Review

Factors impacting the provision of antiretroviral therapy to people living with HIV: the view from Haiti

Vanessa Rouzier1*, Paul E Farmer2,3,4, Jean W Pape1,5, Jean-Gregory Jerome6, Joelle Deas Van Onacker7, Willy Morose8, Patrice Joseph1, Fernet Leandre6, Patrice Severe1, Donna Barry2,3,4, Marie-Marcelle Deschamps1, Serena P Koenig2,3,4

1Haitian Group for the Study of Kaposi's Sarcoma and Opportunistic Infections (GHESKIO), Port-au-Prince, Haiti
2Partners In Health, Boston, MA, USA
3Brigham and Women's Hospital, Boston, MA, USA
4Harvard Medical School, Boston, MA, USA
5Weill Medical College of Cornell University, New York, NY, USA
6Zanmi Lasante, Cange, Haiti
7Ministry of Public Health and Population, Port-au-Prince, Haiti

*Corresponding author e-mail: vrouzier@gheskio.org

Haiti is the poorest country in the Western Hemisphere and has the highest number of people living with HIV in the Caribbean, the region most impacted by HIV outside of Africa. Despite continuous political, socioeconomic and natural catastrophes, Haiti has mounted a very successful response to the HIV epidemic. Prevention and treatment strategies implemented by the government in collaboration with non-governmental organizations have been instrumental in decreasing the national HIV prevalence from a high of 6.2% in 1993 to 2.2% in 2012. We describe the history and epidemiology of HIV in Haiti and the expansion of antiretroviral therapy (ART) over the past decade, with the achievement of universal access to ART for patients meeting the 2010 World Health Organization guidelines. We also describe effective models of care, successes and challenges of international funding, and current challenges in the provision of ART. We are optimistic that the goal of providing ART for all in need remains in reach.

Introduction

Haiti is the poorest country in the Western Hemisphere, and one of the poorest in the world, ranking 161 out of 186 on the 2012 Human Development Index [1]. The country has been battered by political instability and natural disasters for decades, and over half of the population of 10 million lives on less than USD1 per day [2,3]. Yet in spite of these challenges, Haiti has mounted a highly successful response to its HIV epidemic. This success is tied to a strong foundation for HIV care that was in place well before external funding became available, and that combined prevention and treatment [4–6]. Non-governmental organizations had been working with the government to provide high-quality HIV care in Haiti for over two decades, with political commitment at the highest levels. Funding from the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), and the US President’s Emergency Plan for AIDS Relief (PEPFAR) made it possible to scale-up antiretroviral therapy (ART) nationwide. While universal ART access for patients with CD4+ T-cell counts ≤350 cells/mm³ has been achieved this year, significant challenges remain, including the need for expansion of prevention and treatment services to key populations, earlier initiation of ART, further integration between HIV and tuberculosis (TB) services, improved retention in care and earlier detection of treatment failure.

Overview of the current status of Haiti’s HIV programme

Over the past decade, HIV services have been rapidly scaled-up across Haiti. Many HIV prevention activities have been implemented, with mass media campaigns, youth peer groups and community outreach
interventions. From 2005 to 2012, the number of HIV testing sites in Haiti nearly doubled, from 83 to 161 sites (Table 1), and the number of patients tested for HIV each year increased over fourfold, from 196,624 to 854,344. The integration of prevention and treatment was the driving force that led to this rise in testing rates [4,7,8]. In 2003, only two organizations, Partners In Health/Zanmi Lasante (PIH/ZL) and the Haitian Group for the Study of Kaposi’s Sarcoma and Opportunistic Infections (GHESKIO), were providing ART. By 2012, access to care had increased greatly with 96 public and non-governmental organization (NGO)-based clinic sites providing ART free of charge (Table 1; Additional file 1) [9]. As of December 2013, 53,781 patients were receiving ART compared with a few hundred prior to 2002. Haiti had reached 83% coverage of patients estimated to have CD4+ T-cell counts ≤350 cells/mm³ based on 2010 World Health Organization (WHO) guidelines (Figure 1) [10]. As more patients are placed on ART, the life expectancy of people living with HIV (PLHIV) will increase and it is anticipated that incidence will decline.

Three strategic interventions implemented early in the epidemic helped decrease the HIV prevalence from a peak of 6.2% in 1993 – 10% in urban areas – to 2.2% in 2013. These included the closure of commercial blood banks and institution of blood safety, national scale-up of the syndromic management of sexually transmitted infections (STIs) leading to a significant reduction of ulcerative genital lesions and the promotion of condom use [11,12]. The estimated annual number of people newly infected with HIV has dropped by 40%, from 14,000 to 8,500, and the annual number of deaths from AIDS has dropped by 50%, from 15,000 to 7,500, over the last decade [13,14].

The resiliency of Haiti’s HIV programme is evidenced by the response to the earthquake of January 2010, which left over 15% of the population homeless and disabled, and destroyed the centres of government and health care. Within months, the number of patients on ART nationwide was over 90% of the pre-earthquake level, and a recent national study suggests that HIV prevalence has not risen during the 4 years post-earthquake, remaining at 2.2% [12,15,16]. Shortly after the earthquake, Haiti suffered from the world’s largest cholera epidemic, which also could have negatively impacted HIV outcomes, but did not [17,18].

### History and epidemiology of HIV in Haiti

The swift identification of the first symptomatic HIV cases and early establishment of a coordinated response that included both the government and private sector were instrumental to Haiti’s successful response to the HIV epidemic. In 1982, GHESKIO, the first AIDS clinic in the developing world, was formed in affiliation with Weill Cornell Medical College to provide care to patients presenting at the Hospital of the State University of Haiti with a new constellation of symptoms previously unrecognized and never before described in Haiti. As similar cases were being reported to the Centers for Disease Control and Prevention (CDC) in the USA, GHESKIO gathered data on the clinical presentation and risk factors associated with the newly described AIDS syndrome in the Haitian setting [19].

In 1982, the CDC listed Haitian nationality as a risk factor for HIV along with homosexuality, heroin use and haemophilia [19–22]. The stigma conferred by this new, unknown and widely feared disease, often flippantly referred to as ‘the 4H Club’ in the media, was immediate and severe, but only for Haitians did an entire nation suffer the consequences [23–26]. The association between Haitians and AIDS led to unprecedented discrimination of Haitians and caused unparalleled prejudice to the country [25,27]. The cover story ‘AIDS Anxiety’ of New York Magazine on 20 June 1983 read: ‘AIDS victims have been fired from their jobs, driven from their homes, and deserted by their loved ones. Any homosexual or Haitian has become an object of dread’ [24]. Tourism, a backbone

<table>
<thead>
<tr>
<th>Year</th>
<th>VCT sites, n</th>
<th>Patients tested for HIV, n</th>
<th>ART sites, n</th>
<th>Patients newly enrolled on ART, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>83</td>
<td>196,624</td>
<td>23</td>
<td>2,659</td>
</tr>
<tr>
<td>2006</td>
<td>99</td>
<td>290,663</td>
<td>32</td>
<td>4,336</td>
</tr>
<tr>
<td>2007</td>
<td>114</td>
<td>450,627</td>
<td>40</td>
<td>6,643</td>
</tr>
<tr>
<td>2008</td>
<td>122</td>
<td>603,844</td>
<td>45</td>
<td>7,098</td>
</tr>
<tr>
<td>2009</td>
<td>128</td>
<td>620,669</td>
<td>49</td>
<td>8,127</td>
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<tr>
<td>2010*</td>
<td>145</td>
<td>381,821</td>
<td>53</td>
<td>6,208</td>
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<tr>
<td>2011</td>
<td>153</td>
<td>693,624</td>
<td>64</td>
<td>9,314</td>
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<tr>
<td>2012</td>
<td>161</td>
<td>854,344</td>
<td>96</td>
<td>13,710</td>
</tr>
</tbody>
</table>

*The January 2010 earthquake resulted in fewer numbers of patients receiving HIV tests and starting antiretroviral therapy (ART) during the year 2010. VCT, voluntary counselling and testing for HIV.
of the Haitian economy in the 1970s and 1980s, was crippled overnight. The Haitian Bureau of Tourism estimated a decline from 75,000 visitors during the winter of 1981–1982 to fewer than 10,000 by the following year [25]. This stigma against their nationality and country mobilized Haitians to a quick response both locally and internationally. In 1990, when the US Food and Drug Administration (FDA) issued a policy recommending that all Haitians should be banned from donating blood, tens of thousands of people rallied in the streets of New York and Miami to protest against this stigmatization of an entire nation [28–30]. Shortly thereafter, the FDA rescinded this policy.

In the earliest days of the epidemic, Gheskio researchers evaluated risk factors among patients diagnosed with HIV in Haiti. They demonstrated that the HIV epidemic evolved from a homosexual and bisexual population initially that spread to the heterosexual population [31–35]. Initially, 50% of patients or 65% of men diagnosed with HIV in Haiti reported homosexual or bisexual activity. A few years later, a similar pattern was noted in Trinidad (Figure 2). The second most common risk factor was a recent history of blood transfusion [36–38]. In 1983, 49% of women with AIDS diagnosed at Gheskio had received a blood transfusion from a commercial blood bank and in 1985 4% of all blood donors surveyed in Haiti were found to be infected with HIV (Figure 2) [32,36]. At that time, the commercial suppliers were buying blood from impoverished patients. In response to the data linking HIV transmission and blood transfusions from paid donors, the Ministry of Health (MoH) closed the commercial blood suppliers in 1986, and established the Haitian Red Cross as the only organization authorized to collect blood and provide transfusions. They also started surveying potential donors to identify and exclude those reporting high-risk behaviours for acquiring HIV and screened all blood products for HIV; Gheskio provided quality control for these tests. Significant disease transmission was prevented through this provision of a secure blood supply early in the epidemic.
Since 1985, the dominant mode of HIV transmission in Haiti has been heterosexual intercourse. Intravenous drug use, being rare, has never been a significant risk factor for HIV in Haiti, and by 1987, the proportion of cases attributed to homosexuality was just 1% [32]. As heterosexual contact became the predominant route of transmission, more women became infected, shifting from a female-to-male ratio of 1:5 in 1983, to 1:3 in 1985, to 1:1.6 in 1990 and to 1:1 in 2000 [39]. Since 2006, the prevalence of HIV in Haiti has been higher among females compared with males [12]. In 2012, the HIV prevalence for women aged 15–49 years was 2.7%, compared with 1.7% for men in the same age group. HIV prevalence was also higher in urban (2.4%) compared with rural areas (2.0%) [12].

After the monumental step of instituting blood bank safety, another important measure early in the fight against HIV was improving the diagnosis and treatment of STIs in Haiti. Ulcerative genital lesions were found to be very prevalent in patients presenting with AIDS and were associated with a sevenfold greater risk of HIV transmission compared with patients without a second STI, confirming findings reported from other countries [35,40,41]. In collaboration with the government and a network of NGOs, algorithms were developed and distributed nationally for the diagnosis and treatment of STIs based on symptoms, rather than test results, as laboratory tests were too expensive and technically demanding for widespread use. Dissemination of this guide for the syndromic diagnosis and treatment of STIs has led to a significant decrease in the prevalence of STIs and particularly ulcerative genital diseases, and is believed to have contributed to the nationwide decline in HIV prevalence.

As of 2012, HIV infection is generalized in the population with a 2.2% adult prevalence rate. Young adults from 15 to 24 years of age represent over one-third of all new infections. The prevalence rate is much higher in key populations such as men who have sex with men at 18%, street children at 12%, sex workers at 8% and prisoners at 3%. Heterosexual contact remains the primary mode of transmission but homosexual or bisexual activity represents an important risk group that is still highly stigmatized [14].

Expansion of antiretroviral therapy in Haiti

The early collaboration of the Haitian public and private sectors and the priority given to fighting the HIV epidemic were instrumental in setting the stage for the rapid scale-up of HIV services once funding became available. In 2002, Haiti submitted an HIV proposal to and was awarded a grant by the Global Fund. The first Country Coordinating Mechanism, chaired by the First Lady Mildred Aristide, consisted of a partnership of key stakeholders in the public and private sector as well as PLHIV who had recovered their health on ART. The first Global Fund grant paid for the initial development of a nationwide programme for a comprehensive response to HIV.
with two main implementing partners. PIH/ZL provided comprehensive medical and surgical services as well as ART in Haiti’s Central Medical Department. Meanwhile, Gheskio expanded their model of HIV voluntary counselling and testing (VCT) and integrated primary care services to 25 new sites throughout Haiti, providing ART to all patients with AIDS at the Gheskio clinic in Port-au-Prince and eventually all sites in the network [4]. Thus, nearly two decades of public–private collaboration had laid the groundwork for the national scale-up of ART, which proceeded rapidly once funding became available.

A decade after national availability of ART, there are an estimated 150,000 PLHIV in Haiti, with 65,000 of these qualifying for ART initiation based on 2010 WHO guidelines for PLHIV with CD4+ T-cell counts ≤350 cells/mm³ or a WHO stage III or IV condition (Table 2). There are currently 53,781 patients receiving ART, with 17,129 patients newly initiated on ART during the year 2013 [9]. The use of generic ART medications in Haiti procured through PEPFAR funds has increased from 57% in 2005, to 89% in 2006, 92% in 2007 and to over 99% in 2008 [42]. The preferential first-line ART regimen in Haiti consists of efavirenz, lamivudine and tenofovir, which is available as a generic combination pill to be taken once daily, at a cost of USD138 per year [43]. When a patient develops resistance to this first-line regimen, he/she is switched to second-line therapy, which generally includes generic lopinavir/ritonavir at a cost of USD147 per year, with generic zidovudine/lamivudine, at a cost of USD88 per year. Newer medications such as darunavir and raltegravir have recently become available in Haiti for patients who fail second-line therapy, however, these drugs remain expensive, and are not yet available in generic formulations. The best possible price for a third-line regimen is USD2,006 per year [44].

Successful models of care

The Gheskio urban model: clinical care, research and training

Gheskio published the first case series of patients living with HIV in a developing country in 1983, followed closely by many publications on the epidemiology and risk factors for HIV [11,32,36–38,45]. They have continued to provide HIV care in Haiti since that time. The Gheskio Centers are located in two locations, one in the downtown Port-au-Prince area across from five very large and densely populated urban slums and another one in the northern part of the city. The downtown clinics are built on land partly owned by the MoH, a testament to the longstanding collaboration with the government in the national response to the HIV epidemic.

Gheskio integrates HIV testing with services to diagnose and treat STIs, TB, diarrhoeal disease and other communicable infections, and a programme of comprehensive HIV prevention and treatment [4]. All HIV-infected patients with symptoms suggestive of active TB or other WHO stage III or IV conditions at presentation to the VCT centre are quickly evaluated for HIV and TB and offered an integrated package of primary care services at the same site. Family-centred services are provided in specialized clinics: ART, TB, STI, adolescent, reproductive health, prevention of mother-to-child transmission, paediatrics, nutrition and community health clinics. Patients are also provided with HIV and STI prevention counselling, family planning services and, if deemed in need, nutritional support and access to vocational training and micro-credit loans. The Gheskio Centers also serve as effective sites to care for victims of gender-based violence and accidental blood exposure. This model of integrated HIV testing and treatment linked to primary care services has been reproduced at the national level. In collaboration with the MoH, Gheskio supervises the integration of HIV testing and treatment in a network of public and private sites throughout the country, with a site coordinator in place and mobile teams visiting each site regularly to conduct training, monitoring and evaluation activities.

The Partners In Health model of care: rural setting with community-based accompaniment

With the vision of breaking the cycle of poverty, social inequalities and infectious disease, in 1985 PIH/ZL opened an ambulatory clinic in the squatter settlement of Cange, in Haiti’s rural Central Plateau [8,46–48].

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Table 2. Overview of antiretroviral therapy in Haiti

| UNAIDS estimate of number of people living with HIV | 150,000 |
| UNAIDS estimate of number of people who qualify for ART based on 2010 WHO guidelines | 65,000 |
| Number of patients on ART out of those who qualify based on 2010 WHO guidelines (%) | 53,781 (83%) |
| Percentage of patients on first-line ART | 94% |
| Percentage of patients on second-line ART | 6% |

Note that the proportion of patients on second-line medications is higher among clinics with longer use of antiretroviral therapy (ART); for example at the Haitian Group for the Study of Kaposi’s Sarcoma and Opportunistic Infections (Gheskio), 86% of patients are on first-line ART and 14% are on second-line ART. WHO, World Health Organization.
This region is one of the poorest parts of Haiti, and most of the population lives in isolated dwellings or small villages or towns spread throughout the countryside. In addition to providing health care, PIH/ZL also aimed to maximize the well-being of the community by developing clean water systems, building schools, planting trees and initiating economic development projects. In 1986, the first patient with advanced AIDS presented to the PIH/ZL clinic; shortly thereafter, PIH/ZL introduced VCT for HIV. Soon an inpatient facility was opened and by the early 1990s about 40% of inpatients were found to be PLHIV. In 1995, when studies showed that zidovudine could prevent mother-to-child transmission of HIV, PIH/ZL began offering it to all pregnant patients, with the permission of the MoH. Over the next year, the rate of uptake of VCT among pregnant women increased from about 30% to over 90% [7].

By 1996, when ART became available in high-income countries, PIH/ZL had a highly functional community-based health-care system in place in the Central Plateau for the treatment of TB and other opportunistic infections. Directly observed treatment (DOT) and social support was provided by community health workers (accompagnateurs) who lived in the surrounding villages and were paid a stipend to provide care to their neighbours. PIH/ZL found resources to provide ART for as many patients as possible, using the same DOT model that was already in place for TB management. From 1998 to 2002, they used serology and clinical algorithms to identify patients with advanced AIDS, as CD4+ T-cell counts were not yet available in rural Haiti. The dramatic clinical improvements seen with ART among patients with advanced disease (the Lazarus effect) led to further increases in demand for VCT [5,6]. Of the first 60 patients, 59 (98%) had a favourable response [5,6]. This was one of the first demonstrations that HIV could be successfully treated in an extremely poor rural setting and this model has since been replicated in settings around the world [49–53].

When external funding became available, PIH/ZL expanded general medical, paediatric, obstetric-gynaecology and surgical services, as well as comprehensive HIV and TB care through 10 MoH facilities in the Central Plateau and Lower Artibonite regions, serving a population of over 1,200,000 people. In each setting, they worked with under-funded and under-staffed public clinics using resources for HIV and TB programmes from the Global Fund and PEPFAR to reinforce primary care and rebuild capacity in the public sector institutions [8]. Community health workers have played a major role in the provision of all health services and serve as a living link between patients’ homes and clinical institutions [54–56].

Integration of HIV and tuberculosis services

The integration of HIV and TB services has been critical in building the country’s capacity to fight both epidemics [57]. In 1988, TB control in rural Haiti was widely acknowledged to be a failure. PIH/ZL built an extensive network of accompagnateurs to provide aggressive home-based DOT by trained community health workers linked to a comprehensive package of care including financial aid, nutritional supplementation, travel expenses and monthly reminders to visit the clinic [58]. This considerably strengthened the TB programme, which later served as the foundation for the PIH/ZL model in Haiti and at other PIH/ZL sites around the world.

TB was quickly recognized as a common opportunistic infection in PLHIV and a leading cause of death in that population [59–61]. Research conducted at GHESKIO was instrumental in linking HIV and TB services early on in the epidemic. In 1986, the impact of isoniazid (INH) prophylaxis in decreasing the incidence of active TB and AIDS in HIV-infected patients was demonstrated in a clinical trial [61]. Results of this trial and others regarding the role of INH prophylaxis in a TB endemic setting have greatly impacted international guidelines on the management of HIV–TB coinfection. The most recent WHO guidelines continue to recommend INH prophylaxis for PLHIV to prevent the development of active TB [62].

The promotion of the early diagnosis and treatment of TB in patients with HIV has been essential in the scale-up of HIV services. Up to 30% of adult patients who present at GHESKIO for HIV VCT with a cough of more than 2 weeks in duration have active TB [63,64]. Same-day TB screening with sputum smears and a chest radiograph of symptomatic patients and rapid anti-TB treatment initiation are done to stop the chain of TB transmission, minimize chances of being lost to follow-up and improve survival, particularly if HIV-coinfected. Infection control plans have also been developed by the National TB Program at large and TB treatment centres across the country.

The impact of research conducted in Haiti on the clinical care of patients

The success of Haiti’s response to the HIV epidemic has also been in part due to the impact of locally conducted clinical and operational research on the care of patients. It has guided the national implementation of evidence-based strategies. The ability to describe the Haitian epidemic with its risk factors for HIV acquisition, the rapid progression to AIDS in both adults and children in Haiti as compared with developed countries, and the evaluation of strategies for the treatment and prophylaxis of opportunistic infections including TB, isosporiasis and cyclosporiasis have allowed for the deployment of targeted interventions that are best adapted to resource-poor settings [4,35–37,58–60,63,65,66]. As Haiti was one of the first low-income countries to treat patients...
with ART, early studies described the successful outcomes of these early programmes [5,6,8,33,67]. Patient care has been improved by locally conducted research evaluating timing of ART initiation, various treatment regimens for HIV and TB coinfection, and monitoring and support strategies for patients throughout therapy [54–56,64,68–79].

Much of this research has been conducted with funding from the US National Institutes of Health and in collaboration with universities and institutions such as Cornell, Harvard, Vanderbilt, Dartmouth and the Mérieux Foundation. These research efforts have facilitated the introduction of specialized HIV and TB laboratory techniques in the country, such as CD4+ T-cell count, dried blood spot PCR, HIV viral load and drug resistance testing, and the creation of a biosafety level-3 laboratory with capacity for identification of mycobacteria by culture, PCR and spoligotyping. Applied research has thus contributed to the betterment of care accessible to patients as well as to building national capacity for HIV and TB programmes.

Successes of international funding and technical support

Widespread use of ART in Haiti would have been impossible without new mechanisms for international funding. With financial assistance from the Global Fund and PEPFAR, the expansion of prevention and treatment services in Haiti finally became feasible. This funding has provided for the development of clinic and laboratory infrastructure; counselling and testing services; mother-to-child prevention services, including care of HIV-exposed infants; treatment of TB and other opportunistic infections; other important social services for those infected with HIV, including nutritional supplements; and the provision of ART.

One major PEPFAR success in Haiti has been the improvement in supply chain management through the establishment and funding of the Supply Chain Management System (SCMS) [80]. As a result of this collaboration between PEPFAR, the MoH and local NGOs, stock-outs of ART drugs have rarely been a problem in Haiti. Even after the January 2010 earthquake, which caused massive devastation to the country’s infrastructure, this coalition was able to rapidly provide ART to those patients on treatment. The PEPFAR team was on the ground in Haiti, providing HIV medications and test reagents in the immediate aftermath of the earthquake, even in the midst of the repeated aftershocks.

PEPFAR and the Clinton Health Access Initiative (CHAI) have also been highly effective in reducing the cost of ART through the use of generic medications and brokering of drug distribution agreements. Support from CHAI has also been instrumental in scaling-up paediatric ART capacity with the introduction and promotion of paediatric fixed-dose ART combination pills. This has greatly enhanced the capacity to treat children in rural sites without the need to refer them to a major centre and increased ease of medication administration and adherence for children. Another positive outcome from international funding and technical support is the strengthening of monitoring and evaluation systems. Due to donor requirements, more rigour and attention has been focused on obtaining good strategic information for measurement of programme performance.

Current challenges in the provision of antiretroviral therapy

The need for timely HIV testing and linkage to care

The cascade from HIV diagnosis to linkage and retention into care is complex and involves many steps (Figure 3). High rates of attrition prior to ART initiation have been described in many settings. One review of 28 African studies found that a median of 59% of patients (range 35–88%) were retained in care from HIV testing to CD4+ T-cell testing or clinical staging, 46% (range 31–95%) from staging to ART eligibility, and 68% (range 14–84%) from ART eligibility to ART initiation. The estimated median completion of the above three stages was only 17%, with an 80% CI of 7–32% [81].

In Haiti, attrition rates during ART staging are lower than in most published studies, likely due to faster service delivery [81]. In the year 2012 at GHESKIO, 72% of patients received a CD4+ T-cell count within 2 weeks of HIV testing. Even with this rapid provision of test results, patients are lost in the ART staging process. As illustrated in Figure 4, nearly 30% of newly diagnosed patients are lost to care prior to having a CD4+ T-cell count or returning for results. Point-of-care testing, which has recently become available, will likely improve CD4+ T-cell test completion rates [82–85]. Most patients who complete the staging process and qualify for treatment are rapidly enrolled on ART. At GHESKIO, among PLHIV with baseline CD4+ T-cell counts <200 cells/mm³, 86% initiate ART a median of 8 days after CD4+ T-cell testing. Loss to care occurs early, as 82% of patients who ever start ART do so within 6 weeks of CD4+ T-cell testing. Interventions to improve ART uptake would have to be delivered in the early period after HIV testing in order to be effective.

Late initiation of antiretroviral therapy

Despite the increased access to testing services over the past decade in Haiti, many patients still present with advanced AIDS. At the GHESKIO VCT centre, the
largest HIV testing site in Haiti, about one-quarter of patients continue to present with CD4+ T-cell counts <200 cells/mm³ at HIV diagnosis. Additional efforts, such as community outreach interventions for HIV testing, are now being discussed to bring more PLHIV to earlier care.

The CIPRA HT 001 randomized trial, which was conducted in Haiti, demonstrated that mortality was reduced by 75% among patients with CD4+ T-cell counts from 200 to 350 cells/mm³ who started early ART, which was also found to be cost-effective [69,70]. This was followed by a change in WHO guidelines in November 2009 to recommend that all HIV-infected patients should initiate ART when their CD4+ T-cell count drops below 350 cells/mm³ or they develop WHO stage III or IV disease [68,86,87]. This policy change has had a local impact – at GHESKIO, the proportion of patients who started ART with a CD4+ T-cell count <200 cells/mm³ dropped from 63% of patients in 2005 to 27% in 2012 (Figure 5) [88].

Retention in care and medication adherence
Patients on ART must maintain high treatment adherence to achieve durable suppression of viral load. Though reported ART adherence rates in low- and middle-income countries are equal or superior to those reported from high-income countries, access to viral load monitoring is limited in lower-income settings [89–94]. As a result, drug-resistant infections, whether primary or acquired, are often detected late. Expansion of access to viral load testing is critical. Taking daily medication is challenging over the long term, especially for patients whose ability to adhere is interrupted by extreme poverty, food insecurity, uncertain access to care close to their home or by the disruptions in service encountered in the course of political disarray or after natural disasters. Even in these times of austerity, it is essential to provide social and economic support to minimize barriers to adhering to therapy.

Retention in care strategies are also necessary for patients to remain adherent. In the urban GHESKIO setting, only 6% of patients who receive at least 1 month of ART are lost to follow-up within the subsequent 2 years [88]. In the rural PIH/ZL setting, the loss to follow-up rate is less than 5%, with a system of accompagnateurs providing social support and DOT for ART, which is provided using the same method as for TB. These high levels of retention are attributed to patient tracking for those who miss visits, provision of

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**Figure 3. Steps in HIV care from diagnosis to treatment**

Unaware of HIV status → HIV testing → Staging for ART qualification → Retention in care until qualify for ART → Initiate ART → Adhere to ART → In long-term, continuous HIV care

**Figure 4. Proportion of HIV-infected patients completing CD4+ T-cell counts at GHESKIO (May 2008 to December 2012)**

<table>
<thead>
<tr>
<th>HIV-positive patients who received test results and counselling</th>
<th>Blood drawn for CD4+ T-cell count</th>
<th>Returned for CD4+ T-cell count result</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% (14,027)</td>
<td>81.5% (11,435)</td>
<td>70.2% (9,841)</td>
</tr>
</tbody>
</table>

GHESKIO, the Haitian Group for the Study of Kaposi’s Sarcoma and Opportunistic Infections.
transportation subsidies and nutritional supplementation for those in need [95, 96]. Similar low-cost interventions to keep patients engaged in care have been shown to be cost-effective [97].

Challenges in human resources in the provision of antiretroviral therapy

The capacity to train medical personnel also played an important role in the expansion of HIV services. GHESKIO is Haiti's largest training centre for medical and non-medical personnel. From 1992 to June 2013, GHESKIO trained 3,478 physicians, 4,893 nurses, 1,746 laboratory technicians and 1,375 social workers, as well as 311,787 community and religious leaders (Table 3). GHESKIO has also established three specialized training programmes to expand human resources: the country's first Master's in Public Health Program in 2005, the first Nurse Practitioner Program in 2009 and a training course for laboratory technicians in 2010. These programmes are successful because they are developed and taught in collaboration with local institutions.

PIH/ZL has also focused extensively on training health-care providers. In collaboration with the MoH they developed a family practice residency at Saint-Marc, and a nurse anaesthetists programme. In addition, all graduates of the Hospital of the State University of Haiti take their community health rotations at a PIH/ZL site. In the town of Mirebalais, PIH/ZL and the MoH recently opened the first public university hospital in rural Haiti. This 300-bed facility will work with Haitian medical and nursing schools to develop academic programmes, including residencies in a wide variety of specialties (Additional file 2). With only 25 physicians per 100,000 inhabitants in Haiti, task-sharing with nurses, nurses' aides and community health workers has been necessary, particularly in rural areas. In 2007, PIH/ZL conducted a mapping exercise and found a large shift in HIV-related tasks, with nurses and community health workers playing major roles in the delivery of care, compared with the traditional doctor-based model of care [55]. Staff were satisfied with the new model of care [55].

However, 'brain drain' remains a major challenge for Haiti. Because of continued political turmoil, insecurity and violence, and limited economic opportunities in Haiti, many personnel emigrate to seek economic advancement opportunities and safer living conditions. It is estimated that over 80% of Haiti's university graduates leave the country, and that there are more Haitian medical personnel working outside of than within Haiti [98]. At GHESKIO, for example, 63 of the most highly qualified physicians, nurses, psychologists and social workers emigrated after the 2010 earthquake. That represented 14% of its entire staff and 25% of its medical personnel.

Unfortunately, access to specialized training also has the perverse effect of rendering candidates more competitive for emigration. The rapid turnover of medical staff is a challenge to the continuity of services and increases the risk of potential fatigue of remaining staff. Retention strategies are urgently needed to help reduce.
staff loss to emigration. Additional opportunities for academic and career advancement in Haiti would encourage health-care providers to remain in the country. For example, it is anticipated that the newly opened University Hospital in Mirebalais, which is being run by the MoH and PIH/ZL, will provide a counterweight to the external brain drain, as PIH/ZL is the largest employer of medical staff in rural Haiti, and the new hospital will open up new opportunities through the provision of tertiary surgical and medical care.

Challenges in the management of international funding and technical support

The coordination of international funding and technical support from various donors has presented some important challenges as well. One such challenge in the Global Fund and PEPFAR programmes in Haiti has been duplications in effort in the selection of the CD4+ T-cell count testing equipment and electronic medical records (EMR) systems to be used nationally. While functioning systems were already in place prior to the availability of external HIV funding, a second system for testing CD4+ T-cell counts and another EMR were introduced rather than expanding the ones already in place. This resulted in delays in ART scale-up at smaller peripheral sites that had to send specimens for CD4+ T-cell testing at referral centres and decreased capacity for patient monitoring with the newer EMR. Another burdensome duplication has been in the procurement of ART drugs and the requirement by the Global Fund and PEPFAR to have different pharmacy systems, EMR files, locations for medications, ART stock and staff. While improvements have been made in coordinating procurement, additional steps could be taken to ease the burden on grant recipients.

Furthermore, the management and supervision of the international funding of the Haiti HIV programme has raised important issues about the roles and relationships of the various parties involved. In many countries with a high burden of HIV, international support should strive to achieve the delicate balance of capacitating national governments to manage funds while ensuring accountability and monitoring project implementation. For the Global Fund grant, poor collaboration between the supervising body serving as the principal recipient and sub-recipients has led to frustrations, delayed disbursement of funds and limited the flexibility of local implementing partners in adapting to challenging financial situations.

While most clinical and research grants include a percentage rate for indirect costs for the implementing organization to pay for administration and other costs that are associated with many services and activities, PEPFAR does not provide indirect costs to local NGOs or the MoH. Until recently, an 8% indirect cost rate was added to Global Fund grants in Haiti; this has since been removed. The sub-recipients now have to budget indirect costs on a per-item basis. This is difficult because these services cover many programmes and these costs can change during a single budget period. The lack of indirect costs has also left sub-recipients more vulnerable to delays in disbursement from donors. Such grant management issues are particularly frustrating because they appear to be unilaterally applied to sub-recipients but indirect costs seemed to have been maintained for the primary recipient, which is the United Nations Development Program for Haiti’s Global Fund grant.

Specific needs and challenges for Haiti’s HIV programme

Reinforcement of the public health system and strengthening of ongoing decentralization efforts

NGOs play a vital role in providing health services in Haiti, delivering many health interventions and reconstruction efforts. Soon after the earthquake, large international NGOs provided a wide variety of services. In the chaotic post-earthquake situation, the NGOs efforts could not be coordinated. To maximize efficiency in the

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<tr>
<td>Laboratory technicians, n</td>
<td>1,253</td>
<td>105</td>
<td>150</td>
<td>186</td>
<td>52</td>
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<td>44</td>
<td>65</td>
<td>73</td>
<td>28</td>
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<tr>
<td>Nurses, n</td>
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<td>238</td>
<td>367</td>
<td>373</td>
<td>150</td>
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</tr>
<tr>
<td>Physicians, n</td>
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<td>204</td>
<td>161</td>
<td>206</td>
<td>133</td>
<td>3,478</td>
</tr>
<tr>
<td>Other, n</td>
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<td>256</td>
<td>231</td>
<td>294</td>
<td>38</td>
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<tr>
<td>Total, n</td>
<td>9,808</td>
<td>847</td>
<td>974</td>
<td>1,132</td>
<td>401</td>
<td>13,162</td>
</tr>
<tr>
<td>People trained through community outreach activities, n</td>
<td>127,216</td>
<td>19,628</td>
<td>65,996</td>
<td>89,747</td>
<td>19,200</td>
<td>311,787</td>
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GHESKIO, The Haitian Group for the Study of Kaposi’s Sarcoma and Opportunistic Infections.
future, it is important that the government and the MoH determine funding priorities for international aid and health-care interventions. Over time, it is essential that a higher proportion of international funding goes to the Haitian Government and that the MoH plays a greater role in setting health strategies and priorities. Rwanda is a good example of a country that has succeeded in reducing many health disparities [50]. The strong leadership of the Rwandan Government is one of the essential reasons for this huge success. The current Haitian Minister of Health, Dr Florence Guillaume has shown much strength in leading the country’s health effort.

Another key priority for Haiti’s national HIV programme is the expansion of ongoing decentralization efforts. Currently, all of the major public hospitals in Haiti function as ‘centres of excellence’ and supervise the peripheral HIV clinics in their area of influence. Peripheral clinics, in turn, supervise smaller health centres. Today, ART is available in all regions of Haiti. These decentralization efforts will dovetail perfectly with the planned deployment of 10,000 polyvalent community health agents by the MoH. These agents will provide health education for patients and families, and accompany them in seeking health services, serving as a link between clinics and the surrounding communities.

The need for ongoing international funding
As of July 2013, Haiti had reached universal ART coverage for patients with CD4+ T-cell counts ≤350 cells/mm³. Though there are competing funding priorities, the new WHO guidelines, recommending that ART be initiated in all patients with a CD4+ T-cell count ≤500 cells/mm³, will reduce morbidity and mortality and lower the risk of HIV transmission [62]. At PIH/ZL and GHESKIO, implementation of these new guidelines will increase the proportion of newly diagnosed patients qualifying for ART from 53% to 72%.

In October 2013, the Haitian MoH changed the national guidelines to recommend ART for all patients with a CD4+ T-cell count ≤500 cells/mm³. Since Haiti is a small country, with an HIV prevalence of 2.2%, it will be feasible to move to earlier treatment without overwhelming the fragile health system, but donors will need to provide additional funds for ART medications. Over 75% of the funding for Haiti’s HIV response is provided by external donors [13]. As Haiti’s economy improves post-earthquake, it is hoped that national funding will also increase, as has been the case in many other PEPFAR and Global Fund recipient countries.

While the support of the international community remains vital today to preserve these achieved successes, sustainable funding strategies that include increased national government contribution and ownership are essential to prepare Haiti to be eventually weaned from donor dependency. Public–private partnerships, increased staffing, significant cost reductions for deliverables and considerations for the implementation of a national insurance plan that would help generate income and support the most vulnerable are small steps being undertaken by the Haitian government. They are also working to integrate HIV services within a well-coordinated primary health-care system to increase efficiency and maximize cost-effectiveness.

An important consideration in this transition is the need for complete national ownership of the national HIV/AIDS, TB and malaria programmes by putting the local government in charge of the Global Fund programmes as principal recipient, initially in collaboration with experienced private institutions. This is an essential key test that would demonstrate Haiti’s capacity to lead. The Haitian Government would also need the support of local NGOs. However, these NGOs have no indirect cost support and no way to build long-term capacity with the current PEPFAR and Global Fund structures. That would need to change as well. Involving the private health sector is also essential. This could be done by favouring private hospitals with tax preferences in exchange for converting them into teaching hospitals with dedicated free clinic days for patients who lack the financial resources to pay for the cost of the services provided.

Lessons learned from other countries, such as Rwanda, where the transition from solely donor-supported HIV programmes to nationally-owned health services will be important, as well as guidance and support from donor countries as international funding becomes more and more scarce. In summary, Haiti needs to be imaginative to develop a unique model for sustainable funding to continue its successful response to the HIV epidemic.

Conclusion
Though Haiti has faced tremendous challenges from political instability and natural disasters over the past decade, the country has achieved a highly successful response to the HIV epidemic, with a decline in HIV prevalence and increased number of PLHIV receiving ART. Key elements to this effective response include longstanding country-level ownership, strong public–private collaboration, dedicated local NGOs, international support and the development of decentralized HIV treatment models that were already established prior to the availability of external funding. Important challenges remain for the future. Further efforts are necessary to reduce pre-ART attrition, ensure retention in care and adherence to ART, and expand the use of viral load for earlier detection of treatment failure. It will also be essential to scale-up prevention and treatment programmes for adolescents and young adults, especially...
girls, promote early detection of HIV in key populations for rapid placement in care, include HIV prevention and care services in the basic health-care package at all levels of care, continue and improve the coordination between HIV and TB programmes, and extend specialized training programmes for nurses and other non-physician clinicians to create the critical mass of health professionals capable of caring for HIV-infected patients.

For key populations with higher HIV prevalence, strategies to improve and intensify programmes aimed at men who have sex with men, female commercial sex workers, prisoners and street children, will be essential. It is also important to emphasize the need to provide patients with economic and social support to assist them in surmounting the barriers to remaining in HIV care. In these times of reduced funding for HIV, more must be done with less. Yet, we remain optimistic that the goal of providing ART for all HIV-infected patients and as part of relevant prevention programmes, remains in reach, as long as donor countries remain committed to funding global HIV prevention and treatment programmes and are committed to building capacity of local institutions.

Acknowledgements

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Disclosure statement

The authors declare no competing interests.

Additional files

Additional file 1: A map of antiretroviral therapy clinics in Haiti can be found at http://www.intmedpress.com/uploads/documents/3225_Rouzier_Additional_file_1.pdf

Additional file 2: A photograph of the University Hospital of Mirebalais can be found at http://www.intmedpress.com/uploads/documents/3225_Rouzier_Additional_file_2.pdf

References


