing
VMMC	voluntary male medical circumcision

Executive Summary

Using geospatial analysis to improve resource allocation for HIV programs in Iringa Region, Tanzania: Over a two-year period, MEASURE Evaluation worked with local authorities in the Iringa and Njombe regions of Tanzania to illustrate the potential of maps and geographic information systems (GIS) for supporting effective programming of resources and to enhance demand for and use of data for decision making in the health sector. The work started with activities designed to gather data on HIV transmission dynamics and service coverage, and continued with activities aiming to increase the capacity of district council health management teams (DHMTs) to use this and other data to improve resource allocation for HIV programs.

Dynamics of HIV transmission were assessed using a Priorities for Local AIDS Control Efforts (PLACE)-lite survey, which investigates AIDS prevention program coverage in areas where HIV transmission is most likely to occur. Participatory mapping and site visits were used to identify and map locations and catchment areas of service delivery points providing HIV prevention, care, and treatment. Using open source GIS software, these sites and catchment areas were mapped, and were combined with population estimates and data from semi-annual and annual U.S. President's Plan for Emergency AIDS Relief (PEPFAR) reports to map coverage provided by services at each site. Through a rapid data demand and use (DDU) assessment of the HIV prevention services in these regions, MEASURE Evaluation found that decision makers needed increased monitoring and evaluation (M&E) capacity to most efficiently analyze their service data and use these maps for policy and programmatic decision making. Accordingly, MEASURE Evaluation undertook a series of activities with council health management teams to build capacity for using maps for decision making. These included a dissemination workshop, GIS mentorship visits, and a DDU workshop.

This document describes the capacity building process, following a brief review of the data gathering activities. In the dissemination workshop, results from the PLACE-lite survey, the participatory mapping exercise, and the rapid DDU assessment were shared with local authorities and implementing partners. Participants were asked to use maps of the data to identify gaps in coverage and areas to prioritize resources. The mentorship visits were designed to institutionalize capacity for mapping and use of geographic and health data to strengthen HIV services at the

local level. At the DDU workshop, local authorities identified and prioritized their M&E questions, analyzed available information, and crafted solutions. During the workshop, each DHMT shared how it was using maps to visualize data and facilitate decision making. This document concludes with lessons learned for other organizations interested in using GIS and improving data demand and use in their local HIV response, or in other health interventions.

Context

The Iringa and Njombe regions in south-central Tanzania are resource-rich areas offering numerous employment and income-generating activities, including farming and mining. As part of a major transportation hub that links several adjacent countries, the two regions attract numerous migrants, including entrepreneurs, laborers, and commercial sex workers. At the time this activity was begun, the regions were combined.* Between them, with a population of approximately 1.5 million, these regions have the highest adult prevalence of HIV in the country—9.1% in Iringa and 14.8% in Njombe—close to twice the national prevalence of 5.1%.[1] The U.S. Agency for International Development (USAID) Mission in Tanzania is supporting a broad scale-up of behavioral, biomedical, and structural HIV prevention activities in both regions.[2] Ensuring the effectiveness of these programs requires a detailed understanding of existing HIV services and prevention activities, and of the local context and behaviors contributing to the high prevalence. To that end, the USAID funded MEASURE Evaluation to conduct a series of activities from 2011 to 2013 to improve understanding of the regions' HIV epidemic. These activities were conducted in all seven districts—Mufindi, Kilolo, Iringa Urban Municipality, Iringa Rural, Njombe, Ludewa, and Makete. Through these activities, MEASURE Evaluation collected, mapped, and disseminated information about HIV high-risk areas, vulnerable populations, service sites, and ongoing HIV prevention, care and treatment, and outreach efforts in Iringa and Njombe regions. A combination of methods and tools were used for collecting and mapping data, including surveys, key informant interviews, global positioning system (GPS) devices, flat maps and geospatial information system software.

* Njombe Region was created in 2012 from three southern districts from the Iringa Region. After Njombe's creation, the MEASURE Evaluation activities continued in Njombe's districts and the remaining districts of Iringa.

Implementation

MEASURE Evaluation's work consisted of six activities: three data-gathering exercises and three data use/capacity building exercises:

- identifying areas of potential HIV transmission in Iringa Region (PLACE-lite survey);
- identifying coverage areas of available services and gaps in services (Iringa participatory mapping exercise);
- conducting a rapid data demand and use (DDU) assessment of the HIV prevention services;
- disseminating rapid DDU assessment, PLACE-lite, and Iringa participatory mapping findings to local authorities in a regional dissemination workshop;
- mentoring of DHMTs on data use, creation of tailored maps and use of GIS software; and
- providing technical assistance and guidance for using data for decision making through a DDU workshop.

The PLACE-lite survey and Iringa participatory mapping exercise have been documented elsewhere.[3,4] PLACE-lite was adapted from PLACE, a rapid assessment tool developed by MEASURE Evaluation to monitor and improve the coverage of HIV prevention programs in hot spot areas.[5] The rapid DDU assessment was conducted using the Assessment of Data Use Constraints tool, developed by MEASURE Evaluation to identify barriers and constraints to data use and guide effective approaches to address them.[6] The Data Gathering section below summarizes these three activities. The DDU/GIS Capacity Building section then discuss the regional dissemination workshop, GIS mentorship visits, and DDU workshop.

Ensuring local commitment: Throughout its work in Iringa and Njombe, MEASURE Evaluation met with regional health and administrative officials to ensure continued local support among key decision makers.

Data Gathering

This section summarizes the PLACE-lite survey, Iringa participatory mapping exercise and rapid DDU assessment, which provided substantial data used in the dissemination, mentorship, and workshop activities.

PLACE-lite Survey: In February and March 2011, the MEASURE Evaluation team worked with health officials in Iringa's seven districts to conduct a modified form of the PLACE assessment called PLACE-lite.[5,7] PLACE is a rapid assessment tool developed by MEASURE Evaluation to monitor and improve the coverage of HIV prevention programs in "hot spot"* areas.[5] PLACE-lite uses community informants in a sample of wards to identify venues and events where people seek sexual partners. In Iringa and Njombe, the informants identified over 2,000 hot spot locations and 1,500 events in 63 villages and urban areas. The MEASURE Evaluation team visited the most commonly named venues to characterize risk behaviors and prevention activities occurring at these sites. The team used these data to produce maps of the hot spots in each district. Maps included information on presence or absence of HIV prevention materials (flyers, wall postings, etc.) (figure 1), number of clients, and other information helpful for prioritizing HIV prevention efforts. The PLACE-lite survey findings were written up in a report.[3] The report and district-specific profiles were shared with each district's council health management team during the dissemination workshop. Key

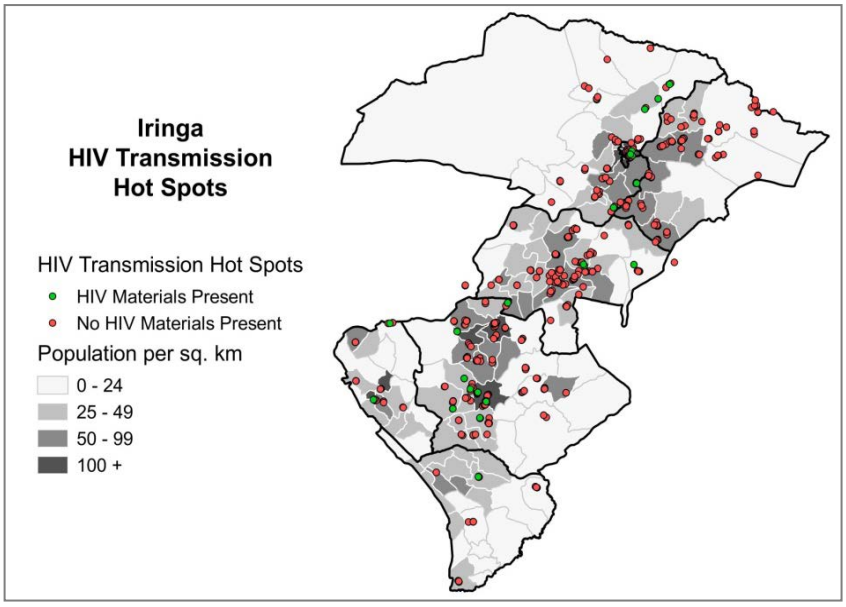


Figure 1: Mapping HIV transmission hot spots through PLACE-lite.

* Bars, brothels, hotels, truck stops, plantations, road construction sites, and other areas where contextual factors suggested high risk behaviors were common.

findings included:

- high prevalence of sex work in the locations visited (40% of venues)
- a lack of HIV prevention outreach activities in 43% of villages visited
- substantial variation in condom availability by district (while condoms were readily available in 75% of all villages, in Makete, only 2 villages (29%) had condoms readily availability)
- patrons at a small but noticeable number of venues (less than 20%) included men who have sex with men (MSM)

Given these and other results, the MEASURE Evaluation team concluded that the situation in Iringa and Njombe regions increased the risk for continued HIV transmission.

Iringa Participatory Mapping Exercise: In May 2012, a small MEASURE Evaluation team visited over 250 U.S. government-supported health facilities and outreach programs in Iringa, where they interviewed key informants and collected GPS coordinates for facilities and community-based organization (CBO) or nongovernment organization (NGO) offices. At each facility, the key informant was asked to identify, from a detailed map of the local area, where the majority of the site's clients came from for each HIV-related service. Using the same detailed maps, CBO/NGO staff members were asked to identify villages where their outreach workers were working. Facility services investigated include voluntary counselling and testing (VCT), prevention of mother-to-child transmission (PMTCT), care and treatment (CT), and voluntary male medical circumcision (VMMC). For outreach services, the team investigated service reach for orphans and vulnerable children (OVC) programs, home-based care (HBC) programs, and condom distribution.

Catchment areas were generated based on the key informants' responses. These were overlaid with other data, including population estimates, regional HIV prevalence and demographic data, USG semi-annual and annual performance reports, and data from the PLACE-lite survey. The result was a series of maps overlaying the location and reach of HIV services and prevention activities with hot spots (figure 2). The maps were initially disseminated for review to key persons in the USAID and USAID implementing partners through ArcGIS Online (a Web-based mapping platform that enables secure access). Findings from the Iringa participatory

mapping exercise were documented[4] and shared with local authorities in each district though a regional dissemination workshop. The MEASURE Evaluation team noted that:

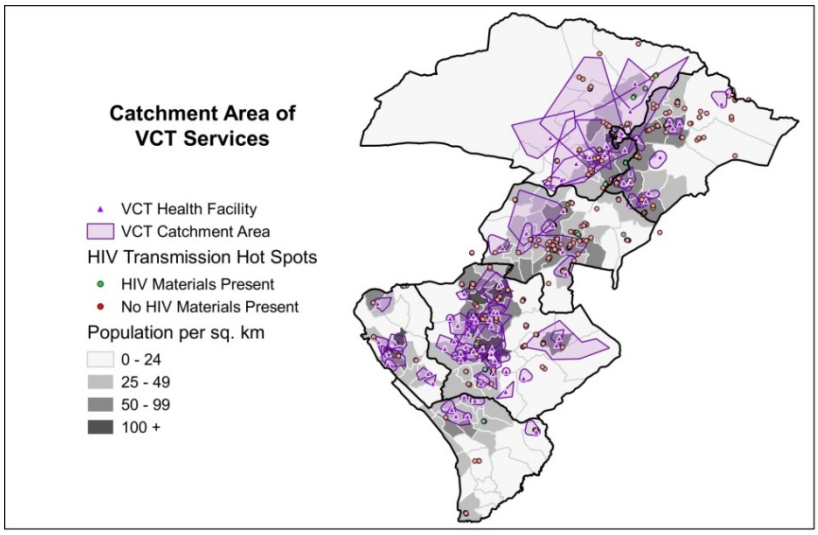


Figure 2: VCT catchment areas and HIV transmission hot spots.

- PMTCT and VCT services were more common than CT services;
- rural and hard-to-reach areas had substantial gaps in coverage for all facility-based services;
- overlapping catchment areas were common in areas with high population density; and
- NGO and CBO staff could identify the districts they were working in, but not the specific wards within the districts.

Rapid DDU assessment of HIV prevention services: In June 2012, the MEASURE Evaluation team conducted a rapid data demand and use assessment of HIV prevention, care and treatment services in Iringa and Njombe regions. The team interviewed data producers, data users and decision makers on (1) data use and (2) barriers to data use in their organizations. Interviewees included a cross section of government and implementing partner staff working at facility and district levels in five districts/municipalities: Iringa Urban, Iringa Rural, Mufindi, Kilolo and Njombe. Questions asked on data use investigated HIV/AIDS and health information needs, data flow, and data use at the facility and district levels for government staff and across the organization for implementing partners. Questions asked on barriers investigated technical, individual, and organizational constraints which limited effective use of information in the decision-making processes.

Through the assessment, the team found that implementing partners employed monitoring and evaluation (M&E)-specific staff and had a culture of using data for informed decision making. The M&E staff were responsible for data review, data entry, and analysis. After data analysis, the

M&E staff typically met with other program officers to discuss the data and address identified gaps. Additionally, implementing partners had structures in place to facilitate the use of information for decision making, including M&E plans and scheduled forums for partners to meet to share their challenges and successes.

Interviews with government district and facility staff revealed a lack of technical capacity to generate and use data, which contributed to low motivation among staff, poor data quality, and minimal use of information for decision making. Facilities lacked dedicated M&E staff. Some staff involved in M&E tasks had received limited M&E training, and primarily collected data without analyzing or interpreting the data. At the district level, factors negatively affecting data quality and use included poor infrastructure, limited financial and human resources, and an absence of a central data repository. In some instances when data were available, program decisions were made based on other criteria. Said one individual:

> *My office is responsible for deciding where to provide services for the partners who are coming to operate in our district. But several times [when] we allocate them to some area, especially the distant areas they say they cannot go there because they do not have enough fund to operate to that area. Because we need their service we allow them to operate in the area they want. This results to some areas being well served while others underserved.*
>
> **District council health management team member**

DDU/GIS Capacity Building

To build district-level capacity to better use information on Iringa's HIV epidemic and service distribution for program planning and decision making, MEASURE Evaluation followed up the PLACE-lite survey, Iringa participatory mapping exercise, and rapid DDU assessment with three activities:

- a regional dissemination workshop (September 2012);
- mentoring in DDU and GIS (November 2012 to July 2013); and
- a regional DDU workshop (November 2013).

During dissemination and capacity building, the MEASURE Evaluation team focused on achieving district-level results by working with two main groups of stakeholders: officials from district municipal and town medical offices, responsible for facility-based services; and staff from district and town executive offices, responsible for community HIV prevention efforts. These

included district AIDS control coordinators, council HIV/AIDS coordinators, district medical officers, and their counterparts from towns or municipal areas, as well as the regional reproductive and child health coordinator, the regional Tanzania Commission for AIDS (TACAIDS) coordinator, and Njombe's regional medical officer.

Given the importance of context and geography for understanding HIV service access and HIV transmission dynamics, both the dissemination workshop and the mentoring activity used maps for visualizing patterns in the data.

Regional dissemination workshop: In September 2012, MEASURE Evaluation hosted a three-day workshop to disseminate the findings from the PLACE-lite survey, Iringa participatory mapping exercise, and rapid DDU assessment; and to build the capacity of local officials to use maps for decision making. Before the workshop, the MEASURE Evaluation team met with and briefed key stakeholders, including the regional administrative secretary and the regional medical officer, on the activity. Each district was asked to send a team of four to six key persons involved in HIV prevention, care and treatment activities. The 50 workshop attendees included such staff from regional and district government agencies, and from PEPFAR implementing partners working in the region.

During the first day, the MEASURE Evaluation team disseminated the PLACE-lite and rapid DDU assessment findings, and the maps of U.S. government-supported services and catchments from the Iringa participatory mapping exercise. Regional staff overseeing HIV/AIDS response efforts[*] described aspects of the local response, including data flow and use. During the second day, the *7 Steps to Use Routine Information to Improve HIV/AIDS Programs*[8] guide was used to facilitate discussions around prioritizing actions to improve HIV service distribution and address transmission dynamics. On the third day, attendees reviewed maps of available services and transmission hot spots, identified gaps in services, and developed action plans to prioritize or expand services. Attendees' planned actions included sharing the findings from the maps during office meetings and with local stakeholders, expanding specific services, and using the maps to support planning and supportive supervision.

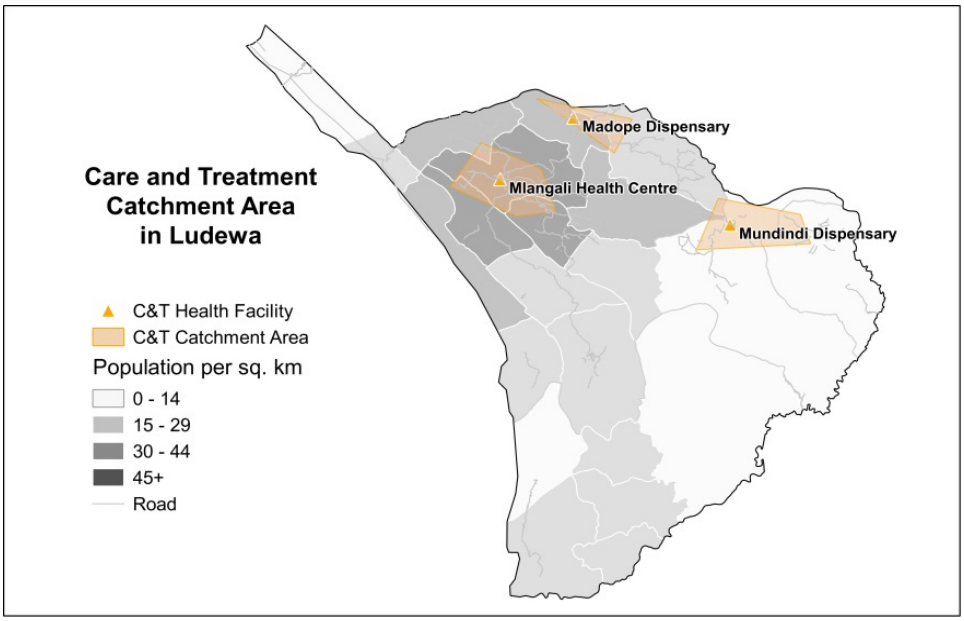
[*] Regional AIDS control coordinator, regional TACAIDS coordinator, and regional reproductive and child health coordinator.

The MEASURE Evaluation team identified a few weaknesses in the workshop outcomes. Though many of Iringa and Njombe's key stakeholders had attended the meeting, not all were present. Also, given a delay between the data collection and the workshop, data included in the maps were slightly dated. It was essential that officials be able to map current data on their own and tailor the maps to their needs. The MEASURE Evaluation team therefore determined that further follow up and capacity building through on-site mentoring were necessary to solidify map-making skills and ensure that the action plans were implemented.

On-site district mentoring: During the dissemination workshop, participants from four of the seven districts showed greater understanding of the potential of the maps as planning and advocacy tools than participants from other districts. We selected these four for on-site mentoring based on this engagement.[*] The selected districts included urban and rural districts from both regions. The mentoring was provided from November 2012 to April 2013 to the two main stakeholders in the districts (the district medical officer's office [DMO], responsible for services; and the district executive officer's office [DED], responsible for outreach and prevention activities). In Njombe district, the DMO and DED town counterparts for Njombe town were also visited. Most of the key staff in these offices are also part of the DHMTs. The mentoring visits were designed to support the implementation of the action plans developed in the regional workshop, to create new maps to meet current priorities, and to build capacity for districts to map their own data independently.

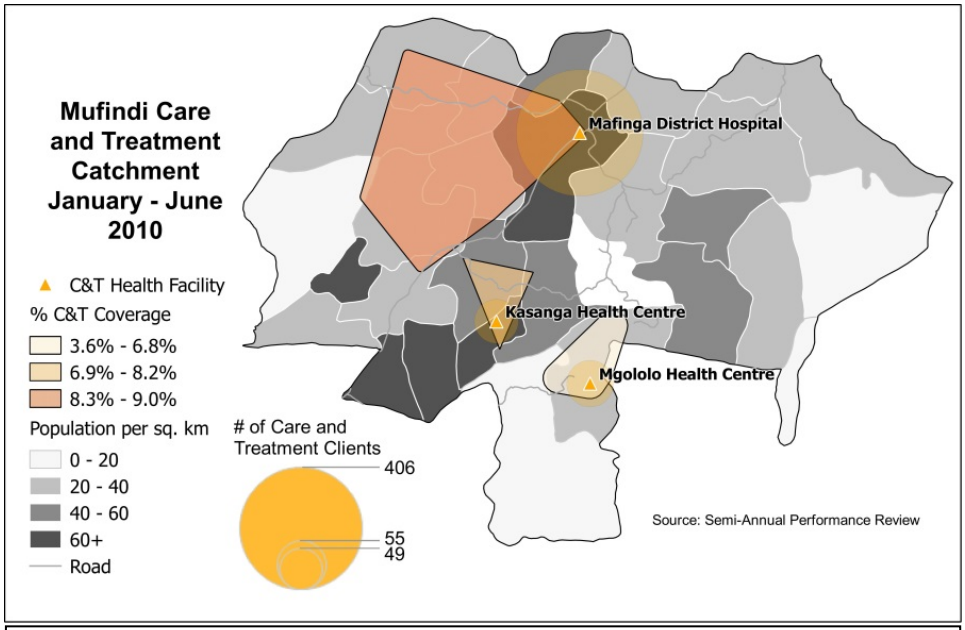
A more specific goal of the mentoring visits was ensuring stakeholders knew how to use maps showing disaggregated facility and CBO/NGO data. Maps showing this level of detail can help identify specific facilities that may be over-burdened or wards which may have gaps in services. For example, in Ludewa, the care and treatment centers were all centered on the northern side of the district, leaving a gap in the south (figure 3). Similarly, in Mufindi, several high population wards lack care and treatment services (figure 4).

[*] Mufindi District, Njombe District, Iringa Urban Municipality, and Kilolo District.



Identifying potential gaps in coverage: At the regional workshop, the Njombe regional medical officer and the Ludewa district council health management team identified a gap in care and treatment centers near the center of the district in an area with increased mining activity and high population growth.

Figure 3: Catchment areas for care and treatment centers, Ludewa.



Advocating for additional services: DHMT members in Mufindi noted that the existing care and treatment centers provided insufficient coverage and included over-burdened facilities. With this and other information, they lobbied for and obtained funding to offer care and treatment at additional facilities.

Figure 4: Care and treatment coverage, Mufindi.

Matching GIS training to local work cycles: The MEASURE Evaluation team conducted two sets of mentorship visits for DHMTs. Each visit took place over two to five days, depending on staff availability at the district offices receiving the support. The mentoring sessions began with a review of the PLACE-lite survey and Iringa participatory mapping exercise; and a discussion of each district's current priorities for addressing HIV in their districts. Participants reviewed their data, data gaps and how the data could inform their priorities. The MEASURE Evaluation team then worked with local staff to develop their technical skills for using QGIS (formerly Quantum GIS) and Excel spreadsheets to create maps, and provided participants with a manual on using QGIS and displaying data. Sites with poor data quality identified during the data review were noted for further follow-up and support.

During the first set of mentorship visits, in November 2012, two of four councils received training on creating maps for Tanzania's annual planning period to help allocate health resources for the upcoming fiscal year. Maps created during this training showed gaps in coverage where services could be expanded, hot spots where community outreach could be prioritized, and communities with poor condom availability needing improvements in distribution.

The two remaining councils received training during the second set of visits (February and March 2013). Because the planning period had ended by that time, their training focused on mapping routine data for routine decisions. With support, the districts mapped facility reporting rates, month-to-month HIV cases, and service distribution. Routine data were extracted directly from the health management information system (HMIS).

During both sets of visits, participants learned to make district-level maps from a variety of sources including:

- transmission hot spots from the PLACE-lite survey;
- catchment areas and facility distribution from the Iringa participatory mapping exercise;
- population density from census data; and
- facility-based HIV service statistics from the HMIS.

Continued remote training and technical support were offered to each district. This primarily included phone and email conversations between GIS staff on MEASURE Evaluation and

trainees to troubleshoot GIS problems—such as challenges in setting up the data or in customizing maps. Several additional visits were made to help generate specific maps in response to requests. By being responsive to immediate needs, these visits were important in continuing to build local technical capacity and ensuring use of the data.

Follow-up and evaluation: In July 2013, the MEASURE Evaluation team returned to Iringa and Njombe regions to follow up on the results of the mentoring visits, assess capacity development, and identify challenges. They found that while the maps created during the mentoring sessions had been used, and were seen as useful, the district teams did not feel sufficiently prepared to update and continue creating new maps without support. Additionally, trainees said that they would "find the creation of further non-HIV maps useful"—for example, maps showing family planning coverage, schools and educational resources, and sanitation issues.

Recognizing the need for further follow-up to ensure maps and other data were being routinely used for planning, monitoring and evaluation, MEASURE Evaluation staff conducted a regional DDU workshop (described below) in November 2013, and second set of follow-up visits in February 2014. During the February follow-up visits, MEASURE Evaluation staff worked with a smaller group of district staff who had been most engaged throughout earlier trainings and the interim to review progress on using the GIS software and help update or create new maps. During these follow up trips, district staff were able to identify the data they needed to map to address their M&E questions, but felt they needed continued technical assistance link that data to the GIS to create new maps.

Data demand and use workshop: In November 2013, MEASURE Evaluation conducted a regional level DDU workshop which brought together staff from the Iringa regional health management team and the four DHMTs in Iringa Region. Using a data demand and use training package, district and regional health management teams were oriented on data use concepts and tools, and trained in data analysis techniques, presentation, and interpretation. A stakeholder analysis was conducted and action plans developed by each district to address data use constraints. Through the implementation of the *7 Steps to Use Routine Information to Improve HIV/AIDS Programs* guide, councils identified and prioritized M&E questions, analyzed routine health data from January to September 2013 to address these questions, and crafted solutions.

Using the *Framework for Linking Data with Action* guide,[9] councils outlined the relationship between the analysis and the M&E questions, the proposed solutions, stakeholders who need to be involved in these solutions, and timelines for bringing about change in the following fiscal year. In addition, councils shared experiences and strategies for using data and information in program management, implementation and decision-making. Finally, councils shared how maps were being used to facilitate decisions being made in routine work. Maps showing the locations of facilities were being used to identify contiguous facilities for planning supportive supervision visits. Maps showing the spatial distribution of service coverage increased the councils understanding of potential gaps to review during the annual planning period. Such maps also helped councils with identifying locations for outreach centers and with scheduling outreach activities.

Using Maps to Support Decision Making: What Worked

Overall, participants in the mentoring activity gained a strong understanding of the value and uses of GIS and geospatial data for resource allocation. With on-site support, participants were able to create maps that reflected their own districts' priorities. Further, the maps created during the mentoring activity and previous MEASURE Evaluation activities were used productively to illustrate priorities and visualize data for discussion.

Illustrating priorities: Several districts used maps to illustrate the local HIV context and the spatial distribution of facilities and services, identifying gaps to prioritize for additional resources. For example:

- Mufindi District used maps (figure 4) showing the current distribution of care and treatment facilities during a Council Comprehensive Health Plan (CCHP) meeting to support the argument for an increase in the number of care and treatment clinics based on existing coverage and work-load:

  > *I used coverage maps to argue that we needed to add coverage of CTC sites in the areas where no CTC existed, funding was allocated for four existing health facilities to begin offering care and treatment sites.*
  >
  > **District AIDS Control Coordinator**

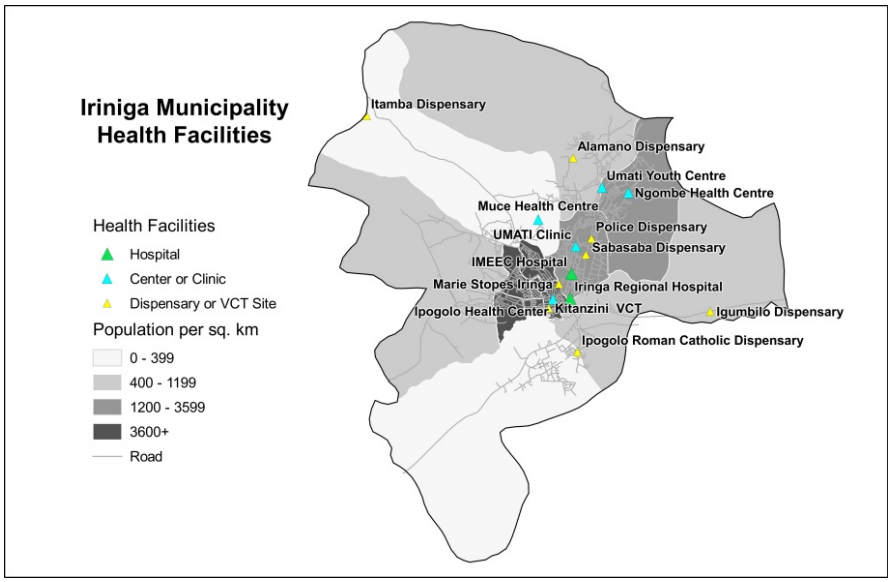
- Another member of Mufindi's DHMT used the map of hot spots to demonstrate the need for and secure public sector funding for increased condom distribution at an underserved village in Mufindi.
- Mufindi District Hospital used maps to communicate their concerns around inefficient service delivery at the hospital resulting from their over-burdened care and treatment service. The "facility distribution" map helped the district select a nearby facility to transfer patients to and build capacity at. As a result, the referring hospital improved the efficiency and quality of its care, while the receiving site took on care and treatment clients, ultimately increasing the coverage and quality of care and treatment services.

For those familiar with their districts, geographic gaps in service coverage became clear even during the earlier stages of the Iringa activities. During the regional dissemination workshop, for example, one of the participants identified an area in Ludewa district (Njombe Region) where a

new mine was opening, but few HIV services were available (figure 3). The maps helped him anticipate an area where service coverage would need to be increased.

Aiding visualization: In Iringa Urban, Iringa Rural, Mufindi and Njombe districts, health and HIV staff and decision makers used the maps to plan supportive supervision, report on HIV services in their district profiles, and build awareness of HIV prevention and treatment activities. To build awareness, the maps were posted prominently in each district health office, and shown to program staff and visitors working on HIV prevention, care and treatment activities. Further, the maps were examined by councils during the annual planning period.

- Mufindi District used the maps to help plan routine activities such as supportive supervision—the maps allowed them discuss the proximity of poorly performing facilities to others which may need more support, and plan their visits.
- In Iringa Urban Municipality, maps were included in the district health profile to visualize progress on HIV indicators.
- The Njombe health officers hung the maps on the wall in the DED's office. The maps provide a focal point for DHMT members to discuss service coverage and hot spots with visiting stakeholders.
- Iringa Urban Municipality used maps showing health facility distribution (figure 5) and service coverage in CCHP meetings. At these meetings, multiple stakeholders with varied M&E backgrounds meet to analyze and interpret routine data. The maps helped



"Maps provide comprehensive visual data which is easy to access and interpret." **Community development officer**

Figure 5: Health facility distribution by type, Iringa Urban Municipality.

stakeholders mentally link results with specific facility locations, facilitating discussion and the planning process.

- In HMIS trainings, Iringa Urban Municipality staff use maps to provide trainees with visualizations of data analysis results.

Though the maps helped participants visualize, services and characteristics of the HIV epidemic in Iringa and facilitated discussions on program coverage, districts encountered several challenge while attempting to use them routinely.

Challenges

Appropriate participation: Due to competing priorities, participants were often unable to attend the training, or stay for its duration. Yet even when participants were able to attend the full mentorship training, the "right" participants were not always selected. The GIS mentorship work required individuals with high computer literacy and strong database management skills, while data use initiatives required participants be familiar with their programs and program data. In some districts, both sets of attendees were not available for the entire mentorship visit.

Time and capacity building: Most participants felt that not enough time was spent building capacity for generating new maps. Further mentoring work was done to help overcome this challenge. Despite the added mentorship, the MEASURE Evaluation team note that longer-term software mentorship, beyond the scope of these activities, was needed for building sustainable capacity. Further, participants identified the need for adequate time set aside in their general work week to practice and apply the skills they had learnt. Providing them with this time required engaging their supervisors and highlighting the importance of the GIS tool and what they can expect their staff to accomplish—something which was done on the last follow-up visit.

Lessons Learned

A clear message from the Iringa mapping activities was that to use maps effectively and sustainably, participants needed specific maps matching their needs against up-to-date data. Stakeholders wanted the skills that would allow them to link routine health data with their maps to update them over time. Building capacity for generating such maps required that each mentoring visit needed a balance of several critical factors--the right trainees, the right setting, the right software, and the right data.

The human factor: Implementing sustainable initiatives entails not only establishment of relationships (and support) at the right levels, but ensuring that the appropriate people receive training.

- *Multi-level buy-in and engagement.* Ensuring support of the right officials, in the right department or departments, affected the degree of participants' participation in the mentoring activities. MEASURE Evaluation visited the regional medical officer and the regional administrative secretary to obtain their permission to work with their staff. During the district mentoring visits, time spent with the head of the district office paid off in the form of better engagement and participation from the participants.
- *Trainee skill sets.* Training may work best when participants have complementary skill sets. Participants should include both those who will interpret data (program staff) and those who can manage the software (computer and information technology staff).

Curriculum:

- *Duration.* For any training event, it is important to ensure that sufficient time is available to cover all essential material. For the mentoring activity, MEASURE Evaluation initially provided two-day sessions, but by the end of the activity, was providing five-day mentorship sessions to provide ample time for instruction in *both* identifying how existing data relates to priority programmatic questions and software use.
- *Local ownership.* Training should also take into account the topics of most interest to the participating office. Because conditions and data are never static, the greatest challenge of the mentoring sessions was to build capacity to update maps over time. Changes

occurred mainly in two categories: creation of new facilities (requiring the capture of new data and service statistics) and, more importantly, changes in hot spots. Hot spots change constantly, with new bars cropping up and the popularity of existing clubs changing; tracking them was of major interest to participants.

While MEASURE Evaluation was able to train participants to make basic maps with support, updating hot spots, adding new facilities, and mapping changes was beyond the scope of these activities. These might be feasible to teach in a longer-term project or in a location where there was already strong support for and use of GIS technology.

Software/equipment: Providing maps alone will not ensure their sustained use; map users also need software (and the capacity to use it) to be able to create new, updated maps. MEASURE Evaluation used open source software—QGIS—to limit future cost barriers. As new service delivery points are added, GPS devices and training on them are needed for staff to include updated geographic coordinates for these sites in the maps. In certain districts, GPS devices were available from the planning department. In others, new sites were updated during the mentorship visit when the MEASURE Evaluation team brought a GPS device with them.

Data: Before the training begins, trainers or facilitators should make sure that all trainees have access to the same data. During the mentoring activity, MEASURE Evaluation found that not all trainees had access to all the necessary data.

- *Building on available resources.* It is important to build off of existing GIS datasets. At the time of the mentorship exercise, Tanzania had developed a national health facility list GIS coordinates, which was incorporated throughout the training.
- *Matching data needs*: Mufindi and Iringa Urban districts have expressed interest in expanding the maps out beyond HIV/AIDS to other areas of health and development. Based on the district's request, MEASURE Evaluation provided training and support for Iringa Urban Municipality to map sanitation and environmental issues, including legal and illegal waste collection points.
- *Obtaining high-quality data in low-resource settings.* The PLACE-lite and Iringa participatory mapping exercises enabled collection of high-quality data using rapid, low-

technology methods.[3,4] Obtaining data on service catchment areas is typically difficult and expensive, but such data were necessary to improve HIV services in Iringa. MEASURE Evaluation used a low-cost, innovative method—combining interviews and mapping—to describe the catchment areas. Mapping hot spots, programs, and catchment areas provided a nuanced context of the epidemic for decision-making.

Conclusions

The PLACE-lite survey and Iringa participatory mapping exercise provided valuable insight into HIV hot spots and service coverage across the Iringa and Njombe regions. The Iringa mentoring experience demonstrated that HIV program staff found GIS-based mapping highly acceptable as a way of monitoring the coverage of HIV services in high transmission areas in low-resource settings. Officials from participating districts have used maps showing data at detailed, disaggregated scales to illustrate and clarify priorities and support decisions. Two districts have also proposed using maps that cross sector boundaries--combining data on health and HIV with data on education or creating separate maps showing sanitation and environmental issues.

Through the rapid DDU assessment of the HIV prevention services conducted in Iringa, MEASURE Evaluation found high capacity for data use among implementing partners. At the district level, poor infrastructure, limited financial and human resources, and an absence of a central data repository contributed to poor quality and low use of routinely collected information. Findings from the assessment also suggested that effective use of information and map products for policy and programmatic decision making required capacity building in M&E, analytical and data use skills for decision makers, data users and data producers in the regions.

Using GIS-based technology to track HIV efforts requires building local capacity to create, interpret, use and update maps that characterize the local epidemic—entailing training for both program staff who use the data and computer staff who enter it. MEASURE Evaluation's experience in mentoring district officials in GIS-based map-making showed that participants understood the potential of creating and sharing maps for many purposes--including illustrating local service locations and gaps, tracking hot spots, and demonstrating priorities. Computer-savvy participants were able to learn how to create maps from existing data.

Results from these activities suggests that building capacity for basic mapping and using maps to inform decision making requires medium- to long-term intermittent investment through a combination of an initial training, follow-up mentoring visits and refresher training events, as well as remote support. For GIS to be truly institutionalized, however, would require further investment in capacity for updating raw spatial data—including facility locations, catchment areas, and transmission hot spots.

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