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Lessons learned while implementing an HIV/AIDS care and treatment program in rural Mozambique

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Abstract

Mozambique has severe resource constraints, yet with international partnerships, the nation has placed over 145,000 HIV-infected persons on antiretroviral therapies (ART) through May-2009. HIV clinical services are provided at > 215 clinical venues in all 11 of Mozambique's provinces. *Friends in Global Health (FGH)*, affiliated with Vanderbilt University in the United States (US), is a locally licensed non-governmental organization (NGO) working exclusively in small city and rural venues in Zambézia Province whose population reaches approximately 4 million persons.

Our approach to clinical capacity building is based on: 1) technical assistance to national health system facilities to implement ART clinical services at the district level, 2) human capacity development, and 3) health system strengthening. Challenges in this setting are daunting, including: 1) human resource constraints, 2) infrastructure limitations, 3) centralized care for large populations spread out over large distances, 4) continued high social stigma related to HIV, 5) limited livelihood options in rural areas and 6) limited educational opportunities in rural areas.

Sustainability in rural Mozambique will depend on transitioning services from emergency foreign partners to local authorities and continued funding. It will also require "wrap-around" programs that help build economic capacity with agricultural, educational, and commercial initiatives. Sustainability is undermined by serious health manpower and infrastructure limitations. Recent U.S. government pronouncements suggest that the U.S. President's Emergency Plan for AIDS Relief will support concurrent community and business development.

FGH, with its Mozambican government counterparts, see the evolution of an emergency response to a sustainable chronic disease management program as an essential and logical step. We have presented six key challenges that are essential to address in rural Mozambique.

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INTRODUCTION

Mozambique is a coastal nation in south eastern Africa and ranks among the world's least developed nations. In 2007, the population was estimated at ~21 million persons, and Mozambique ranked 172 out of 177 on the UNDP Human Development Index [1,2]. Mozambique has one of the most extensive, generalized HIV/AIDS epidemics in the world, with a national HIV prevalence rate of 16% and roughly 1.5 million persons living with HIV infection, including 100,000 children [3,4].

In 2004, the Mozambican Ministry of Health (Ministério da Saúde or MISAU) initiated a national antiretroviral treatment (ART) expansion program funded largely from four sources: the President's Emergency Plan for AIDS Relief (PEPFAR); the Global Fund to Fight AIDS, Tuberculosis and Malaria; the World Bank; and the Clinton Foundation HIV/AIDS Initiative [5,6]. In addition, charitable support from religiously affiliated groups such as S'ant Egidio's DREAM Project provided additional patient care support, particularly in the Maputo area and in Beira, Mozambique's second largest city [7,8]. As of May 2009, 145,000 persons had been placed on ART and roughly 530,000 HIV-infected patients were being followed in care [3,4]. Although there is no impact data yet published, it is believed that this intervention has saved tens of thousands of lives and hundreds of thousands of disability-adjusted life-years.

Strategies for national ART "roll out" or "scale up" programs in Africa have been based largely on the early successes of programs in resource-limited nations such as those in Uganda, Botswana and Haiti. Hoping to get the most benefit from early investments, nations focused initially on urban settings that had the most resources available and the highest HIV seroprevalence rates [9,10]. This strategy was manifested in Mozambique for HIV care and treatment through urban, centralized HIV clinics called "Day Hospitals" under the direction of MISAU. In 2003, prior to the national ART expansion program, ART services were offered in only 10 health centers distributed among 6 of Mozambique's 11 provinces (Maputo City, Maputo Province, Niassa, Sofala, Tete, and Zambézia). As of May 2009, ART services were offered in 216 health centers distributed throughout all 11 provinces of the country [4]. While this progress represents significant success in the Mozambican response to the HIV crisis, expansion of services further from the urban centers and provincial capitals into the predominantly rural areas of the country is causing severe stresses to an already overburdened and under-capacitated health system.

The Vanderbilt University Institute for Global Health (VIGH), through its affiliate nongovernmental organization (NGO) Friends in Global Health, LLC (FGH), has been working in the Zambézia Province since February 2007 as a PEPFAR funded partner to MISAU, first under subcontract from the Elizabeth Glaser Pediatric AIDS Foundation and later as a direct grantee from the U.S. Centers for Disease Control and Prevention - Global AIDS Program (CDC - GAP). FGH is assisting local health authorities with the development and implementation of a comprehensive model for rural ART expansion that integrates health and social services, addresses human resources and infrastructure constraints, and making sustainable improvements to the health care system. Although the Global Fund, World Bank, and the Clinton Foundation do contribute to the HIV efforts at a

national level, their day to day presence is not felt at the provincial and district levels. This qualitative report is limited to the rural health experiences and lessons learned by FGH in its first two years as a PEPFAR funded clinical care and treatment partner in rural Mozambique.

DESCRIPTION

A Rural HIV Healthcare Context

Zambézia Province is overwhelmingly rural, located in north-central Mozambique, and depends almost entirely on subsistence farming and fishing. It has been identified as a focus province by MISAU, the U.S. Embassy in Mozambique (head of PEPFAR activities), and the Millennium Challenge Corporation [3,11]. It is the country's second most populous province with ≈4 million persons and an estimated adult HIV/AIDS prevalence rate of 19% [4]. The capital city, Quelimane, is the only urban (>50,000 persons) area with a population of ≈200,000 people and an HIV prevalence as high as 35% extrapolating from antenatal sentinel surveillance in one city clinic [1,4,12]. Zambézia Province was the site of much of the armed conflict in Mozambique's 16-year civil war (1976–1992) and suffered disproportionately in destruction of infrastructure and retardation of development [13]. Zambézia Province (103,000km^2) is roughly the size of Tennessee (USA) or Portugal (Europe), with its people scattered over a large geographical area, as often seen with a subsistence farming economy. Each of its 17 districts consists of an administrative center and a main rural hospital where ART services are centralized with smaller rural health centers distributed throughout the district. Typically, the rural hospital has only one doctor on staff and the rural health centers are staffed by only one or two mid-level health staff (nurse or clinical officer [técnico de medicina]).

FGH began its support of the HIV care and treatment program in 6 of Zambézia's 17 rural districts (Alto Molocúe, Ile, Inhassunge, Gilé, Lugela, and Namacurra) as per the MISAU national plan (Plano Estratégico Nacional de Combate ao HIV/SIDA) [4]. At program initiation in February 2007, three of these districts did not have communications coverage (telephone or radio of any kind) and two were not connected to the electrical grid. In 2009, all but one of these 6 main rural hospitals has been connected to the electrical grid and all six have access to cell phone service. Despite core infrastructure development (phone, electricity, water) having expanded to the majority of the districts, services have rarely been extended to areas beyond the main administrative centers and into the smaller rural health centers. It is important to note, that MISAU initiated ART in each of its main district health centers during this period. FGH provided support to 6 of these districts and support was provided to the remaining districts by other non-governmental organizations.

Clinical ART Protocols

Facility-based HIV testing occurs predominantly in three locations: VCT units, prenatal/PMTCT clinics, and the district TB program. New national protocols have been established recommending an opt-out strategy utilizing provider initiated counselling and testing (PICT) within all health facility services. As of 2009, PICT has yet to be widely implemented in Zambézia Province due to manpower shortages and not infrequent shortages of HIV test

kits. After receiving an HIV positive test result, patients are referred to the HIV care and treatment clinic for evaluation, including medical history and physical examination. Staff seek to ensure same-day specimen collection for CD4+ cell count, a complete blood cell count (CBC), and a basic biochemical profile. The patients are asked to return in two week's time to review laboratory results, participate in the first of three pre-ART counselling sessions, and make a determination of ART eligibility based on World Health Organization (WHO) staging and CD4+ cell count. Prior to initiation of ART, patients must undergo three separate sessions of pre-ART counselling.

Zambézia Province, like the rest of Mozambique, is suffering from a severe shortage of physicians. When FGH first initiated its support activities in 2007, not all districts in the province had a physician. Currently (late 2009), all of Zambézia's districts have one or two national physicians, but they serve district populations of 150,000–400,000 persons and typically have substantial administrative burdens. As a result, the vast preponderance of the health care is delivered by clinical officers (técnicos de medicina) and nurses.

ART is prescribed by physicians or clinical officers according to Mozambican national protocols. As of May 2009, HIV positive adult patients are determined eligible for ART if: CD4+ cells <250/mm^3 (an earlier CD4+ cell cut-off to determine eligibility was <200/mm^3) independent of clinical status, CD4+ cells <350/mm^3 and WHO stage III, or WHO stage IV independent of CD4+ cell count. The first-line regimen in Mozambique is stavudine, lamivudine and nevirapine available in a fixed-dose combination tablet. For patients co-infected with tuberculosis, ART is deferred for at least 8 weeks, depending on CD4+ cell count, unless the CD4+ cell count is <50 cells/mm^3, in which case, ART is started immediately with an efavirenz-based regimen. Cotrimoxazole prophylaxis is provided to all asymptomatic patients with a CD4 count < 350 cells/mm^3 and symptomatic patients with WHO stage III or IV. The evidence base for delays in co-therapy of TB and HIV and continued first line use of stavudine are questioned by many, at present, and the policy of stavudine use in first line therapy may change in 2010 [14,15].

Viral load assessments are neither available nor a part of the national protocols at present. Therefore, treatment failure and consideration for switching to second-line therapy are defined via immunologic and clinical criteria. Currently, second line therapies and national protocols do exist and provide options for various drugs that may be used in combination including: didanosine, tenofovir, nelfinavir, lopinavir/ritonavir, and saquinavir. However, all patients in Mozambique being considered for second line therapy must have the medication change approved by a centralized national ART committee based in Maputo. As a result, backlogs and delays result in very few patients actually switching to second line drugs.

Pediatric patients are eligible for ART if they are: < 12 months of age and have a PCR test which is positive for HIV or a positive rapid test and a CD4 percent < 30%. As of May 2009, first line therapy consists of water dispersible fixed-dose combination tablets of stavudine, lamivudine, and nevirapine. Prior to May 2009, water dispersible fixed-dose combinations were not available for the initial 2-week induction phase of treatment, and available therapies consisted only of individual syrups. The dosage and administration of these syrups was confusing and difficult for parents and contributed to lack of adherence to

medications in children. Cotrimoxazole prophylaxis is given to all HIV exposed and HIV positive children during the first 18 months of life and is continued in HIV positive children >18 months of age with a CD4 percent < 25% until age 5. We hope for access to small-sized pediatric dosage tablets in 2010.

Patients on ART present to the pharmacy each month to collect their medications until the patient has exhibited positive adherence behaviors and then those medication pickups can be extended to every 2–3 months based on clinical recommendation. Clinical visits are scheduled once per month for the first 4 months of therapy and then every 3 months, and CD4+ cell specimens are collected every 6 months.

Laboratory Testing

Laboratory testing capacity in Zambézia Province continues to be a limitation for efficient patient care. Currently, all rural hospitals have laboratories, but they are understaffed and have limited laboratory equipment. In this setting, HIV is diagnosed with rapid tests for patients >18 months of age and with PCR for patients <18 months of age, as described above. Some, but not all district labs have been equipped with hematology and biochemistry machines for ART treatment monitoring. Diagnostics for opportunistic infections (OI) are basically non-existent. TB culture only exists in the national capital city, Maputo, and is reserved primarily for cases of suspected multi-drug resistant TB (MDR-TB). Two more regional laboratories are currently under renovation for the expansion of TB culture capacity throughout the country (to serve the Central and Northern regions), but dates for initiation of this service are uncertain. In the districts, TB diagnoses are primarily determined using direct visualization of stained sputum by microscopy.

Through funds from PEPFAR, FGH has been able to assist with the renovation of existing district labs and the creation of lab space using pre-fabricated buildings. The US government has legal restrictions about foreign aid assistance that permits some grantees to construct new buildings (USAID recipients), while denying this to other grantees (CDC recipients). In the latter category, FGH has nonetheless been able to follow US guidelines by restricting our physical investments to renovations and set-up of pre-fabricated facilities. As of the second quarter of 2009, FGH has collaborated with the Association of Public Health Laboratories (APHL) to install biochemistry and hematology equipment in 3 of the 6 districts that were initially supported by FGH; the province has been supplied with cytometers in 5 districts, four in larger ART care centers supported by the International Center for AIDS Care and Treatment Programs (ICAP), an affiliate of Columbia University, and one in a district supported by FGH. Current national standards for equipment include the flow cytometer using FACSCount™ and FACSCalibur™ (Becton Dickinson Inc., Franklin Lakes, NJ, USA) for CD4+ cell counts. Humalyzer 2000/3000 (Human GmbH, Wiesbaden, Germany), Reflotron® Plus (Roche Diagnostics, Switzerland) semi-automated analyzers and ABX Pentra 400 (HORIBA ABX Diagnostics, France) automated analyzer for biochemistry, and the KX-21N (Sysmex Corporation, Kobe, Japan) for hematology.

In the absence of equipment for hematology, hemoglobin concentration is estimated using the Lovibond hemoglobinometer (Lovibond, Tintometer, Salisbury, UK), that does not require a reliable electric power supply. Due to the lack of flow cytometers and present

unavailability of point-of-care CD4 kits for most rural locations, ART sites typically have 1–2 days per week scheduled for the collection of CD4 tests. (This is not convenient for patients who are required to return for a blood specimen collection on a day that is different from their original visit day, and missed re-visits for CD4+ tests are common.) Samples are then transported to other districts which have labs with cytometers. All districts are currently sending PCR samples, dried blood spots collected on filter paper cards, for early infant diagnosis to one of two molecular labs in the country. FGH is currently assisting the provincial laboratory with the ordering and installation of PCR equipment, needed lab renovations, and lab staff training. Future viral load testing will then be feasible in Zambézia.

Logistics Support for Pharmaceuticals

As previously mentioned, Zambézia Province is extremely poor, rural, and has limited infrastructure and expertise to deal with the increasing daily demands on its health care services. Mozambique also continues to function primarily through a tightly controlled centralized system, indicating that even when resources exist at the national or provincial levels, stock-outs of desperately needed commodities are not easily resolved by local health authorities. This is especially true for medications, including those for ART and OI treatment, and for laboratory supplies, such as HIV rapid tests. Mozambique's supply chain system is currently fragmented, and management responsibilities belong to different sectors of the health care system. Currently, when problems occur, it takes significant time and energy to pinpoint where the system defaulted and organize the appropriate authorities for resolution.

FGH collaborates with the Provincial Health Directorate of Zambézia (Direcção Provincial de Saúde or DPS) to support the improved communication and flow of the supply chain from the province to the districts. This is done by: 1) improving infrastructure of district and peripheral health centers in order to increase warehousing capacity and efficiency; 2) mentoring district pharmacy staff to build capacity in medication forecasting and accurate completion of monthly requisitions; and 3) providing technical assistance to provincial health authorities to troubleshoot weaknesses and provide financial and/or logistical support for transport needs so that supplies arrive quickly to the sites where they are needed. FGH also participates in national level technical working group meetings in order to share provincial level concerns with appropriate government and donor agency representatives and to advocate for improvements in the national supply chain system.

Monitoring and Evaluation and Patient Tracking

Prior to the availability of ART, district level health facilities in Zambézia Province did not have a system for archiving longitudinal patient data. Notes from patient encounters were maintained on a yellow card purchased by the patient to take to the clinic for each visit; no records were kept on file at the clinic. Vital statistics were monitored using service-specific patient registers for the tabulation of monthly reports. With the expansion of ART offering promise for ongoing chronic disease management, use of medical records for the HIV care and treatment program have been implemented using standardized national forms and an HIV service card, known as the "Green Card", which are maintained by patients in order to

identify them as part of the service. Data for the PMTCT, VCT, and TB programs continue to rely on collection of this rudimentary patient register information.

Patients entering the health center are given a patient identifier which is linked to the particular service for which they are being seen. If the same patient visits two different services in the same day or returns to the health center on a different day and is seen in a different service, they would be given a number specific to that service. As a result, it is currently impossible to track patients throughout the health system from service to service.

FGH is establishing an electronic medical record system to facilitate efficiency and integration of the medical records. The first step has been the implementation of an electronic patient tracking system (PTS) developed by ICAP, using MS ACCESS® (Microsoft Corp., Redmond, WA, USA) for the HIV care and treatment programs. After a "care and treatment" patient encounter, data entry personnel retrospectively enter information from paper charting forms into the PTS. This PTS is designed for adult and pediatric HIV care and treatment only and is an interim solution. Provincial authorities and FGH are developing a more practical system suitable to support other service activities, including providing a greater focus on the clinical management and follow-up of patients and may ideally be used for all health care needs at some point in the future, not only for the HIV-related services. We use the Open Medical Record System (OpenMRS) framework, developed under an open source license and supported by a global community of users and software experts [16]. The application provides a more detailed electronic medical record of each of the patients enrolled in the HIV care and treatment program with the user interface matching the paper forms developed by the Ministry of Health and used by the clinical staff. Current pilot projects in two districts are testing the new electronic systems that have been developed for HIV care, VCT, PMTCT, and TB services.

The patient tracking system that is currently in use has proven valuable in the management of patients lost to follow-up by allowing the district health teams to generate reports from the electronic database identifying patients who have not returned for medication pick-up. Patients are considered "late" if they do not appear within 3– 59 days of their scheduled medication pick-up to refill their medications and are classified as "lost to follow-up" if they have not appeared within 60 days. Lists are generated on a weekly basis of patients who are late or lost to follow-up, and these are used to prioritize active case finding of the patients by non-clinician community health workers and volunteers.

Roll-out of ART

Circumstances in rural Zambézia Province are not unique. The national effort to roll-out ART has been struggling with a severely damaged health care infrastructure (even nearly two decades after the conclusion of the civil war), one of the lowest ratios of trained health personnel to population in the world, travel distances of upwards of 100km to access ART services, and an undereducated populace. Despite these challenges, in the 6 districts FGH supports there were roughly 13,000 patients enrolled in the HIV care services (69% female) and roughly 3000 patients initiated on ART by May 2009. Of these, 673 children (< 15 years of age) were enrolled in services, and 209 were started on ART. FGH's approach to roll-out has been organized around three core principles: 1) direct technical assistance to the

government facilities to implement ART clinical services at the district level; 2) human capacity development; and 3) health system strengthening (Table 1).

To meet the demands of this under-capacitated rural environment, FGH placed a single expatriate clinician (doctor, nurse-practitioner, physician assistant, or nurse) in each rural hospital to provide technical assistance for the care and treatment program. These clinicians functioned as FGH district liaisons, working side-by-side with their Mozambican counterparts to improve the volume and quality of services. In addition, FGH contracted Mozambican health workers to complement their state-employed compatriots, reinforcing human resource capacity within the expanding ART services.

Bringing care and treatment services closer to where the vast majority of persons live within these rural districts is essential to improving ART adherence rates as travel distances to any given district's lone ART rural hospital is often daunting. Under the direction of the DPS, FGH has begun providing technical assistance and support for expanding ART services to smaller health centers. This hub-and-spoke model is far more realistic to enhance adherence than to expect rural subsistence farmers to spend a day or more traveling for a routine HIV-related visit at a distant clinic. While home-based visits for ART services are not the standard in Mozambique, they must be considered given successes in Haiti and Uganda, for example [17,18]. The hub-and-spoke model may meet much of the need, reducing the magnitude of required house-to-house services.

In acknowledgment of the extensive capacitation needed to prepare rural health centers to provide ART services, a temporary system was established in 2007; rural health centers served as satellite sites of the main rural hospital with weekly visits from an ART team. Concurrently, the DPS, with FGH support, focused on renovations, recruitment and training of staff, and organization of drug and supply logistics. Directives and regulations promulgated in 2009 from MISAU have stipulated that in order for a smaller rural health center to be allowed to function as an independent ART provider, a minimum standard for health facility infrastructure and human resources must be fulfilled before the initiation of services. Prior to this MISAU directive, DPS/FGH had been permitted to implement this system in at least one rural health center per district in each of the original 6 districts receiving FGH support. Current plans are to incorporate more rural health centers into the ART network pending a satisfactory evaluation of these pilot sites. The MISAU directive will delay implementation in the short run, but is intended to improve rural clinic capacitation in the longer term.

In early 2009, FGH expanded its supportive role to 6 more districts in Zambézia Province (Chinde, Maganja da Costa, Mopeia, Morrumbala, Namarroi, and Pebane) (Figure 1). In these districts, HIV care and treatment services already existed, but remained highly disorganized and were functioning with minimal resources. During the same time period, FGH assumed the responsibility of providing support to the district-level prevention of mother to child transmission (PMTCT) programs, voluntary counselling and testing (VCT) programs, as well as the tuberculosis (TB) programs, reinforcing an integrated and comprehensive HIV/TB support program. This increased responsibility was a necessary programmatic adjustment to cope with realities of addressing the HIV epidemic in rural

Africa. These PMTCT, VCT, and TB services had been managed previously by other partners, creating an absurd surfeit of partners in small rural venues, deemed highly cost-inefficient both by DPS/MISAU officials as well as the PEPFAR management teams.

This integration of facility-based support services has allowed for much better coordination between partner organizations and their government counterparts. As a result, activities have become more streamlined in terms of human resource management, reference/counter reference between services, logistical support, and diminished confusion over partner responsibilities. These improved aspects of service organization and efficiency have greatly accelerated both the government's and the partner organizations' responses to programmatic barriers and to conflict resolution and have allowed for increased focus on quality service delivery. Besides these improvements in service delivery, this integration and broader scope of system support comply with current strategic planning for PEPFAR funding globally and will allow for an easier transition as this funding potentially evolves into a larger more ambitious "Global Health Initiative".

Discussion and Evaluation

To date, the large investments by PEPFAR in Zambézia Province are beginning to yield the desired results: increased access to ART and consequent clinical and social benefits. Despite this, progress is slow in the face of such huge infrastructure needs and manpower shortages, and achievements are fragile, needing constant support.

Mozambique, like many of the PEPFAR-focus countries, still reflects two vastly different worlds. Urban centers, such as Maputo, Kampala, Nairobi, Johannesburg, and Lusaka, generally have greater resources and may continue to benefit from vertically funded or program specific activities. However, in extremely challenged resource-limited rural settings (e.g., districts of Zambézia Province), new approaches that reinforce the basics of the health care system, while maintaining the gains made to date from PEPFAR's vast investments, are fundamental to future successes and sustainability.

We suggest 6 key issues that are essential to address in the long-term maintenance of a chronic disease program in rural Mozambique. We speculate that these challenges exist throughout sub-Saharan Africa to a greater or lesser degree depending upon venue (Table 2).

1. Human Resources: Africa's human resource crisis in the health care sector has been well described in the literature [19,20]. Mozambique has long-suffered from these challenges exemplified by the following experiences of Zambézia Province.
    a. Number of health workers: As of 2006, there were 4 doctors and 21 nurses per 100,000 population [4]. Current production of doctors, nurses, clinical officers (técnicos de medicina), laboratory technicians, counseling staff, public health educators, maternal-child health workers, and other key health workers is far too low to achieve sustainability in a primary health care program focused on increasing the number of persons accessing the system.

b. Health worker salaries and living conditions: Mozambique currently offers few private sector jobs in health care and thus relies on state-centered employment for the vast majority of Mozambican health workers. Current salary structures and often poor living conditions in state-subsidized housing, especially in the rural areas, drastically affect health worker motivation, morale, and performance.

c. Organizational deficiencies: Mozambique's current national health care system lacks many of the positions within its organizational structure that are considered essential for the functioning of PEPFAR programs and also for any broad multidisciplinary health care system. Examples include counsellors, social workers, and data entry personnel. As a result, these personnel are currently hired by NGOs, in parallel to the national system. A strategy for their incorporation into the national system is needed.

2. Infrastructure:

a. Physical infrastructure: Travel distances in the rural areas to reach a health center with the resources to provide ART services or any other chronic disease management has been a significant limiting factor in FGH's experience in Zambézia Province. In its first two years, FGH successfully renovated two health centers per each of the six original districts in terms of physical space, water and electricity, for a total of 12 health centers. While this represents a significant improvement, each of these districts has on average 10–12 rural health centers in need of infrastructure improvements. Investments and expansion of these existing structures will be essential in order to alleviate the rapidly increasing demand for services created by programs such as PEPFAR. This will also bring services closer to where people live and will likely improve adherence to services offered.

b. Supply Chain Management Infrastructure: There is no greater frustration, for both health workers and/or patients, than to be sent home and told to return another day because of a lack in basic essential supplies and/or medicines. This is especially true in rural areas such as Zambézia Province where patients make great sacrifices in order to arrive at the point of care. During the two year period FGH has been working in Zambézia, stock-outs of essential medicines and basic laboratory tests and reagents (supplied by MISAU and DPS in conjunction with other PEPFAR contractors) continue to be a major barrier to the success of these programs. In a time when proven supply chain management methodologies exist, greater investments and additional oversight in the basic supply chain infrastructure (including the often forgotten and difficult rural areas) are both essential.

c. Laboratory Diagnostic Infrastructure: Current laboratory capacity in Mozambique, especially in the rural areas, can only provide minimal diagnostic capacity. In the vast majority of laboratories, simple and fundamental lab tests which are essential to HIV care and other chronic

disease management do not exist (hematology, biochemistry, and microbiology). Partner organizations such as FGH are exhausting many resources -- financial, material, and human -- through transportation logistics to send samples to provincial or regional labs. As the demand for services increases, the sustainability of this logistic support to both the partner organization and certainly to the parent country will quickly be outpaced. Investments need to be made now in the expansion and roll-out of local laboratory capacity and in point of care technologies.

d. Health Information System Infrastructure: It is well accepted in Mozambique that the paper based system for health information management is antiquated. In the rural areas of the country, other than in the HIV services, there is no retained documentation about an individual patient's history at the health center. Also, program documentation tools have been developed in a very vertical process without much thought to the integration of this data across services in the health center. As a result, there are numerous forms to be completed with excessive repetition of information gathered. Not only is this an inefficient use of time for an already overstretched health work force, but it also does not allow for productive use of collected data with which to guide future policy decisions.

Investments in technologies which develop electronic medical record systems afford developing countries, such as Mozambique, an opportunity to move forward in terms of medical record development, in much the same way that cellular phone technologies obviated the need for fixed phone lines [21]. These EMR systems also allow health systems to provide better follow-up of patients, improve clinical management of patients, and increase laboratory efficiency [22,23].

3. Integration of Services: Many of the donor agencies have supported only vertical HIV/AIDS programs and have not supported a broader use of funding to improve the health care system on a larger scale. Recent efforts have expanded those funds to include tuberculosis and malaria, primarily, providing additional support to general primary care improvements. Continuing to move in the direction of horizontal program integration will benefit all health sector areas including HIV. Allowing HIV fund utilization to be broader in scope could also benefit all areas of primary care in rural areas.

4. Stigma Reduction: In many areas of sub-Saharan Africa, including Mozambique, there continues to be tremendous stigma surrounding HIV and AIDS [24,25]. Stigma has been shown to be an important determinant in all aspects of HIV prevention, care and treatment with significant negative impacts at both the community and health facility levels resulting in diminished and/or delayed access of services such as testing and treatment until later in the disease process [26,27,28,29]. Anecdotally, it is our experience in rural Zambézia Province that stigma seems to be a more significant issue, with regards to accessing services, in

those areas with the lowest HIV prevalence and less access to HIV services. This is supported by a recent study comparing three countries in Sub-Saharan Africa and Thailand, which found “more negative attitudes” directed towards persons with HIV in those areas with the lowest HIV prevalence [26]. Another recent multi-country study suggests that greater access to services through treatment scale-up has a positive impact on reduction of stigma [27]. While these studies support our anecdotal experience, we recognize that stigma is a dynamic phenomenon and further studies which take into account the socio-cultural dimensions of a particular local need to be conducted. FGH is currently conducting evaluations of medication adherence, including issues surrounding perceived stigma.

5. Bridging Educational Development with Health Education: A minority of rural Mozambicans attain a level of education high enough to master the nation’s lingua franca of Portuguese or to acquire skills that make them competitive for jobs other than subsistence agriculture. Furthermore, the skill set of many teachers is modest and didactic approaches are often rudimentary, with few resources made available, such as blackboards/chalk, paper/pencils, or books. Because of the weaknesses within the educational system and the limited educational backgrounds, identifying ways to educate patients about their disease and developing methods to encourage adherence to HIV care and treatment requires novel approaches to improve health literacy and numeracy of the population [30,31]. Current HIV funding through PEPFAR does not allow investments to be made directly towards development within the education system. However, we feel that in the future, PEPFAR funds could easily be leveraged against other development funds (such as education) from the US government and other international donors, to create “wrap-around” programs which are more integrated and harmonize efforts. By doing this, the huge investments made in HIV care will take on a new role of also pushing forward broader development and poverty reduction strategies.

6. Increased Sense of Health System Ownership: Due to many of the challenges faced by developing countries such as Mozambique, international donor governments, NGOs, and other organizations have provided extensive support to improve the health system to a level which is competent to provide HIV/AIDS care and treatment and other infectious and chronic disease management. By doing so, responsibility for the country’s health has been diverted from many of the nation’s citizens. Identifying ways in which to strengthen the sense of ownership that health care staff and Mozambicans in general have about their health will only increase the sustainability of those changes currently being made to the health care system.

CONCLUSIONS

PEPFAR has enabled a historic transition for rural Mozambique by initiating the revitalization of infrastructure, manpower, management, and primary care [32]. PEPFAR partners seek to assist the Mozambican government to prepare a new generation of health care professionals for the challenges in chronic disease care management, starting with HIV/AIDS. Challenges are sometimes daunting, but are not overwhelming when provided with

adequate resources to address the health care specific deficits. More elusive are efforts that will make the health care improvements sustainable: expanded health manpower and incentives for rural practice, strengthening of rural livelihoods, upgraded universal education, economic development, and expanded infrastructure and management for sustained chronic disease care programs.

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Figure 1.

Map of Mozambique and locations of FGH supported HIV care and treatment programs. ✚ represents 6 initial district sites supported ▲ represents sites expanded into as of 2009.

Table 1

Specific Components of FGH Assistance to the DPS

Direct technical assistance to the government facilities to implement ART clinical services at the district level
1) On-site technical assistance with program supervision/organization
2) District-level basic laboratory and province-level reference laboratory improvements
3) Technical assistance with monitoring and evaluation
4) Creation and implementation of an electronic medical record system
5) Logistical support for pharmaceutical distribution and other needs
6) Use of non-clinician community health workers to provide psychosocial support, including stigma, HIV education, and family-based adherence counselling
Human capacity development
7) Training of mid- and basic-level health staff in HIV/AIDS prevention, care and other primary care
8) On-site clinical mentoring
9) Technical assistance and financing to the local Health Sciences Training Institute to increase the number of new mid-level health workers
10) Support to associations of persons living with HIV/AIDS (PLWHA)
Health system strengthening
11) Financing/direct contracting of district level health workers to complement existing health workers
12) Improved physical infrastructure through renovations and placement of pre-fabricated buildings (including running water and electricity)
13) Information technology support for the installation of internet and e-mail capabilities

Table 2

Lessons Learned and Next Steps for FGH and Rural Implementation in Zambézia

	Lessons Learned	**Next Steps**
Human Resources	• Human capacity development requires ongoing support and creative ideas to maximize pre-service and in-service training. • Increased human resources are required to address increasing number of patients. • Health worker motivation plays a big role in the provision of quality HIV services.	• On-the-job clinical mentoring that focuses on delivery of quality care and services. • Improved M&E indicators and methodologies that evaluate the impact of training (not only numbers of persons trained). • Expanding the number of pre-service training courses for key health care staff through 1) increased dedicated funding of courses and curriculum development and 2) simultaneous investments in infrastructure, number of professors, and capacity of professors to improve pre-service institution capacity to cope with the increased number of courses. • Advocacy with Government bodies to create place for essential positions within Ministry of Health organizational structures. • Advocacy with Government and donor countries to increase investments in health care worker salaries.
Infrastructure	Physical Infrastructure • Increasing space is essential when increasing patient volume. • Rural health centers need basic necessities required for health care delivery, including steady water and electricity supplies.	• Prioritize renovations and improvements of existing health infrastructure to allow for expansion of HIV services into the periphery.
	Supply Chain Management • ART roll-out has been severely affected by shortages in essential medicines and basic lab tests.	• Focus on improving the logistical legs of the supply chain system within the province (e.g., warehousing, transport, and forecasting) while working with government and donor agencies towards an improved supply chain system.
	Laboratory Diagnostics • HIV/AIDS and other chronic disease programs, delivered with quality, require access to regular laboratory monitoring and opportunistic infection diagnostics.	• Advocate for Point of Care CD4 testing • Expand rehabilitation of laboratories to provide basic lab testing and machine installation, e.g., hematology, biochemistry • Advocacy for funds to support provincial and district opportunistic infection diagnostics with priority focus on TB diagnosis.
	Health Information System • HIV services and chronic disease management generates a larger amount of paperwork than does an acute care program. • Use of documentation tools in a vertical fashion, without planning for integration, creates large inefficiencies in management and utilization of patient data.	• Utilize current information technology investments made for program specific databases as a platform to build integrated systems which incorporate reporting requirements and patient management tools. • Advocacy for broader use of patient data in the day-to-day management of patients as well as program reporting. • Highlight the advantages of electronic medical records in patient management, information utilization, and efficiency for health staff.

	Lessons Learned	Next Steps
	• Development of data collection tools based on government and program specific reporting requirements allows for limited patient and program analysis. • Information technology infrastructure to support robust health information systems at the facility level requires creativity and short-term financial investments.	• Expand both pre-service and in-service training opportunities for national health workers focusing on quality assurance, data collection, and data utilization by 1) advocating at national level for the incorporation of data entry staff into the national cadre of recognized health personnel 2) improving training in monitoring and evaluation for the persons who are currently identified as M&E staff by the national health system, and 3) developing appropriate curricula and practical training sites within the national training institutions. • In Mozambique, non-health related information technology infrastructure investments (laying of fiber optic lines) is happening relatively fast. Expand investments in appropriate short-term solutions such as satellite internet in order to scale-up health information systems in the interim.
Integration of Services	• Inequities created by large vertically funded programs include 1) decreased health worker motivation in other service areas; 2) diminished focus on combating other diseases that may have higher morbidity/mortality; 3) creation of inefficiencies and duplications in management and monitoring systems.	• Advocacy with government and donor agencies for fund utilization which is broader in scope. • Highlight the need for existing funds to be leveraged with other development funding to create wrap-around projects.
Stigma Reduction	• Communities with low HIV prevalence and that do not have adequate or correct information about a disease fuel stigma. • Stigma has a severely negative impact on care and treatment roll-out.	• Emphasize social support amongst people living with HIV (PLWHA) by increasing investments in government-authorized associations for PLWHA and, community- and clinic-based support. • Incorporate PLWHA into the health system and the community level activities as peer educators to increase awareness and provide an opportunity for sharing experiences and knowledge • Focused, locale driven studies which improve understanding of the socio/cultural dimensions of stigma in a particular community need to be conducted and used to target resources and activities.
Bridging Educational Development with Health Education	• Poor education level of a community and literacy can negatively impact on treatment understanding and adherence.	• Ensure that health care providers have appropriate and tested teaching tools that are available in both local language and in graphic designs. • Advocacy for investments in rural educational development.
Increased Sense of Health System Ownership	• Implementation of rural services under an “emergency” mandate required dependence on a large percentage of expatriate clinicians and advisors, particularly due to the human resource constraints. • It is desirable to replace expatriate staff with nationals expeditiously.	• Programmatic support approaches will be modified at the district and health facility levels to increase implementation capacity and accountability of local health systems (i.e., direct financing from NGO partner organizations to district health authorities for program implementation through sub-agreements) • Long-term health program sustainability in rural Mozambique benefits from economic, educational, and agricultural capacity-building.