

# Referral Network Analysis

## for Improved HIV Care in Homa Bay County, Kenya

### Final Report

Chris Bernard Agala, Khou Xiong, James C. Thomas, Richard Powell

**February 2016**

WP-16-159



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## **MEASURE** Evaluation

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## **ABBREVIATIONS**

ART	antiretroviral therapy
HBC	home-based care
HTC	HIV testing and counseling
MOH	Ministry of Health
PMTCT	prevention of mother-to-child transmission
STI	sexually transmitted infection
UNAIDS	Joint United Nations Programme on HIV/AIDS

# EXECUTIVE SUMMARY

This paper reports on a network analysis of healthcare providers in Homa Bay, Kenya. It presents a quantitative description of how these providers coordinate their activities and identifies ways to improve the care they offer to people living with HIV. As part of the analysis, we paid particular attention to referrals linking HIV testing and the provision of antiretroviral therapy (ART), because these are an important element in the achievement of the 90-90-90 goals of the Joint United Nations Programme on HIV/AIDS (UNAIDS).

## Background

People living with HIV have many clinical, nutritional, and social needs, all of which can seldom be met by a single provider. Providers typically focus on their own services and not the comprehensive needs of the patients. This is often reflected in a lack of coordination among care providers. But in fact, patient care is better when providers are aware of appropriate services at other facilities and refer patients to them. In a county whose HIV prevalence is among the highest in Kenya, we identified the organizations providing some aspect of HIV care and investigated the ways in which they work—or don't work—together to cover the comprehensive needs of those they serve.

## Analysis

We identified 56 organizations and interviewed a representative from each of them about their services and their connections with the other 55. Referral connections among them in the past 30 days were relatively rare, averaging less than two; 13 organizations made no referrals at all. Notably, five facilities that test for HIV did not refer their clients to an ART provider. We found two distinct clusters of connected organizations: one in Homa Bay Township and the other in Rangwe Subcounty. When we convened the organizations and presented our results to them, they expressed interest in establishing better connections and referrals.

## Conclusions

Homa Bay has an opportunity to improve care for people with HIV simply by making better use of the services already available, without deploying new ones. This can be achieved by informing each organization of the services provided by each of the others, and by bringing the organizations together to plan and monitor the services' coordination. These steps could be implemented separately in each of the two organizational clusters.

## CHAPTER 1: INTRODUCTION

In 2014, UNAIDS announced its 90-90-90 goals for HIV: by the year 2020, 90 percent of all people living with HIV should have been diagnosed, 90 percent of those diagnosed should be on HIV treatment, and 90 percent of those treated should have viral suppression (1). People with HIV have many health and social needs, and a wide array of services address them. Very few organizations provide the full array. More commonly, someone with HIV requires services from several organizations. And to ensure that their patients receive all needed services, those organizations should facilitate referrals.

Improving health outcomes through coordination and integration of health interventions within a strong and well-functioning health system is an essential principle of the Global Health Initiative (2). Inter-provider care coordination has been shown to improve HIV-positive clients' health outcomes (3). Thomas and colleagues also reported that HIV clients are less satisfied with services in facility networks where interaction and coordination are low (4). Together, these findings suggest that strengthening HIV-positive client referrals among facilities can improve treatment access and ultimately help achieve the UNAIDS 90-90-90 goals.

Populations bordering Lake Victoria, in East Africa, are among those most in need of achieving the 90-90-90 goals. Homa Bay County, Kenya, has the highest HIV prevalence in the country, estimated at more than 26 percent (5), with more than 130,000 adults and 23,000 children living with the virus (6). Despite the substantial benefits of ART in reducing mortality and onward HIV transmission and disease burden, 44 percent of 54,000 adults and 83 percent of 17,000 children in the county need but do not receive ART (6). Indeed, ART's reach among HIV clients in the county is significantly below the national averages of 81 percent for adults and 38 percent for children (6). Further, the Ministry of Health (MOH) has identified the following gaps in ART coverage: weak HIV testing and linkage to care and treatment, a high number of people who need ART, and children's access to ART lagging behind that of adults (7).

HIV care and treatment facilities often function in silos in Kenya, with minimal to no coordination with other facilities that offer complementary services. Lack of service documentation and patient follow-up contribute to poor interfacility referrals. This exposes clients to delayed, irrelevant, duplicate, or unnecessary care and services, which increases costs and results in poor health outcomes, including mortality.

Effective testing, linkage, and continuity of care in Kenya will require robust coordination among facilities. Facilities within a community therefore need to function as a network—that is, to be connected by such ties as relationships or interactions. In a network of organizations, the ties can be reflected in exchanges of information and clients. The Kenyan MOH recognizes the role of organizational networking and referrals in reducing costs and increasing access to and equity among essential healthcare services, such as HIV treatment. The overall goal of the ministry's recently launched Kenya Health Sector Referral Strategy, 2014–2018, and companion implementation guidelines is to improve client HIV treatment and access to care, as steps toward achieving the 90-90-90 targets (5), (1). The strategy's objectives are to improve healthcare providers' capacity to



identify referral cases, develop protocols to improve the efficiency and effectiveness of the referral system, and promote and facilitate information and communication technology to manage referrals, improve care, enhance referral system capacity, provide communication and related equipment, and promote research and innovation for referrals (7). The strategy sets out four classes of referrals: clients, expertise, specimens, and client parameters.

## **Study Objectives**

To contribute to the achievement of the national initiatives in HIV care toward the 90-90-90 target, our study sought to reveal care linkages, or their absence, and retention of HIV-positive clients in Homa Bay County. The findings of this study will inform the design of targeted interventions to strengthen the HIV referral system. The approach will also serve as a prototype for other Kenyan counties facing similar challenges. The specific objectives were to:

- 1) Define referral network pathways in the HIV services referral systems of Homa Bay
- 2) Quantify client movement among facilities within the HIV services referral networks
- 3) Determine the quality of relationships within the HIV services referral networks
- 4) Establish determinants of client flow within the HIV services referral networks
- 5) Estimate the financial cost of conducting an organizational network analysis in such settings

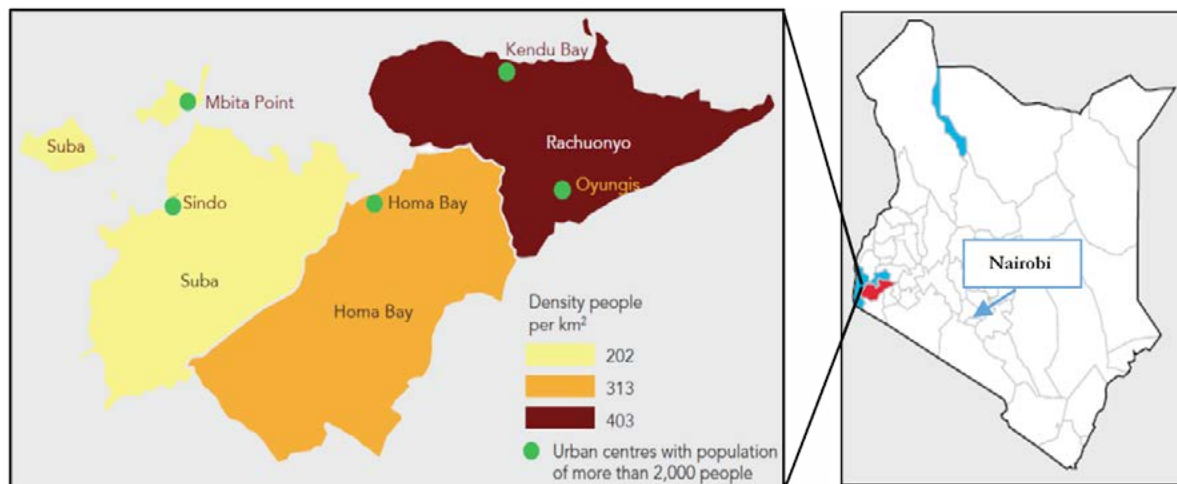
## CHAPTER 2: METHODS

### Study Setting

For effective control of HIV, the Kenyan MOH focuses resources on populations among whom prevalence is highest (5). Homa Bay County was selected for this study, because it has the highest HIV prevalence in the country. Despite this burden, the county ranks 25th and 21st respectively in adult and child ART coverage out of 47 counties nationwide, suggesting an urgent need for interventions that can link those who test HIV-positive to care.

Our study considered health facilities and organizations providing HIV care in Homa Bay County (see Figure 1) between June 2014 and September 2015.

**Figure 1. Map of Homa Bay County**



Source: National AIDS Control Council, Kenya HIV County Profiles, 2014

The county lies along the south shore of Lake Victoria's Winam Gulf, approximately 420 kilometers west of Nairobi, the Kenyan capital. At the time of the study, it had a population of approximately one million (963,794) living in a geographical area of 3,154.7 square kilometers (9). About half (48 percent) of the population is younger than 15 years old. And approximately half (48 percent) lives below the poverty line, defined by the World Bank as less than \$2/day (U.S. dollars, hereafter referred to as USD) (10). Composing 85 percent of Kenya's Lake Victoria coastline, the county is Kenya's leading supplier of freshwater fish.

Administratively, Homa Bay has eight subcounties: Homa Bay Township (referred to hereafter as Township), Kabondo, Kasipul, Mbita, Ndhiwa, Rachuonyo North, Rangwe, and Suba. It has 226 private and public health facilities, with the county referral hospital located in Township Subcounty. The recently launched Kenya Health Sector Referral Strategy, 2014–2018, states what the referral chain should be, from the lowest, community level to the national level (7).

According to the strategy, clients in Homa Bay should be referred from the community health unit. The referral strategy recognizes and encourages participation, cooperation, coordination, and linkages among providers—private as well as public.

## **Study Design**

To determine the HIV referrals occurring in Homa Bay County, we followed three steps: (1) identify all organizations providing an HIV service, (2) collect information on the organizations, including the services they provide, and (3) ask each one about its connections with other organizations in the county (e.g., client referrals). This approach is called an organizational network analysis.

### **Selection of the Organizations**

Network analyses are based on all of the relevant network actors, not a sample of them. The number of actors included is usually determined by the resources available for data collection. In our case, we aimed to include about 50 organizations. Thus, within the county, we focused on two subcounties: Township and Rangwe, with 2014 population estimates of 108,148 and 113,961, respectively.

The county health management team was consulted to review the choice of these two counties, to elicit input, and to secure local buy-in, which could facilitate coordination of the study, cooperation, and adoption and use of the study findings to improve practice.

The subcounties were selected based on their high rankings in the following categories:

- Capacity of testing and treatment services (the subcounty with the Homa Bay County Referral Hospital)
- Number of health facilities shown in the master facility list ([www.ehealth.or.ke](http://www.ehealth.or.ke))
- Population size
- Latest percentage of HIV-positive tests, as recorded in the Kenya DHIS 2
- Completeness of reported data ([www.dhis2.org](http://www.dhis2.org))

Additionally, the subcounties selected had three major advantages for this study:

1. Homa Bay County Referral Hospital is a level 5 facility serving the entire county. (In the Kenyan health system, community health units are level 1; health centers and dispensaries are levels 2 and 3; county and subcounty hospitals are levels 4 and 5; and national referral centers are level 6). It is therefore a high-performance facility with potentially the highest impact on referrals.
2. Inclusion of Rangwe Subcounty ensured the study captured the aspect of referrals from subcounties without level 5 facilities. Thus, the referral patterns observed in this subcounty may be generalizable to the other six subcounties not included in the study, controlling for specific facility factors—such as geographic location—that may have an impact on client transportation costs.
3. The two subcounties are contiguous and the referral network spans them. This characteristic

facilitated easier study coordination, reduced the effects of geographical bounding, and helped reduce study costs with easier and faster coordination among study sites.

Facilities and organizations included in the study provided services in the HIV care continuum (HIV pretest and posttest counseling, testing, ART for adults and children, and prevention of mother-to-child transmission) and operated within the boundaries of Township and Rangwe subcounties. They included private and public facilities. An initial list of 41 relevant facilities was obtained from the county master facilities list. Each was then asked to identify all relevant facilities they knew of in their catchment area. This process revealed an additional 15 facilities, for a study total of 56: 30 in Township and 26 in Rangwe.

Each of the 56 facilities was represented by an appointed facility staff member with administrative and operational knowledge of the facility.

### **Data Collection**

Staff from each organization were interviewed in person about the characteristics of the organization and their interactions with other organizations. The respondents had administrative and operational knowledge of the facility. They were given permission to seek information from other staff if needed.

The survey instrument included structured closed- and open-ended questions. The closed-ended questions had programmed response options or short answers, whereas responses for open-ended questions were summarized to capture the key points and not complete, verbatim statements. Questions about the organizational attributes included the number and type of healthcare workers within the facility, the types of services offered, and the global positioning system coordinates. Questions about the connections with other organizations included the number and type of in- and out-referrals the previous month with each of the other organizations and the quality of the interactions with the other facilities.

A trained interviewer administered the questionnaire, reading the questions and entering the responses using a mobile electronic tablet. The data were thus available for analysis the same day. Data collectors kept registers of contact information; scheduled, rescheduled, and completed interviews; and the facility name, name of interviewee, and date and time of interview.

### **Data Analysis**

The organizational characteristics were summarized as counts and proportions using Microsoft Excel and Stata 14 (15). To map the organization locations, we used ArcGIS (16) and QGIS (an open-source geographic information system software package).

To describe and analyze the connections among organizations, we used UCINET6 software (14). We assumed a connection between two organizations existed if either of them reported at least one of the connections under consideration. UCINET analyzes each connection between every possible dyad of organizations in the network. In the case of our study, the connections analyzed were:

- Shared funding (money)
- Client referrals
- Shared resources (time, office space, written materials, pamphlets, posters, supplies, drugs, laboratory, equipment, and staff)
- Shared information (reports and formal and informal communications)
- Joint programming

One of the statistics used to summarize the connections throughout the network is density. It is the number of connections (e.g., referrals) among organizations as a proportion of the total number of possible connections. Possible values range between 0 and 1. UCINET also visualizes the connections in sociograms. We visually inspected these for the identification of cliques: a set of organizations that connects closely with one another and more distantly, if at all, with others.

We studied the effect of relationship quality between organizations on various outcomes using regression analyses. For continuous outcomes, such as the number of male and female clients, we used ordinary least squares linear regression. For binary outcomes, such as having a written agreement with another organization (i.e., yes or no), we used logistic regression. For outcomes with several possible levels (e.g., poor, fair, good, and excellent), we used ordered logistic regression.

Organizational network analysis includes all of the relevant organizations. Because there is no sampling, test statistics for random error of estimates (e.g., measures of association) do not apply. Thus we report measures of association without test statistics.

### **Ethics Review**

This study was approved by ethics review committees and institutional review boards at the University of North Carolina at Chapel Hill, North Carolina, USA (UNC Institutional Review Board study number 14-2265) and the Kenyatta National Hospital/University of Nairobi's Ethics Review Committee, approval number KNH-ERC/A/267.

## CHAPTER 3: RESULTS

Interviews were conducted with all 56 of the organizations identified. In some instances, however, the intended respondent was unavailable and another staff member answered the questions. It cannot be known whether and how this affected the accuracy of responses.

### Organizational Characteristics

Of the 56 facilities delivering HIV services in two subcounties, the government operated nearly two-thirds (35, or 62.5 percent) (Table 1). The remainder were roughly equally divided between private (10) and civil society (11) providers. Nearly half of all facilities and organizations in the study were dispensaries.

Comparing the two subcounties, each had a subcounty hospital, although Township had in addition the county referral hospital. They had a similar number of health centers, but Rangwe had nearly twice as many dispensaries. Township had three times as many nonpublic facilities as Rangwe (16 and 5, respectively).

**Table 1. Type of Health Facility, by Subcounty**

Type	Township	Rangwe	Total
County referral facility	1	0	1
Subcounty hospital	1	1	2
Health center	3	4	7
Dispensary	9	16	25
Nongovernmental organization	6	1	5
Community-based organization	1	0	1
Faith-based hospital	0	1	1
Faith-based clinic	2	0	2
Private health clinic	7	3	10
<b>Total</b>	<b>30</b>	<b>26</b>	<b>56</b>

Nurses were the most common type of staff at facilities, followed by community-based staff (community health extension workers, community health workers, or volunteers) (Table 2). The number and types of personnel were similar in the subcounties, with the exception of medical doctors, who were twice as numerous in Township, because of the referral hospital.

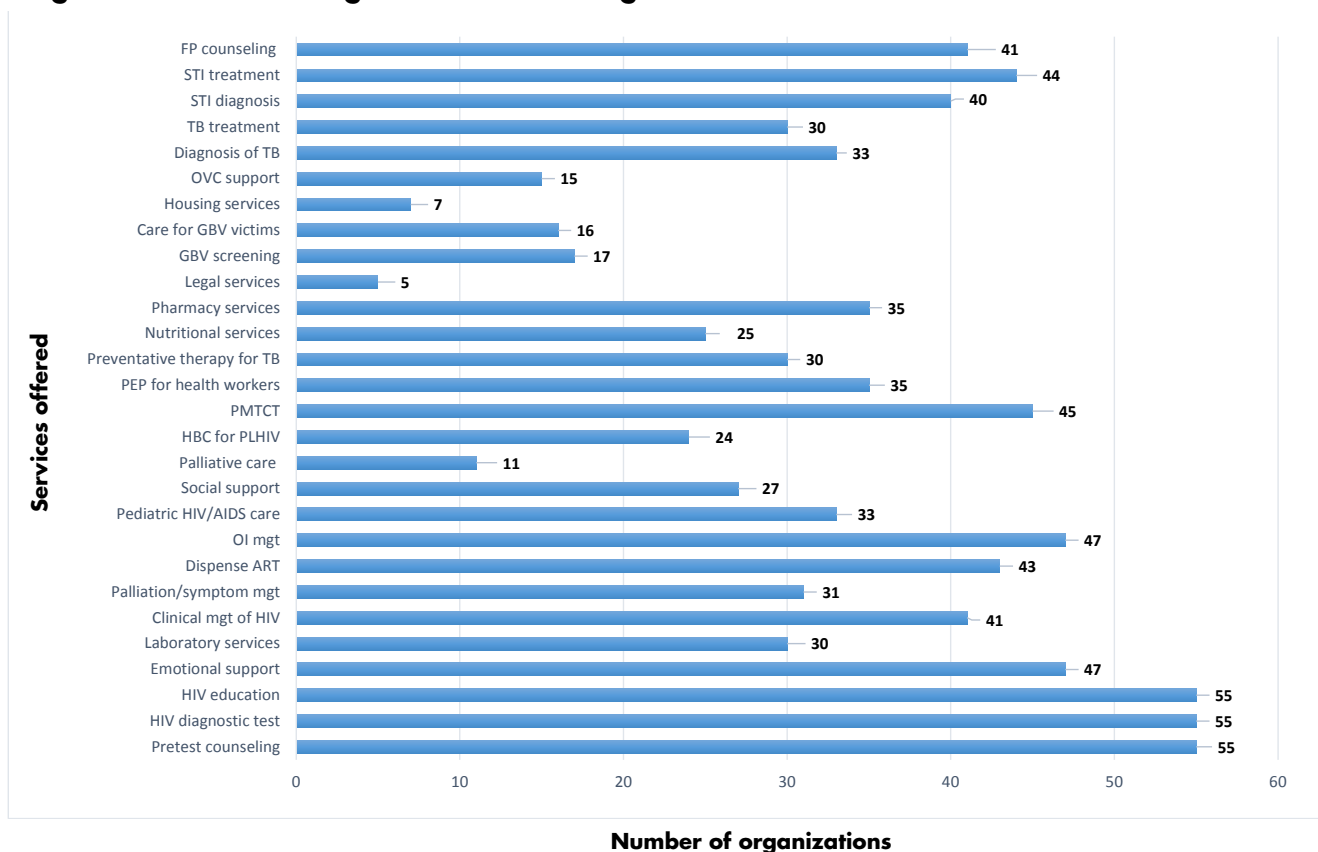
**Table 2. Facility Personnel, by Subcounty**

<b>Cadre</b>	<b>Township</b>	<b>Rangwe</b>	<b>Total</b>
Surgeons	0	1	1
Medical doctors	6	3	9
Clinical officers	12	11	23
Nurses	22	24	46
Laboratory technicians	13	12	25
Pharmacy technicians	6	5	11
Nutritionists	2	1	3
Peer educators	20	19	39
Voluntary counseling and testing counselors	23	20	43
Community health extension workers	16	12	28
Community health workers	18	18	36
Paid volunteers	6	8	14
Unpaid volunteers	6	6	12
Other staff 1 (specify) <sup>1</sup>	16	17	33
Other staff 2 (specify) <sup>1</sup>	8	7	15
Other staff 3 (specify) <sup>1</sup>	6	1	7
<b>Total</b>	<b>180</b>	<b>165</b>	<b>345</b>

HIV education, pretest counseling, and diagnostic testing were the most common services offered by the facilities (Figure 2). Legal and housing services were the least likely to be offered. Seventeen facilities screened for gender-based violence and 16 provided care in this domain.

<sup>1</sup> "Other staff 1–3" were casual staff, security guards, grounds people, cleaner, data clerk (officer), registry clerk, dentist, HIV testing and counseling (HTC) provider, health records information technicians, linkage officer, maintenance officer, nurse aid, project coordinator, public health officer, optician, health records information officer, field officer, human resources officer, lay counselor, and social worker.

**Figure 2: Number of Organizations Providing Services**



Source: MEASURE Evaluation PIMA

Key: FP, family planning; STI, sexually transmitted infection; TB, tuberculosis; OVC, orphans and vulnerable children; GBV, gender-based violence; INH, isoniazid; PEP, post-exposure prophylaxis; OI, opportunistic infection; HBC, home-based care.

Seventeen facilities did not disclose their operating budgets. The annual budgets of the remaining 39 ranged from Ksh 15,447 (Kenya shillings, or \$172 USD) to Ksh 10,200,000 (\$113,333 USD), with a median of Ksh 700,000 (\$7,778 USD).



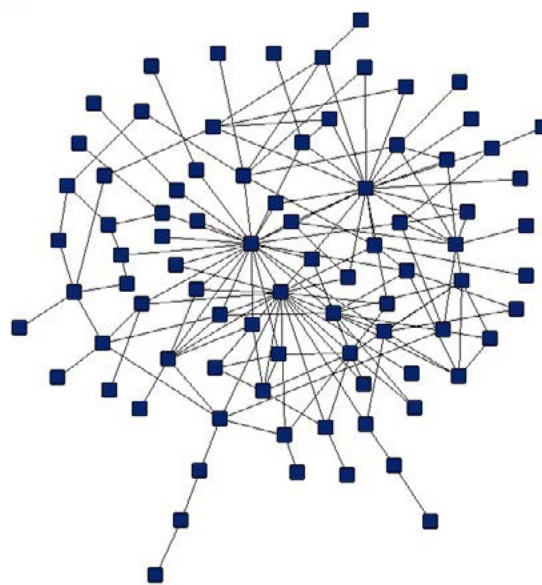
## Organizational Connections

Eighty percent of the interviewed facilities had sent or received at least one client to or from another facility in the previous 30 days (see Figure 3). Rangwe subcounty hospital reported referral connections with 15 organizations—the largest number of any in the network. The network density for connections of any type was 0.021, with an average of two ties per facility. Most connections were for information exchanges and joint programming. The organizations with the most connections—the central organizations—were Ndiru Health Centre, Rangwe Subcounty Hospital, Homa Bay County Referral Hospital, and the Elizabeth Glaser Pediatric AIDS Foundation.

Referral connections were relatively rare, as Figure 4 shows. The overall network density for client referrals was 0.025, with an average of 1.4 ties per facility. Ndiru Health Centre, Rangwe Subcounty Hospital, and Homa Bay County Referral Hospital were the most central for referrals. There were nine facilities that provided only HIV testing. Client referral for posttest HIV services by these facilities was low or nonexistent. Private facilities offered fewer services, had fewer or no connections with other facilities, and referred fewer clients. Dispensaries, similarly, referred few clients.

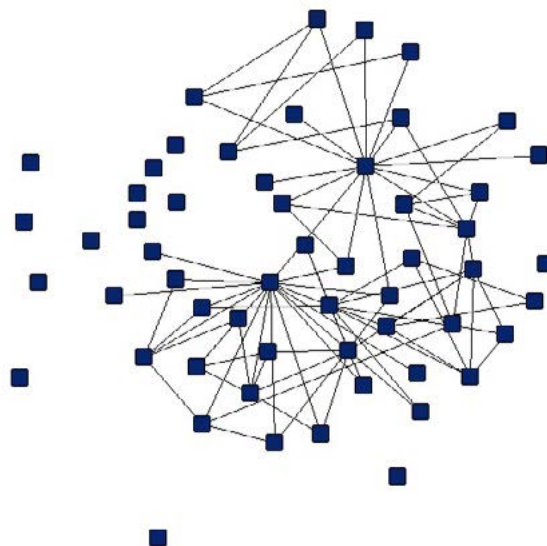
HIV diagnostic testing and ART were the two services of most interest to the authors of this study for achieving the UNAIDS 90-90-90 goals. All but one facility provided diagnostic testing. Of those, 12 did not dispense ART. Of these 12, five did not report referring clients for ART. Four of the five were dispensaries (not all dispensaries can dispense ART). Three were in Township and two were in Rangwe; three were public facilities. Each had a catchment area of more than 15,000 people. Their years of service ranged from 0 to 24. Two facilities that did provide ART also referred clients for ART elsewhere.

**Figure 3. Sociogram of All Connection Types**



Source: MEASURE Evaluation PIMA

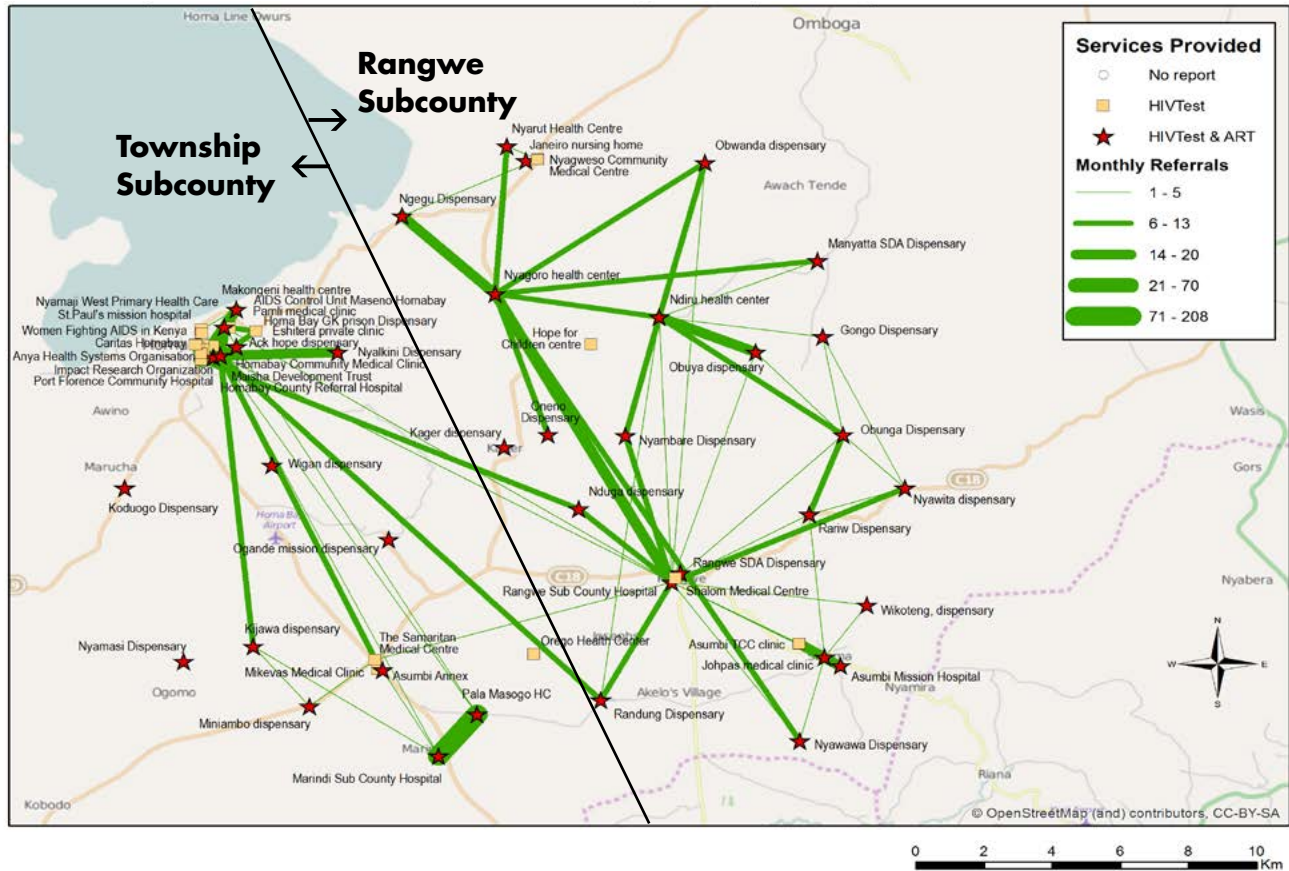
**Figure 4. Sociogram of Client Referrals Only**



Source: MEASURE Evaluation PIMA

Two clusters or organizational cliques are evident in Figure 4, with only two connections between the two cliques. To better understand these cliques, we overlaid a referral network on a map of the study area (see Figure 5).

**Figure 5. Geographical Representation of Client Referrals in Homa Bay County, Kenya**



Source: MEASURE Evaluation PIMA

The map reveals that the cliques represent the two subcounties. Homa Bay County Referral Hospital was the point of centrality for Township, and Rangwe Subcounty Hospital was the central point for Rangwe. (The two subcounties are demarcated with an approximate line, because Kenya adopted a county and subcounty system only recently, and geographic maps are not up to date.)

The network analysis also revealed gaps in referrals for other HIV-related services (Table 3). For example, Dispensary 5 did not provide the following services or refer their clients for them: ART, preventative therapy for opportunistic infections, treatment of tuberculosis (TB), and provision of prophylaxis for prevention of mother-to-child transmission (PMTCT) and home-based care (HBC) for people living with HIV. Similarly, Dispensary 4 provided only HIV testing services. While they did make referrals for preventive therapy for opportunistic infections and pediatric HIV care, they did not make referrals for ART, treatment of TB, treatment of sexually transmitted infections (STIs), prophylaxis for PMTCT, and HBC for people living with HIV.

**Table 3. Example of Actual and Potential Referrals**

<b>Organization Name</b>	HIV diagnostic testing	Dispense ART	Preventive therapy for opportunistic infections	Treatment of TB	Treatment of STIs	Provision of prophylaxis for PMTCT	Pediatric HIV/AIDS care	HBC for PLHIV
Hospital 1	●	●	●	●	●	●	●	●
Dispensary 1	●	●	●	●	●	●	●	
Dispensary 2	●	●		■	■			
Dispensary 3	●	●	●	●	●	●	●	●
Dispensary 4	●		■				■	
Dispensary 5	●				●			

● Service provided    ■ Service referred, but not provided    || Service gap

Three facilities in close geographic proximity provide another example. We will call them A, B, and C. A provided HIV testing only; B provided all services listed in Figure 4 except HBC; and C provided HIV social services, but not ART. Clients who tested positive for HIV at A could benefit from referrals to B and C, but A did not refer them there.

### Factors Affecting Connections

Forty percent of the facilities reported having a written agreement with other facilities, and nearly 70 percent had designated network facilitators committed to maintaining linkages with other facilities. There were 97 linkages representing joint programs in the network. Of these, approximately 30 percent reported a poor or fair relationship with the other; approximately 70 percent reported a relationship quality of good or excellent.

Having a designated network facilitator and having a written agreement between two facilities each independently more than doubled the likelihood that a patient would be referred to the other organization (159 percent and 138 percent increase, respectively). Having a joint program also independently increased the likelihood (87 percent), but relationship quality had little effect (-7 percent). Having a network facilitator, in turn, increased the probability of having a joint program by 14 percent. A larger annual operating budget was associated with resources for communication and transportation.

Respondents reported qualitatively that good relationships between organizations were facilitated by the availability of funds, information exchanges, good leadership, and high trust. Factors frequently reported as hindering effective partnerships were lack of information about services provided by others, competition for clients, poor coordination and sharing, lack of or unequal distribution of funding, and poor communication.

## Dissemination Meeting

The results of the study were presented to 25–30 Homa Bay stakeholders on August 6, 2015. The participants were representatives of the organizations studied: the country referral hospital, the two subcounty hospitals, and the county and subcounty offices. Unfortunately, a number of more senior decision makers were away at another meeting that was announced just a few days before this study's meeting.

The purposes of the meeting were to ask the local participants whether the data seemed to accurately reflect the situation in Homa Bay, seek their insights for interpretation of the findings, and discuss what they would like to do in light of the findings. The study rationale, methods, and findings were presented to the group. Everyone present then discussed the findings. Afterward, they discussed in three smaller groups potential actions to take to strengthen the network. After listening to the participants' ideas, the study team presented theirs, which were similar to the participants' insights.

Participants made the following comments:

- The numbers reported for the different cadres of health workers were not as expected (e.g., the high numbers of doctors and surgeons recorded). A review of the raw data indicated that the inclusion of private clinics in the study had a “double count” effect on data. Owners or consultants at these clinics either worked in the mainstream government health system at the facility level or as managers in the county offices. That is, they were reported as personnel in more than one facility.
- Some larger facilities were known to offload clients into newer, smaller facilities.
- Client targets and the desire to keep client numbers up negatively affect referral.
- Information sharing on HIV clients was not effectively implemented between personnel supported by nongovernmental donors (e.g., peer educators) and clinical staff.
- To facilitate referrals, the organizations would like a directory of facilities with contact details.
- The organizations wanted to know how to contribute to attaining the 90-90-90 targets for HIV.
- They wanted clear definitions of the roles and responsibilities of partner-supported staff and how they fit in the facility.
- There is a desire for ongoing forums for networking to address challenges of mistrust among organizations, especially between private and public facilities.
- The county office should develop a plan to enhance networking among facilities.
- Tuberculosis networking was noted as a success that could be considered in strengthening HIV networking.
- The turnaround time for HIV tests is long. Delays should be reduced to facilitate linkage to care and treatment.
- Ways to trace HIV clients should be developed and/or strengthened to confirm referral completion.
- Use of a national, unique identification number was suggested as a “sure” way to enhance linkages.

In addition, the participants requested that the researchers (1) study client choices and preferences for facilities and referrals, (2) conduct an intervention to improve network density, and (3) present the study to the county health managers (who were away for another workshop) and work with them to develop a list of priorities for improving the network.

## **Study Cost**

The study cost \$24,896 USD ( Ksh 2,240,706). The items included in this sum were:

- **Personnel:** Salaries and remuneration for the field team of three technical specialists and eight data collectors for eight days of training, data collection, and the dissemination meeting
- **Transportation:** Two hired vehicles for transportation of the technical team to project sites during data collection
- **Workshops and stakeholder meetings:** A three-day training for data collectors, a one-day participants' conference, and a stakeholders' planning and intervention design meeting
- **Supplies and equipment:** Stationery, photocopying, and printing of training material and workshop material and referral network maps for the dissemination meeting (There were no equipment costs—desktop computers, tablets, laptops, overhead projectors, etc.—because staff used their regular work equipment.)
- **Operating expenses:** Ethics review fee, airtime for mobile phone communication, and Internet bundles for synchronization of data in the data server in the United States

## CHAPTER 4: DISCUSSION

Homa Bay County has a sizable number of HIV-related service providers, but it still has the highest county prevalence of HIV in the country. One interpretation of this apparent inconsistency is that most of those with HIV are being kept alive by ART, thereby keeping the prevalence high. This is one potential outcome of the 90-90-90 goal. However, the county's low ranking in ART coverage (25th out of 47 counties) indicates that the high prevalence results from high transmission, unabated by treatment (and thus reduced infectiousness) of those with the virus.

It does not appear from this network analysis that more service providers are needed. Rather, the array of services already in place needs to be more effective. Inevitably, there is room for improving the services of each organization. But given HIV's complexity and the number of cases in Homa Bay, the organizations will have to work together to achieve the synergies needed. Patient referral is an important example of the type of coordination required.

The network analysis revealed much room for improvement in service coordination. The network density of .021 and the average of only two linkages per facility can be considered quite low. It shows that facilities in the county rarely referred clients, exchanged information, shared resources, or implemented joint programs with one another.

Our study found that lack of information on services provided by others, lack of funding, lack of staff committed to maintain relationships with other facilities, and the absence of written agreements contributed to a low number of linkages. Conversely, facilities with committed network facilitators were more likely to have joint programs and significantly better relationships. An effective network facilitator can share information on services, help write agreements, and generally build trust between organizations.

Together, these findings suggest that having a designated network facilitator can improve the quality of organizational relationships and increase the number of clients referred. A network facilitator is also likely to initiate new relationships with facilities while maintaining existing ones, thus increasing network linkages.

Facilities in the same subcounty referred to one another more frequently than to facilities across subcounties, suggesting that proximity also facilitates connections. Strengthening connections with close-by neighbors is a reasonable way to enhance referrals, as long as the services needed are available in the subcounty. Of course, accessing services that are only in another subcounty will require the building of longer-distance relationships.

Some solutions for improving linkages may require policy-level interventions: for example, funding for public facilities. Other solutions may be low-cost and network-oriented: for example, creating service directories and distributing them to all facilities and organizations in the network. In addition, creating a trusting environment and developing good rapport among facilities may also be a low-cost intervention that can improve the quality of relationships. Other potential solutions include facility-level interventions, such as developing procedures for accurate and sustained recording and follow-up for clients sent and received.

## Recommendations

The primary recommendations for Kenyan counties arising from this study are:

- Share information on services provided by facilities and organizations within a county.
- Develop, maintain, and sustain a common client referral records system to be used by all facilities to eliminate discrepancies, facilitate client monitoring, and reduce the waste of resources used in HIV care.
- Find sustainable ways to designate network facilitators to initiate and maintain relationships with others in the network.
- Initiate and maintain regular network strengthening and monitoring meetings where organizations can learn about one another, develop agreements, and grow in their trust of one another.
- Use existing tools to identify and strengthen areas of the referral system that need improvement. Examples are MEASURE Evaluation's M&E Capacity Assessment Tool and the Referrals System Capacity Assessment Tool.
- Develop a system to trace and follow up with clients to help facilities and organizations manage client referrals more effectively.

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